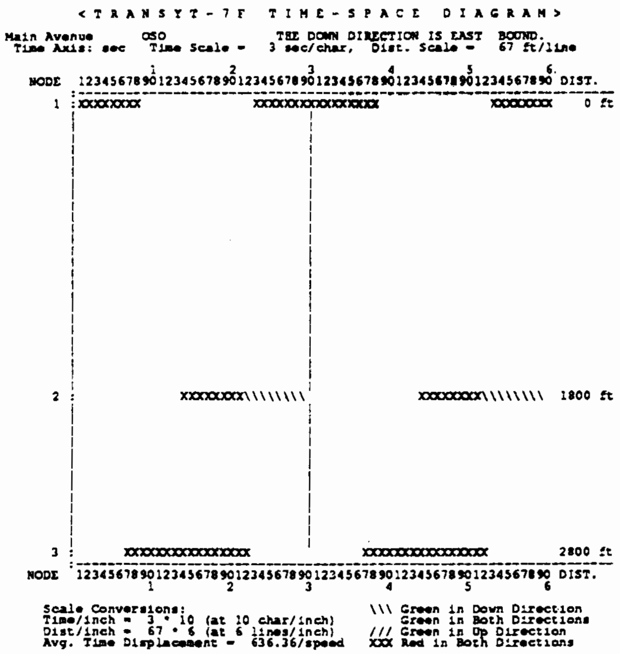
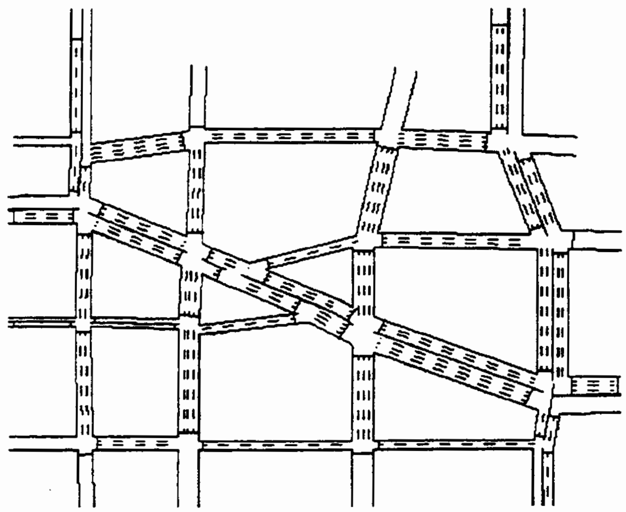
PB94-111879

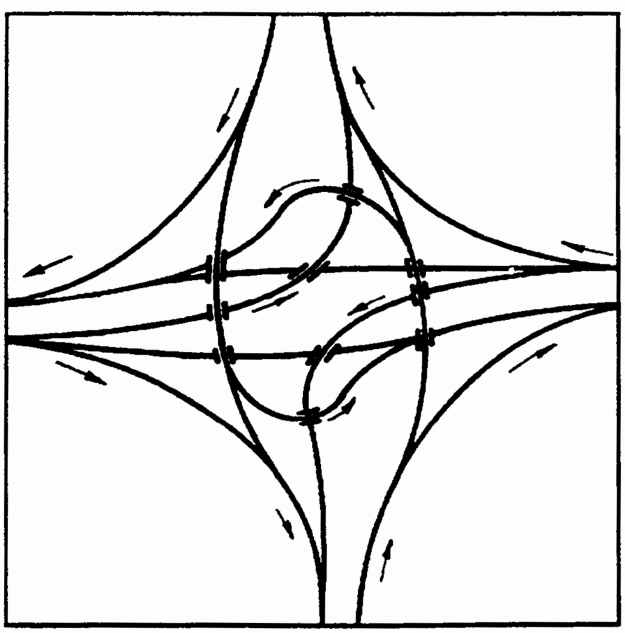
U.S. Department
of Transportation

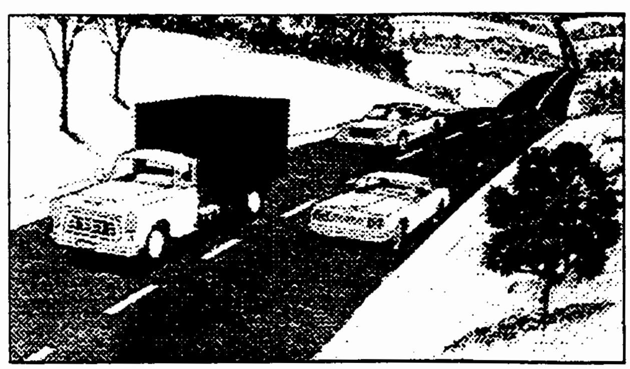
**Federal Highway
Administration**

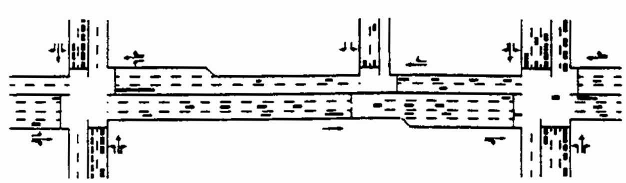
Traffic Models Overview Handbook











Notice

PASSER Output for Offset and Split Optimization

```
(COVER)
                TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
PASSER II-90        MULTIPHASE ARTERIAL PROGRESSION - 145101      VER 1.0   DEC 90

OS              Main Avenue                     DISTRICT Va 03/31/92    RUN NO.  1

                                   - PROGRESSION MODE.

                               **** INPUT DATA SUMMARY ****

     NUMBER OF            LOWER CYCLE         UPPER CYCLE         CYCLE
     INTERSECTIONS        LENGTH              LENGTH              INCREMENT

         3                    90                  90                 10

     MASTER               REFERENCE           REFERENCE           SYSTEMWIDE
     INTERSECTION         INTERSECTION        POINT               LOST TIME

         1                    1                  BEGIN               3.5



(EMBED.DAT)
                TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
PASSER II-90        MULTIPHASE ARTERIAL PROGRESSION - 145101      VER 1.0   DEC 90

   TRAFFIC CONTROL TYPE:    LEFT TURN SNEAKERS:           DELAY UNIT:

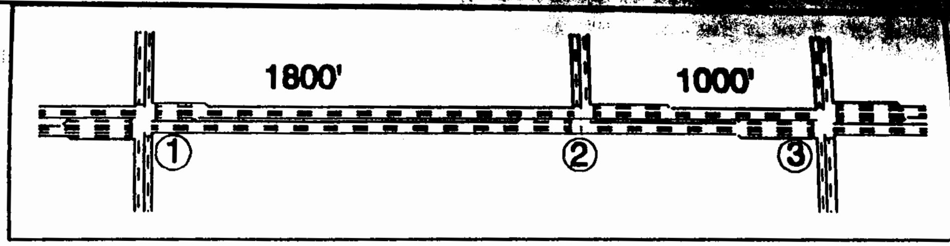
    PRETIMED OPERATION        2.0 VEHICLES                TOTAL DELAY

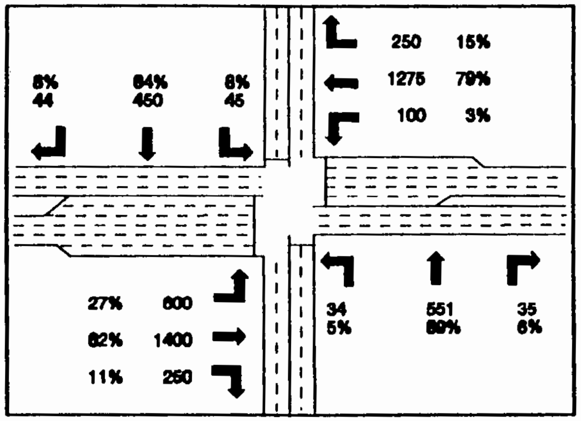
   IDEAL SATURATION FLOW:     PHASE LOST TIME:        LOS DELAY CRITERIA:

       1800   PCPHGPL          3.5 SECONDS              A -   6.5 SECS/VEH
                                                        B -  19.5 SECS/VEH
   ANALYSIS PERIOD:          LEFT TURN PHASING:         C -  32.5 SECS/VEH
                                                        D -  52.0 SECS/VEH
       60 MINUTES             APPROACH-BASED            E -  78.0 SECS/VEH
                                                        F -  78.0 SECS/VEH

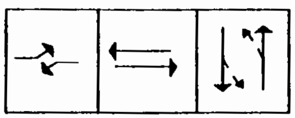
   PERMITTED LEFT TURN MODEL: (6) TTI MODEL

   MODEL COEFFICIENTS:  VO = Opp Sat Flow    (vph) = 1750
                        T  = LT Critical Gap (sec) =  4.5
                        H  = LT Headway      (sec) =  2.5
```

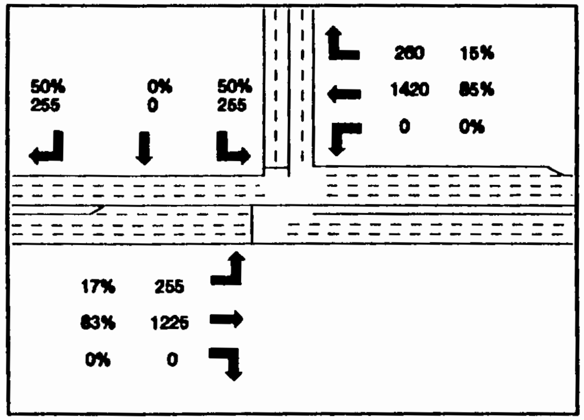




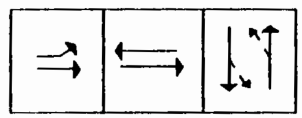
Node 1, 1st Street



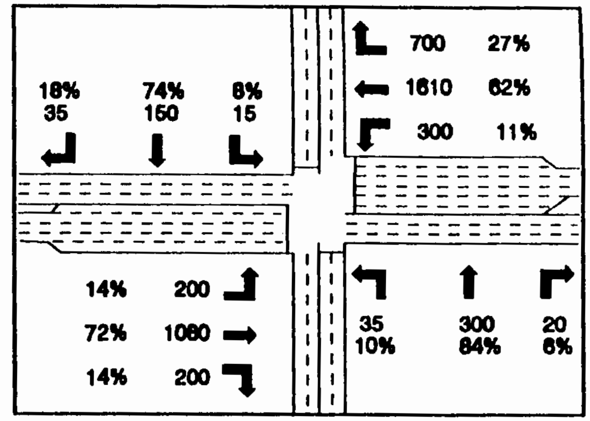
25 sec 34 sec 31 sec
Offset = 0 sec. Cycle = 90 sec.



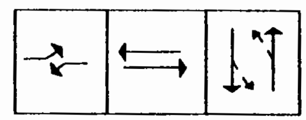
Node 2, 2nd Street



25 sec 42 sec 23 sec
Offset = 48 sec. Cycle = 90 sec.



Node 3, 3rd Street



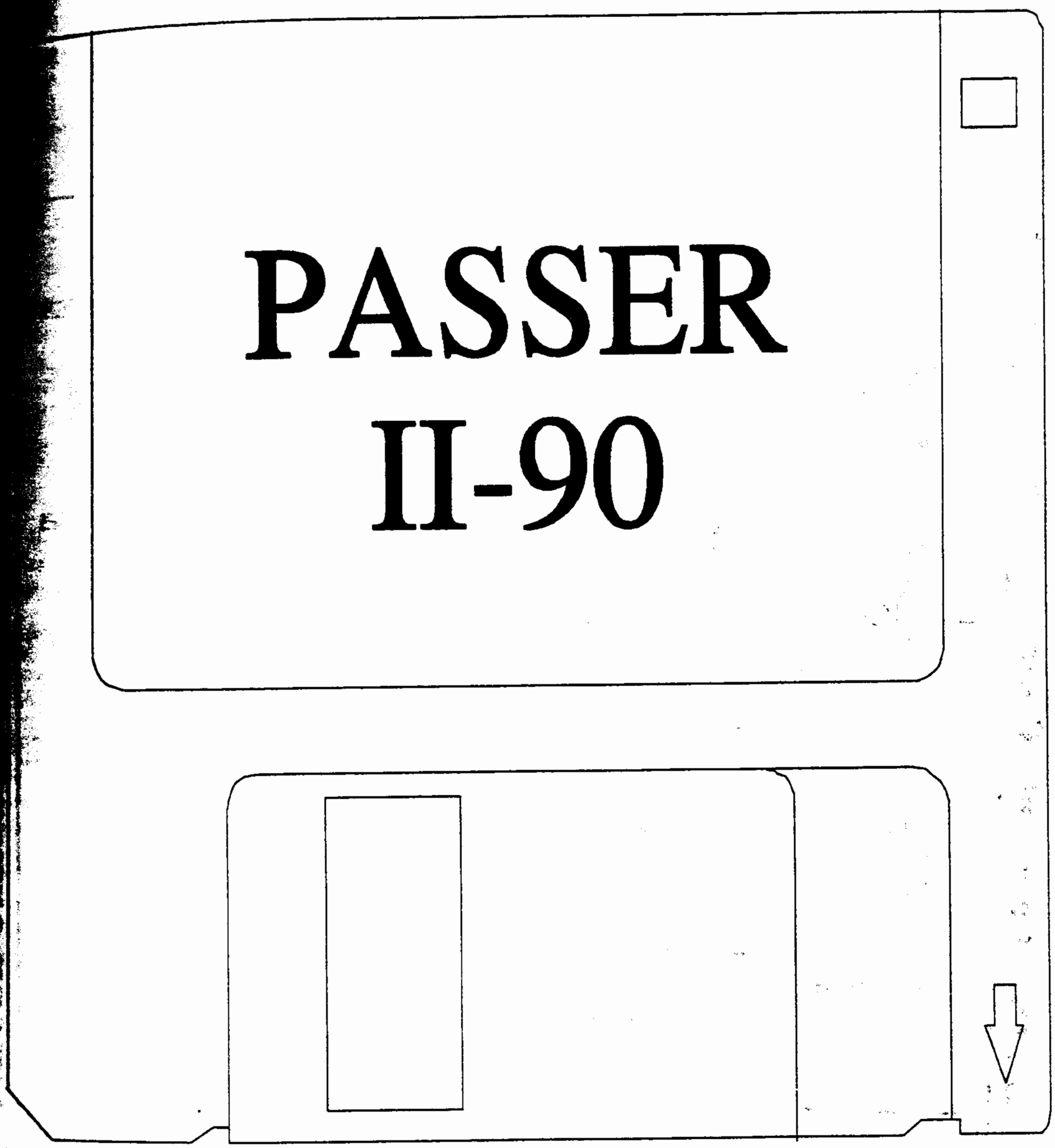
18 sec 41 sec 31 sec
Offset = 47 sec. Cycle = 90 sec.

Phase Sequence LT|G for EW|NS. Protected Dual Lefts (1+5) followed by Throughs (2+6) for the EW movements and Green Ball (4+8) for the NS movements.

Phase Sequence ER|G for EW|NS. Leading Left (2+5) for the EB movement followed by Throughs (2+6) for the EW movements and Green Ball (4+8) for the NS movements.

Phase Sequence LT|G for EW|NS. Protected Dual Lefts (1+5) followed by Throughs (2+6) for the EW movements and Green Ball (4+8) for the NS movements.

Green splits and offsets shown are "existing" values before optimization is performed. This sample problem did not include phase optimization.


PASSER
II-90

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APPENDIX I

SELECTED TRAFFIC MODEL INPUTS AND OUTPUTS

This Appendix contains outputs from 9 of the programs reviewed in this handbook. Some of these programs were pre-release versions of either new programs or updated programs. The outputs contained in this Appendix therefore may not be reproducible. For some of the programs, portions of the outputs were deleted for the sake of brevity.

The programs for which sample outputs have been provided are:

PASSER II-90
TRANSYT-7F
TRAF-NETSIM
CORFLO
(NETFLO 1)
(NETFLO 2)
(FREFLO)
FRESIM
ROADSIM
MAXBAND 86
SOAP-84
TIMACS

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Minimum Computer Hardware Requirements	FREQ10: PC compatible 80286/80287 computer. FREQ11: PC compatible 80386/80387 or 80486DX computer with 8 MB of memory.
Recommended Hardware Specifications	PC compatible 80386/80387 33/40 or 80486DX 33 computer with 8 MB of memory.
Operating System and Environment Requirement and Compatibility	DOS 5.0
Program Language(s)	FORTRAN

FREQPE outputs are similar to FREQPL with the addition of a ramp control plan.

> Traffic performance tables containing travel time, delay, queue, speed, and fuel and emission rates optionally for each time slice.
>
> Contour maps of up to ten traffic performance measures.
>
> Differential spatial and modal response effects tables comparing non-HOV with HOV alternatives using various traffic performance measures.

Freeway ramp control plan.

The Measures of Effectiveness (MOEs) generated for each sub-section by each time slice include:

Flows	V/C Ratios	Speeds
Densities	Travel Times	Ramp Delays
Total Veh-Hrs	Total Veh-Miles	Traffic Queues
Vehicle Noise	Fuel Consumption	Cost Effectiveness

Preprocessors

FREQ is used for preparing a common database and program specific data for the FREQPL and FREQPE programs FREQ includes a graphical user interface (GUI) and performs a comprehensive input check.

Post-processors

FREQ is also an output processor in that the user can select those FREQPL and FREQPE program outputs of greatest interest to the user and also the output of contour plots. Differential spatial and modal response effects tables for comparing alternatives using various traffic performance measures is also controlled by FREQ.

Program Maximum Dimension Limits

	FREQ10	FREQ11
Time slices:	24	24
Freeway subsections:	38	158
Origins and Destinations:	18	78

Program Modelling Limitations

Priority Entry and Priority Lanes can not be performed concurrently.

Ramps have vertical queues, that is, no spillback modelling of ramps.

Alternative route (parallel arterial) traffic flows and geometric connections to freeway.

HOV lane design specifications in terms of their location, number of lanes, and the "cut-off" vehicle occupancy limit of the HOV lanes being evaluated. HOV lanes may service busses only, or carpools and busses.

FREQPE input is similar to the data requirements of FREQPL.

Freeway design features such as subsection lengths, capacities, speed-flow curves, location and capacity of ramps, grades, and lanes.

Freeway demand patterns in terms of time slice specific user supplied or synthetically generated Origin-Destination (O-D) data and the occupancy distribution at each on-ramp.

Alternative route (parallel arterial) traffic flows and geometric connections to freeway.

Ramp control specifications which define an objective and a set of constraints (for optimization) so as to uniquely define a strategy of ramp control.

Optional time slice specific reductions in subsection capacities for incident scenarios or roadway maintenance.

Outputs

FREQPL output consists of:

Traffic performance tables containing travel time, delay, queue, speed, and fuel and emission rates optionally for each time slice.

Contour maps of up to 10 traffic performance measures.

Differential spatial and modal response effects tables comparing non-HOV with HOV alternatives using various traffic performance measures.

Cost-Benefit performance index for comparing different HOV operational designs.

Documentation, Availability and License Cost

A research report/user manual is available from:

Systems Unit
Institute of Transportation Studies
111 McLaughlin Hall
UCLA-Berkeley
Berkeley, CA 94720
Phone (510)-642-1008

License cost is $500 and includes one year free telephone support and updates.

Modeling Approach

A deterministic, macroscopic traffic simulation model serves as the nucleus of FREQPL and FREQPE. The simulation responds to time varying traffic demands, modal shifts, and also spatial shifts through a demand-performance (supply) feedback process if a parallel arterial is also specified. FREQPE handles ramp metering while FREQPL simulates HOV lanes. Ramp queues are handled as "vertical" queues, that is, there is no spillback modelling. Merging and weaving analysis are performed according to the 1965 HCM. Aggregate travel times, travel distance, average speed, fuel and emissions are computed during each time slice for each subsection. The relationship between user specified subsection capacity and speed-flow curves along with mainline shockwave analysis govern the simulation process.

For priority entry control, vehicles with more than "n" occupants are not metered. Special metered ramps can be specified as HOV only operation. FREQPE can maximize vehicle-miles or passenger-miles. A linear programming decision model is utilized for generating an optimal entry control for each ramp. Optional, the user may request interaction to occur between the simulation, optimization, and demand-performance modal shift routines until equilibrium is reached.

Input Requirements

FREQPL input consists of:

> Freeway design features such as subsection lengths, capacities, speed-flow curves, location and capacity of ramps, grades, and lanes.
>
> Freeway demand patterns in terms of time slice specific user supplied or synthetically generated Origin-Destination (O-D) data and the occupancy distribution at each on-ramp.

Program/Package Name	FREQ
Developer	Institute of Transportation Studies, University of California, Berkeley, California
Brief Description	FREQ is a traffic model package for either freeway corridor priority lane simulation or a freeway ramp metering (control) optimization/simulation. FREQ is a system consisting of an input/output processor - FREQ, a corridor simulation program for investigating Priority (HOV) Lane operations - FREQPL, and a Priority Entry control optimization program for ramp metering and entry - FREQPE. There is no direct interaction between the FREQPL and FREQPE programs.
Application Areas	The major application of FREQPL is for evaluating the benefits of implementing Priority Lanes (HOV) strategies on a freeway system with or without a parallel arterial in an arterial. Much of the processing in evaluating HOV lanes as compared to a non-HOV lane operation has been automated in FREQPL including adding the lane to the existing freeway, modal shifts (non-HOV vehicles to HOV vehicles) and spatial shifts between freeway and the arterial for both non-HOV vehicles and HOV vehicles where Origin-Destination demands vary over time. The major application of FREQPE is in the evaluation of a user supplied or optimum program generated metering plan. Modal shifts and spatial shifts to the arterial as a result of the metering plan are also modeled. Design improvements (capacity) can be evaluated by either model.
Product History	FREQ (FREQ1) was developed in 1968 for the purpose of evaluating alternatives for improving 140 miles of freeway in the San Francisco Bay Area. FREQ has been continuously improved since that time in response to the changing traffic flow theory, travel demand modelling, and simulation modeling knowledge base, and the need to include additional capabilities in response to increased travel demand and other transportation system management concerns. Capabilities added have included detailed fuel consumption and emissions models, modal shift models, spatial shift models, optimization models, and improved input and output capabilities.
Current Version/Releases	FREQ10 and FREQ11 Version 3.0 (FREQ11 is a larger version of FREQ10)

Program/Package Name PROG.D - PROGRESSION THROUGH A SERIES OF INTERSECTIONS WITH TRAFFIC ACTUATED CONTROLLERS

Developer Deakin, Harvey, Skabardonis, Inc.

Brief Description This is NOT a computer program but is a research report and implementation guideline for applying traffic signal timing optimization program outputs, such as PASSER II, TRANSYT-7F, and MAXBAND, to an arterial or network system of coordinated actuated controllers. Together with the TIMACS program and report, this report and implementation guide provides the means to implement signal timing plans in the field and/or to test and further refine them using simulation software.

Application Areas Where the TIMACS program provided the ability to determine the yield point, force-offs, and permissive period settings, this report and set of implementation guidelines provide additional help in further optimizing the actuated controller settings for arterial systems and for grid networks. Criteria for choosing the type of control at selected intersections within the coordinated system are also presented in the report.

Product History The guidelines were developed based on the operating strategies developed and tested through simulation using NETSIM-Q5, a predecessor to TRAF-NETSIM.

Documentation, Availability, and Cost FHWA Reports RD-89-132 and RD-89-133 are available from McTrans (University of Florida) as PROG.D for $10.

Outputs	TIMACS program has two outputs, the first is an input echo and the second is traffic actuated controller setting output with computed Yield Points, Force-Offs, and Permissive Period begin and end times.
Preprocessors and Post-processors	All input, calculations, and output are performed by TIMACS.
Program Maximum Dimension Limits	Four phases, six dials, and six permissive periods.
Minimum Computer Hardware Requirements	Any PC compatible.
Recommended Hardware Specifications	Any PC compatible.
Operating System and Environment Requirement and Compatibility	DOS 2.0+
Program Language(s)	Source code not normally available to users. Compiled Basic.

Program/Package Name	TIMACS - Timing Implementation Method for Actuated Coordinated Systems
Developer	University of Florida Transportation Research Center
Brief Description	TIMACS package provides 1) guidelines for implementing computerized traffic model timing designs at non-coordinated traffic actuated controllers, and 2) a program for implementing computerized traffic model timing designs at coordinated traffic actuated controllers.
Application Areas	TIMACS guidelines and the TIMACS program were designed as aids to implementing signal timing plans generated by traffic models such as SOAP, TRANSYT-7F, PASSER II, MAXBAND, and any others. The TIMACS program is especially helpful in computing Yield Points, Force-Offs, and Permissive Periods for coordinated actuated controllers. The program handles both "Ped Omit" and "Phase Omit" permissive periods.
Product History	First developed in 1987 with only minor revisions to date.
Current Version/Releases	TIMACS Version 1.2
Documentation, Availability and License Cost	Development of Guidelines for Implementing Computerized Timing Designs at Traffic Actuated Signals - Volume 1: Isolated Intersection Implementation, and Volume 2: Arterial System Implementation. Available from McTrans McTrans (University of Florida) for $40.
Modeling Approach	Not a model. Simple but organized calculations provide needed timing parameters.
Input Requirements	Controller data such as number of phases, dials, and permissive periods and if the NEMA "Walk Rest Modifier" is active. Movement data for specifying NEMA movement numbers to the non-actuated and actuated phases. Timing data such as cycle length, offset to non-actuated phase, walk time, pedestrian clearance, change intervals, computed splits, and vehicle minimums as provided by signal timing plans such as those generated by PASSER II, TRANSYT-7F, and the like.

Post-processors

None

Program Maximum Dimension Limits

One intersection and 48 contiguous time periods can be analyzed

Program Modelling Limitations

The program will not directly analyze actuated signal controllers and cannot be used to evaluated progression or non-random arrivals at the intersection. Shared lanes for through and left movements are not modelled.

Other Features and Capabilities

Embedded parameters can be easily modified to match known field conditions. These parameters include lost-time, left turn sneakers and jumpers, and others.

Minimum Computer Hardware Requirements

IBM PC with 256K memory.

Recommended Hardware Specifications

AT Clone 80286/80287 or better is recommended if multiple time periods are to be analyzed.

Operating System and Environment Requirement and Compatibility

DOS 2.0+

Program Language

Source code not normally available to users.

SOAP	FORTRAN 77
SOAPDIM	Compiled basic

Program/Package Name	SOAP
Developer	University of Florida and Federal Highway Administration. Other contractor(s) involved in development: SRA Technologies, Inc.
Brief Description	SOAP (Signal Optimization and Analysis Program) will design and or evaluate pre-timed isolated intersection signal timing and provide the necessary parameters for developing a detailed signal phasing plan and is capable of handling 48 time periods in which traffic demand, turning percentages, and timing plans can vary.
Application Areas	The program is applied to isolated intersections with existing or planned signal installations. Program provides intermediate calculation tables for detailed analysis over a large number of time periods.
Product History	Developed originally in 1977 and greatly enhanced in 1984 with only minor revisions since then 1984.
Current Version/Release	SOAP 84.04
Documentation, Availability and License Costs	A User's Manual and program is available through the McTrans McTrans (University of Florida) and PC-TRANS (University of Kansas) distribution Centers for about $80.
Modeling Approach	SOAP is a deterministic model which computes the cycle length and phase splits on the basis of flow ratios and the desired saturation level specified as input. The program is designed to minimize delay and or stops based upon user parameters input. The program is capable of analyzing a large number of time periods in which the inputs related to traffic flows or signal phasing may be varied.
Input Requirements	The program requires traffic volumes for each movement and an estimated saturation flow rate plus the signal phasing sequence and minimum green times to be utilized at the intersection. Both travel demand and saturation flow rate may vary over time periods.
Outputs	The program outputs flow ratios, cycle length and phase splits (% and seconds), plus a number of MOE's related to delay, stops and estimated fuel consumption by time period.
Preprocessors	A data input manager (SOAPDIM) is included as part of the program and assists with the assembly of input data.

Recommended Hardware Specifications	Mainframe.
Operating System and Environment Requirement and Compatibility	The program is not yet available for PC's.
Program Language	FORTRAN 77

arrive at the green splits prior to entering the linear programming model.

Input Requirements

Inputs to MAXBAND include splits (phase durations) or movement volumes and capacities, intersection specific data, and control and facility parameters. If Webster's method is used to compute splits, traffic volumes and saturation capacities for each movement are required. There are 15 card types and the input is coded in accordance with various coding schemes that do vary somewhat from the commonly understood notations. However, the type of data actually entered is very similar to PASSER II in several instances. For basic runs the primary cards are "START", SETUP, ARTERY, and ART2 at the system level and MAP, VOLUME, CAPACITY, MINGREEN, LEFTPAT and SPEED cards for each of the intersections.

Outputs

The program produces most of the standard traffic operation outputs common to these type of analyses. MAXBAND operates primarily as a "design program" and thence outputs basic elements of signal design such as: (1) cycle length range for best optimization (2) number and sequence of phases (side street only one) (3) phase durations (optionally generated by program) and (4) offsets. These data are output in a series of reports (arterial summary and intersection detail) which summarize the data. A time space diagram for the optimal solution is also presented.

Preprocessors

None

Post-processors

None

Program Maximum Dimension Limits

20 intersections per arterial.

Program Modelling Limitations

All times except for cycle length are entered as a fraction of the cycle length, not in seconds as is common to all other programs.

Other Features and Capabilities

Queue clearance times may be specified by the user.

Minimum Computer Hardware Requirements

MAXBAND was programmed for a mainframe computer and requires a FORTRAN compiler and about 1.2 MB of memory. Run time requirements vary significantly. A PC version running on 80386/80387 computers or better may be available in the future.

Program/Package Name MAXBAND

Developer Massachusetts Institute of Technology, Federal Highway Administration, and Texas Transportation Institute.

Brief Description MAXBAND is a mathematical bandwidth optimization program designed to develop coordinated signal timing plans for arterials or networks. MAXBAND maximizes bandwidth by selecting phase sequences, cycle length, and offsets. MAXBAND's unique feature is that it attempts, through the use of mixed-integer linear programming techniques, to produce a mathematically "global" optimum solution to the problem.

Application Areas The model is applicable to a signalized arterial or network of an interconnected signals. The program treats grid networks as a series of individual arterials which can be independently weighted.

Product History Initially developed for mainframe computers in 1980 at the Massachusetts Institute of Technology and updated in 1985 to include network optimization.

Current Version/Release MAXBAND 86

Documentation, Availability and License Costs An updated Users Manual (for arterial applications only) was developed in 1987 and accompanies the program when acquired from McTrans (University of Florida). Documentation is $20 while the program is $30 with an additional $50 9-track tape handling fee.

Modeling Approach The approach of MAXBAND is to optimize the bandwidth by selecting phase sequences, cycle length, and offsets. Both arterial directions and the arterials themselves can be individually weighted by the user. The model utilizes a form of optimization described as mixed integer linear programming. While the specifics of the algorithm are rather complex, in its very "simplest terms", the program is essentially designed to examine phase lead and lag options, compute effective green times and "fit these times" to the optimal time space diagram. The effective green that is maintained "throughout the system" in a particular direction for vehicles travelling at a particular speed is the "optimal bandwidth". The "width" of the band mathematically describes the likely probability of a certain percentage of the vehicles will be able to go through the system without being stopped. Green splits are either provided by the user or if saturation flow and traffic volumes are provided, Webster's method is used to

Input Requirements	For an isolated interchange, the distance between signals, progression speed and queue clearance times are input variables to this program. Traffic volumes, number of lanes, and minimum green times are required for every movement (18 are usually available). Interior travel times (between the signals) and available queue storage are also input. Phasing data is not required for optimization, but can be input as a simulation option.
Outputs	The output consists of the timing plans and an evaluation of traffic flows in terms of queue clearance probabilities, storage ratios and approach delay which lead to an estimated of Level of Service based upon MOE's LOS criteria embedded into the program.
Documentation, Availability and License Costs	The program and user manual are $135 and $15 respectively and are available from McTrans (University of Florida) and PC-TRANS (University of Kansas)..
Preprocessors	Full screen editing included in shell program.
Post-processors	Output viewing and print control included in shell program.
Program Maximum Dimension Limits	The progressive mode has limit of 20 interchanges.
Program Modelling Limitations	Internal delays at each of several interchanges are "held constant" as the optimal bandwidth for the "external delays" are computed in the progression mode, which is considered a limitation of the program.
Minimum Computer Hardware Requirements	640K AT computer with a disk drive is required.
Recommended Hardware Specifications	Same as minimum.
Operating System and Environment Requirement and Compatibility	DOS 3.0+
Program Language	Source code not normally available to users. Shell — Turbo Pascal PASSER III — FORTRAN

Program/Package Name PASSER III

Developer Texas Transportation Institute

Brief Description This model is designed to optimize timings at signalized diamond interchanges. It performs analysis based upon two basic plans - (1) isolated interchange and (2) progressive frontage road approach.

Application Areas This program is limited to the specified purpose of a dual signal diamond interchange analysis. It would not be used at the "Single Point Urban Interchange" since this concept operates with only one signal and phasing pattern.

Current Version/Release PASSER III-90 represents the latest version for the PC.

Modeling Approach The program uses a deterministic time-based optimization technique which examines either the isolated or progressive system using two distinctly different methods. Cycle length is the principle variable which is tested to determine an optimum signal timing solution.

For an isolated interchange, 3 basic signal phases provides the ability to optimize this configuration quickly. The program, however, is able to examine all possible combination of phase sequences with a limit of 15 combinations for the left and right sides of the diamond. Webster method is utilized to obtain desirable green times and the delay for all vehicles entering the interchange and the internal delay is computed using the delay-offset technique.

Either fixed or actuated timing designs may be tested. Only the "average operation" assumption can be used for the actuated signal controller under the presumption that its design will result in timings very similar to those developed as the average splits computed using the Webster algorithm.

In progressive analysis, all of the calculations for the "isolated" interchange are carried out for each interchange in the system connected by frontage roads. The bandwidth efficiency algorithm is applied in a manner as designed by the PASSER II program to the traffic in this system. If carried out "simultaneously" the computational algorithm is excessive, so it is suggested that a 2 step approach be used. In this manner the individually optimized timings at each of several locations are tested only by shifting the principle "offset" to determined the best bandwidth across all of the interchanges, directionally or bi-directionally as selected by the user.

Outputs	The primary outputs of ROADSIM consist of link operating statistics that describe "content" and average speed during each simulation time period selected. The statistics on content are output by intermediate snapshots where the status of each vehicle is described and other data is summarized by link. These include number of vehicles in/out of the link, VMT, mean speed, standard deviation, min & mx speeds of the vehicles simulated on the link. Cumulative statistics for link travel times, mean delay and passing attempts with completions and failures are also compiled for vehicle types for the time period on each link. For each direction, summary data on the distributions of headways, speeds and platoon size are compiled. Finally, speed histograms by vehicle type are output.
Preprocessors	None
Post-processors	None
Program Maximum Dimension Limits	The program dimensions consist of limits of 29 links, 30 nodes, 2 entry nodes, 1 exit for any entry and a total occupancy of 750 vehicles at any time (note this is NOT total vehicles simulated, but only those IN the system at one time). Other parameters include limits on vehicle type (16), speed (75) length (125 ft).
Program Modelling Limitations	Intersections can not be modelled and therefore the effects of the presence of or lack of turn lanes can not be estimated. Truck climbing lanes can not be modelled.
Minimum Computer Hardware Requirements	IBM AT 286 or higher with a math coprocessor.
Recommended Hardware Specifications	A minimum of 10 Meg Hard Disk and a 80386/80387-20 or better CPU is recommended.
Operating System and Environment Requirement and Compatibility	DOS 2.0+
Program Language	Source code not normally available to users. ROADSIM FORTRAN 77

Program/Package Name ROADSIM

Developer Federal Highway Administration

Brief Description ROADSIM is a microscopic, time stepping stochastic model designed to simulate rural 2 lane highway traffic. Every vehicle is traced through the system in a manner similar to TRAF-NETSIM, which provides a detailed set of statistics during the simulation. The program is unique in its ability to provide sufficient evaluation of detailed final design elements of lane configurations, passing zones, sight distances within the system.

Application Areas A number of specific applications relate to the use of the program for evaluation of design elements for rural roadways such as passing zones and truck limitations.

Product History Originated as TWOWAF in 1978 as part of NCHRP Project 3-19. Car following logic from INTRAS (microscopic freeway simulation) and vehicle generation logic SOVT (North Carolina State University two-lane simulation program, 1980) into a New TWOWAF program. TWOWAF was then reprogrammed according to TRAF specifications and renamed ROADSIM.

Current Version/Release The first PC version was released in 1986 and is the current version.

Documentation, Availability and License Costs ROADSIM is currently available only from FHWA but may be available from McTrans and PC-TRANS in the future.

Modeling Approach The models approach is designed to simulate the dynamic vehicular characteristics of a wide range of autos and trucks as they traverse the described segments. Vehicle following algorithms, acceleration and deceleration characteristics are used to respond to congestion and other system incidents. Only one O-D pair is permitted since intersections cannot be modeled. A random seed is used to start the simulation and input vehicle types, drivers type and other parameters into the simulation.

Input Requirements The user must input data in the form of run control, link descriptions (geometry and operations cards) and vehicle characteristics cards, plus entry volumes (by vehicle type) in each direction. Passing zones and sight distance restrictions are also required.

<u>**Minimum Computer Hardware Requirements**</u>	AT Clone 80386/80387 20 MHz with 3 MB of extended, XMS, DPMI, or VCPI compatible memory in addition to the 1 MB or real (conventional) memory.
<u>**Recommended Hardware Specifications**</u>	FRESIM is a computationally intensive program. Based on FRESIM's computational needs and on rapidly decreasing hardware costs and other available and future software requirements, a 486-33 MHz computer with 8 MB RAM and 200 MB hard disk is strongly recommended.
<u>**Operating System and Environment Requirement and Compatibility**</u>	DOS 5.0 Recommended. Also may be executed from within TSIS and FEDIT.
<u>**Program Language**</u>	Source code not normally available to users.

FRESIM	FORTRAN
FEDIT	MS-Professional Basic

Input Requirements

The user must input data in the form of run control, network description (geometry and operations cards) and turn movements (percentages), entry volumes and origin-destination pairs. These data provide a full description of the freeway and its entry and departure points and intervening geometric "conflicts". Other inputs are required if optional features such as ramp metering, surveillance systems, and incidents are to be modelled.

Outputs

The primary outputs of FRESIM consist of link operating statistics that describe "content" and average speed during each simulation time period selected. The statistics on content are output by lane and other data summarized by link. These include number of vehicles in/out of the link, VMT, VHT (in minutes), moving and delay times, hourly volume rate estimate and speeds. Cumulative statistics are also compiled for fuel consumption and emissions for each time period.

Preprocessors

FEDIT is an intelligent, structured, user-friendly input editor and greatly speeds data entry while minimizing input errors. TURNVOL estimates turning volume given turning percentages and entry volumes. INTOFRE converts INTRAS input files to FRESIM input files. Though not a preprocessor, FSMTUTOR is an online tutorial for FRESIM.

Post-processors

CONTOUR reads the FRESIM output file and provides a character-based contour plot of speed and density over time for the first freeway segment. Animation and static graphics programs are planned for the future.

Program Maximum Dimension Limits

FRESIM can handle 200 links, 120 nodes, and 3000 vehicles.

Program Modelling Limitations

FRESIM can model 5 through lanes and 3 auxiliary lanes. Ramp and freeway-to-freeway connectors may have 3 lanes but cannot have lane adds/drops or auxiliary lanes.

Other Features and Capabilities

Multiple time period capability during which traffic volumes, turning movements, and O-D percentages can vary. Lane adds and drops, and multiple destination lanes can be explicitly modelled as can truck restrictions or bias to specific lanes.

Program/Package Name FRESIM

Developer U.S. Department of Transportation, Federal Highway Administration. Other contractor(s) involved in development: JFT Associates, Inc., SRA Technologies, Inc., AEPCO Inc., and VIGGEN Inc.

Brief Description FRESIM is a microscopic, time stepping stochastic model designed to simulate freeway networks. Every vehicle is traced through the system in a manner similar to TRAF-NETSIM, which provides a detailed set of statistics during the simulation. The program is unique in its ability to provide sufficient evaluation of detailed final design elements of lane configurations, merge and diverge points and complex weaves within the system. Congestion and queues are modelled in detail as well.

Application Areas A number of specific applications relate to the use of the program for evaluation of design and operation elements such as ramp metering, comprehensive incident modelling, incident detection algorithm testing, lane restrictions, special driver characteristics, acceleration-deceleration lanes, lane drops, weaving areas, collector-distributer roadways, interchange design, HOV lane and roadway operation, and freeway incident management. Environmental analysis of various alternatives can also be conducted using the fuel consumption and emissions analysis capabilities of the programs outputs.

Product History FRESIM's predecessor was FHWA's INTRAS program which was not widely distributed. FRESIM will be released to the public mid-1993.

Current Version/Release Version 1 is being released for the microcomputer environment in summer 1993.

Documentation, Availability and License Cost A FRESIM User Manual along with a FEDIT, CONTOUR, and FSMTUTOR Manual will be available when the program is released. The program will be available from McTrans and PC-TRANS.

Modeling Approach The model simulates the dynamic vehicular characteristics of a wide range of autos, and single and multiple unit trucks (medium and full load) as they traverse the described freeway segments. Vehicle following algorithms, acceleration and deceleration characteristics, lane changing rules, and stochastic decision processes are used to respond to congestion and other system incidents. Vehicles enter and leave the system using network origin-destination patterns input by the user or generated internally.

period capability for modelling time varying traffic demands. Bus operations are modelled with separate travel statistics. CORFLO traffic assignment can be applied to FREFLO networks.

Minimum Computer Hardware Requirements

AT Clone 80386/80387 with 3 MB of extended, XMS, DPMI, or VCPI compatible memory in addition to the 1 MB or real (conventional) memory with EGA or VGA capability for GCOR graphics or TRAFEdit input.

Recommended Hardware Specifications

Traffic assignment and graphic conversions can be very computationally intensive. Based on rapidly decreasing hardware costs and other available and future software requirements, a 486-33 MHz computer with 8 MB RAM and 200 MB hard disk is strongly recommended.

Operating System and Environment Requirement and Compatibility

MS-DOS 5.0 Recommended. Normally executed from within the TSIS shell program.

Program Language

Source code not normally available to users.

FREFLO	FORTRAN
SCORG	FORTRAN
TRAFEdit	C
TSIS	MS-Professional Basic

incorporating a dynamic speed equation, and buses, carpools, autos and trucks are distinguished as distinct vehicle types.

Input Requirements

The input requirements for FREFLO are defined by the relatively simple link and node descriptions. Under the TRAF sub-system of programs, the traffic volumes may be obtained from other sub-programs or input directly. Basic link node and geometric data along with the special use (e.g. carpool lanes) designations must be input. The capacity of a link are input on a per lane basis and "ramp" links must be adjusted for speeds and capacity.

Outputs

The outputs of FREFLO are characteristic of basic traffic flow and density parameters for freeways. For each link, speed, moving and total delay time and their related flow data are output and summarized for the subnetwork. The program also reports environmental variables such as fuel consumption and emissions.

Preprocessor

All of the inputs can be managed under the TRAFEdit screen editor which is documented separately in the TRAFEdit User Guide. TRAFEdit consists of both a "Smart" and "Quick" line editor. TRAFEdit can also be used to edit NETFLO 1 and 2 data input. NETFLO 1 and 2 are urban street simulation programs of lesser detail than NETSIM which can be used in conjunction with FREFLO as well as TRAFIC which is the CORFLO traffic assignment module. The FEDIT preprocessor for FRESIM can also be used for generating a FREFLO data file excluding those features which are unique to each program.

Postprocessors

CORFLO has a static graphics postprocessor similar to TRAF-NETSIM. The GCOR SCORG (static) progra work with FREFLO as well as NETFLO 1 and 2.

Program Maximum Dimension Limits

FREFLO is capable of handling 500 links and 250 nodes.

Program Modelling Limitations

Up to [illegible] Exit and Entry ramps are treated as sinks and sources, that is they do not connect to a surface street. Any FREFLO link can connect directly to a NETFLO 1 or 2 surface street link via an interface node. Merges and weaves are not explicitly modelled. There is no ramp metering except by constraining capacity on a link.

Other Features and Capabilities

Special purpose lanes for carpools and busses. Each link can have 2 source or destination links. NETFLO 1 and 2 both have multiple time

Program/Package Name	CORFLO FREFLO
Developer	U.S. Department of Transportation, Federal Highway Administration. Other contractor(s) involved in development: KLD Associates, Inc., SRA Technologies, Inc., AEPCO Inc., and VIGGEN Inc.
Brief Description	CORFLO is an integrated set of three simulation programs of which FREFLO provides a semi-detailed (intermediate level) macroscopic simulation of freeway segments. The measures used to describe freeway performance are flow rate, density and space-mean-speed within each defined section. The model is designed to operate in "tandem" with the CORFLO programs so that the interface of freeway ramp movements can be better coordinated with local at-grade arterial signal systems.
Application Areas	FREFLO is applied to evaluate proposed, existing, or alternative freeway configurations to determine their effectiveness in responding to predefined traffic flows or for modelling large scale roadway designs, improvement projects, or traffic management schemes. It is part of a series of CORFLO programs which perform similar activities on surface streets - NETFLO 1 and 2.
Product History	This program was originally developed for mainframe computers and has a long development history. It was publicly released early in 1993 for operation in a microcomputer environment as a module within CORFLO.
Current Version/Release	Version 1
Documentation, Availability and License Costs	The TRAF Reference Guide provides principle documentation for CORFLO FREFLO, NETFLO 1 and 2, and TRAF-NETSIM in a single manual and is available for $50. The CORFLO program package, which also includes FREFLO, NETFLO 1 and 2, along with the TRAFEdit preprocessor program and the GCOR postprocessor graphic programs is about $350. The program is available from McTrans (University of Florida) and PC-TRANS (University of Kansas).
Modeling Approach	The FREFLO simulation is defined in terms of aggregate (macroscopic) measures which discretely establishes a direct relationship for entry flow rate, exit flow rate, density, and space-mean-speed on freeway segments. It has been enhance to include the refinement that equilibrium speed-density relationship is enhanced by

<u>**Program Maximum Dimension Limits**</u>	In NETFLO 1, 250 links, 70 nodes, 20 actuated controllers, and 10,000 vehicles are allowed. NETFLO 2 permits up to 500 links and 240 nodes. Larger networks are possible with customized versions.
<u>**Program Modelling Limitations**</u>	Maximum of 6 approach lanes, 5 approaches, 9 intervals for pretimed signals, and no changeable embedded parameters. Actuated signals within NETFLO 1 can only be single ring controllers.
<u>**Other Features and Capabilities**</u>	NETFLO 1 and 2 both have multiple time period capability for modelling time varying traffic demands. Bus operations are modelled with separate travel statistics. CORFLO traffic assignment can be applied to NETFLO 1 and 2 networks.
<u>**Minimum Computer Hardware Requirements**</u>	DOS 80386/80387 computer or with 3 MB of extended memory, XMS, DPMI, or VCPI compatible memory in addition to the 1 MB or real (conventional) memory with VGA capability for GCOR graphics or TRAFEdit input.
<u>**Recommended Hardware Specifications**</u>	Traffic assignment and graphic conversions can be very computationally intensive. Based on rapidly decreasing hardware costs and other available and future software requirements, a 486-33 MHz computer with 8 MB RAM and 200 MB hard disk is strongly recommended.
<u>**Operating System and Environment Requirement and Compatibility**</u>	DOS 5.0 Recommended. Normally executed from within the TSIS shell program.
<u>**Program Language**</u>	Source code not normally available to users.

CORFLO	FORTRAN
SCORG	FORTRAN
TRAFEdit	C
TSIS	MS-Professional Basic

Modeling Approach

NETFLO 1 is an event based simulation model which is microscopic in nature. Vehicles are simulated across all events experienced in a network, but car following logic (as employed in TRAF-NETSIM) is utilized.

NETFLO 2 further simplifies traffic flow logic to that of a macroscopic platoon simulation in a manner similar to TRANSYT-7F. Vehicle behavior is described by vehicle flow histograms for link entry, input, service, queue and output. These histograms are updated and "reported" to the program at each program "time interval".

Input Requirements

The input requirements for NETFLO are very similar to TRAF-NETSIM, in that basic network and traffic data on a system wide, link and node basis must be provided. Many of the card types are identical. Basic link, node, and geometric data, in addition to signal parameters are required.

With the simulation of actuated signals in NETFLO 1, additional data on approach configuration, phase duration parameters and the location of traffic detectors must be provided, in a manner similar to TRAF-NETSIM.

Both submodels require run control cards that specific simulation time periods and identify related control parameters for the simulation.

Outputs

The outputs of NETFLO 1 and 2 are very similar to those of TRAF-NETSIM. For each link, traffic speeds, stop percentages, number of stops, and moving and total delay time are output and later summarized for the subnetwork. The program also reports on environmental variables such as fuel consumption and emissions.

Preprocessor

All of the inputs are managed under the TRAFEdit screen editor which is documented separately in the TRAFEdit User Guide. TRAFEdit consists of both a "Smart" and "Quick" line editor. TRAFEdit can also be used to edit FREFLO data input. FREFLO is a macroscopic freeway simulation program which can be used in conjunction with NETFLO 1 and 2 as well as TRAFIC which is the CORFLO traffic assignment module.

Postprocessors

CORFLO has a static graphics postprocessor similar to TRAF-NETSIM's GTRAF SNETG programs. The GCOR SCORG (static) program work with NETFLO 1 and 2 as well as FREFLO.

Program/Package Name CORFLO NETFLO 1 and 2

Developer U.S. Department of Transportation, Federal Highway Administration. Other contractor(s) involved in development: KLD Associates, Inc., SRA Technologies, Inc., and VIGGEN Inc..

Brief Description CORFLO is an integrated set of 5 modules - FREFLO, NETFLO 1 and 2, TRAFIC, and CAPACITY. NETFLO 1 and 2 provide a semi-detailed (intermediate level) simulation of urban street networks and their associated signal systems.

Although some of the computational algorithms are similar to TRAF-NETSIM, the NETFLO 1 program provides a more limited simulation of vehicle tracking within the network. The basic difference is that each simulation step is based upon an "event" versus the unit of time step characteristic of TRAF-NETSIM. NETFLO 1 uses many of the same inputs as TRAF-NETSIM and has similar outputs.

NETFLO 2 also uses much the same inputs and has similar outputs to TRAF-NETSIM and NETFLO 1, but process the simulation on the basis of a macroscopic platoon simulation in a manner similar to TRANSYT-7F. In this instance, since individual vehicles are not simulated, actuated signals cannot be directly modelled.

Application Areas NETFLO 1 and 2 are applied to evaluate existing or proposed signal system networks to determine their effectiveness in responding to predefined traffic flows or for modelling large scale roadway designs, improvement projects, or traffic management schemes.

Product History These programs where originally developed for mainframe computers and have a long development history. They were publicly released early in 1993 for operation in a microcomputer environment.

Current Version/Release Version 1.

Documentation, Availability and License Costs The TRAF Reference Guide provides principle documentation for CORFLO NETFLO 1 and 2, FREFLO, and TRAF-NETSIM in a single manual and is available for $50. The CORFLO program package, which includes FREFLO, NETFLO 1 and 2 along with the TRAFEdit preprocessor program and the GCOR postprocessor graphic programs is about $350. It is available from McTrans (University of Florida) and PC-TRANS (University of Kansas).

Other Features and Capabilities

TRAF-NETSIM can model traffic circles as a series of yield sign controlled intersections. It can model traffic streams with motorcycles or bicycles, by replacing the vehicle characteristics of carpool vehicles with those of motorcycles or bicycles. It can estimate capacity by "flooding" an approach with vehicles and observing how many vehicles can go through with given traffic control and geometric conditions.

In the near future, TRAF-NETSIM will be joined with FRESIM, to form a new program called CORSIM which will permit microscopic freeway and urban street simulation.

Minimum Computer Hardware Requirements

TRAF-NETSIM now requires an 80386/80387 of better with 4 MB of memory. The full package requires about 10 MB of disk space but if the GTRAF postprocessors are to be used, the amount of disk space required can be very significant - anywhere from a few MB's to 10's of MB. An EGA or VGA card and monitor are required for the GTRAF postprocessor and TRAFEdit preprocessor. Any color display and the ANSI.SYS device driver (Comes with DOS) is required for NEDIT. 580 K of free real memory is required for NEDIT and GTRAF. DOS 5.0 is required.

Recommended Hardware Specifications

Based on rapidly decreasing hardware costs and other available and future software requirements, a 486-33 MHz computer with 8 MB RAM, VGA, and 200 MB hard disk is strongly recommended.

Operating System and Environment Requirement and Compatibility

DOS 5.0 recommended. Normally operated from within the TSIS shell program.

Program Language(s)

Source code not normally available to users.

TRAF-NETSIM	FORTRAN
SNETG	FORTRAN
ANETG	FORTRAN
NEDIT	Pascal
TRAFEdit	C
TSIS	MS-Professional Basic

Modelling lane obstruction:

Required - Start time or frequency, duration, and which lane.

Modelling pedestrian:

Required - Pedestrian intensity (high, moderate, low or none).

Optional - Amount of delay to vehicles for each pedestrian intensity.

Outputs

The program provides a rich array of output statistics, including vehicle and link based MOE's dealing with effective speeds, saturation levels, cycle failures, moving and stopped delay, total delay, number of stops, fuel consumption, emissions and other outputs such as bus station and path statistics, and special event activities. These data are accumulated at pre-specified time intervals and summarized for the total simulation as well.

Preprocessors

There are two pre-processors to assist in coding the data. NEDIT accepts data on the screen using "forms" processing, resulting in a program which normally treats each card type as a form with context sensitive prompting. TRAFEdit provides a more user friendly "Smart" and "Quick" line editors that run faster and provides a more "interactive" system.

Post-processors

The post-processor package for TRAF-NETSIM is called GTRAF. GTRAF consists of two programs, ANETG and SNETG. ANETG produces animated graphics which displays street layouts, traffic controls and moving vehicles on the screen. SNETG produces static graphics which displays the input data and resulting performance statistics in maps, diagrams, line graphics and bar charts.

Program Maximum Dimension Limits

The current version is limited to 500 links, 250 nodes, 100 actuated controllers, 25 bus routes, 99 bus stops and 60 long term events.

As might be expected, the number of vehicles, links and types of control devices directly affect the simulation to real time ratio, but a small 25 link 3 traffic light system with 1800 vehicle trips in 6 minutes of simulations takes only 320 seconds of CPU time on a 33 Mhz 486. (Note: the graphics option for this sample network simulation would require about 5 Million bytes of disk space.)

Program Modelling Limitations

One limitation at this time is that traffic origins and destinations cannot be directly replicated as the path of individual vehicles is stochastically determined by user specified turning percentages. This will be remedied when TRAF-NETSIM is eventually integrated into TRAF to accept output from "TRAFIC" - a network assignment module which is now a part of CORFLO.

For any run:

Required - Node, link, number of lanes, approach length and vehicle turning volumes.

Optional - Grade; percentages of auto/truck/carpool; channelization; number and length of exclusive turning lanes; pedestrian intensity; mean vehicle headway; free flow speed; start-up lost time; right-turn-on-red; mid-block source and sink; closing of lanes; percentages of auto, truck, bus, and carpool in a vehicle fleet; length, occupancy, maximum acceleration and maximum speed for each vehicle type; left and right turning speeds; acceptable gaps for left/right turning and for lane switching; probabilities of vehicles blocking the intersection duration over-saturated condition; emission rates for HC, CO and NOx by vehicle type; fuel consumption rates by vehicle type; random number seeds for the distributions of traffic patterns and driver types; metric system; etc.

Modelling buses:

Required - Location, capacity and type of bus stop; dwell time; bus route; and bus frequency.

Optional - Distribution of dwell time.

Modelling fixed time signal:

Required - Cycle length, number and sequence of phases, and split.

Optional - Offset, probability of left turn jump at start of signal, probability of making left turn during yellow signal, factors to decide to stop or go during yellow signal, etc.

Modelling actuated signal:

Required - Number and sequence of phases, maximum green, minimum green, vehicle extension, amber duration, detector location, and sensor length.

Optional - Detector type, minimum and maximum gaps, number of actuation, maximum and time added to initial intervals, maximum extension, minimum and maximum recalls, Yellow and red locks, dual ring operation, phase overlap, yield point, force-off, permissive periods, pedestrian actuation, pedestrian arrival patterns, etc.

Modelling stop or yield sign:

Required - None.

Optional - Acceptable gaps for near-side and far-side cross street traffic.

Modelling parking:

Required - Location of parking zone, and duration and number of maneuvers.

Optional - Distance of parking zone from stop line.

8088 and 80286 based computers. The next generation recoded mainframe program, TRAF-NETSIM, was later converted in full to a microcomputer version and was also named TRAF-NETSIM and included a preprocessor and two post-processors. The latest version now requires an 80386/80387 or better to execute.

Current Version/Release

The current Version is 4.0 and was released in late 1993.

Documentation, Availability and License Cost

The user's manual provides documentation of procedures, card input requirements and outputs and is available from both the PC-TRANS (University of Kansas) and McTrans (University of Florida) distribution centers. The license cost (about $350) is dependent on if the user selects to get TRAF-NETSIM with or without the GTRAF postprocessors. Other manuals for TSIS (a TRAF program operational shell), NEDIT and TRAFEdit are also included. GTRAF manuals are available with the GTRAF software.

Modeling Approach

TRAF-NETSIM is time-based microscopic, stochastic simulation of individual vehicles in a traffic controlled urban roadway system which is basically city street or network in character. TRAF-NETSIM traffic flow logic performs a full range of controls on vehicles travelling within specific lanes and responding to any number of control devices which include stop and yield signs, fixed-time and actuated signals and related surveillance systems. Vehicle flow is guided by car-following rules, lane changing logic, and other driver decisions making processes.

Basically, 7 steps are characteristic of the analytical sequence carried out by the model within each one second time step. These are: 1) all vehicles within queues at the commencement of the time step are processed, 2) other vehicles are processed, 3) new vehicles are entered through entry links, 4) new vehicles are added through internal source links, 5) the status of all signals is updated, 6) the standard vehicle and link arrays or statistics are updated (accumulated) and diagnostics performed and 7) if a reporting time period has been reached results are printed.

The model's value is its rich array of statistics maintained at the vehicle and link level, wherein the program outputs a large array of measures of effectiveness (MOE's) for review.

Input Requirements

TRAF-NETSIM can model a variety of situations. The input depends on what is to be modelled. The list below shows both the required and optional data. Optional means the program will supply default values unless the user overrides them.

Program/Package Name TRAF-NETSIM

Developer U.S. Department of Transportation, Federal Highway Administration. Other contractor(s) involved in development: KLD Associates, Inc., SRA Technologies, Inc., AEPCO Inc., and VIGGEN Inc.

Brief Description It is a detailed traffic network simulation model. It can simulate a mixture of automobiles, buses, trucks and carpools/vanpools in the traffic stream. It can simulate streets with different configurations (1 or 2-way streets, T-intersections, intersections with more than four approaches, exclusive turning lanes, etc.) and different traffic controls (fixed time signals, actuated signals, stop signs, yield signs, etc.). It can simulate delays due to pedestrians, bus loading/unloading, parking, lane obstruction, street closure, etc. The model can be calibrated to represent site specific conditions. For instance, The user can specify local vehicle types (auto, bus, truck, etc.) and the characteristics of each type of vehicle (length, maximum speed, maximum acceleration, occupancy, etc.). The user can specify local driver characteristics such as driving aggressiveness; reaction time; acceptable gaps for making turns, response to yellow and red signals; etc. TRAF-NETSIM produces static and animated graphics. It can display street layouts, traffic controls and moving vehicles on the screen. Graphical displays provide visual windows for focussing in on problem areas and help the user in formulating alternative geometric and/or traffic control strategies.

Application Areas TRAF-NETSIM is applicable to evaluating existing or proposed signal systems on a street network to determine their effectiveness in responding to predefined traffic flows. It is also used for evaluating alternative geometric and operational improvements of a detailed nature within a urban street network including bus operations. The flexibility of its inputs permit modelling most any design or operational aspect of urban street networks.

Typical applications include site traffic and/or environment impact analysis, traffic signal evaluation, left turn pocket evaluation, bus stop location analysis, parking policy evaluation, geometric design and traffic operational studies, etc. These applications focus on individual elements of a system. However, it's great strengths are its ability to look at larger systems made up of many urban network components and its ability to model a system where changing one input or parameter can have an effect on the entire network.

Product History Originally developed under the "Urban Traffic Control System (UTCS-1) in the early 1970's, the program evolved under the direction of FHWA as UTCS-1S and was later renamed NETSIM. Due to its heavy computing requirements, its migration to the desktop was very slow. A reduced size and capability version was developed for the

Program Language(s)	Source code not normally available to users.	
	TRANSYT-7F	MS-FORTRAN for 16 bit version
	T7FDIM	MS-QuickBasic
	AAP	MS-Professional Basic
	PPD	Compiled Basic

AAP is also a post processor in that it can take a TRANSYT-7F timing plan and pass it to PASSER II and can also keep a run log for quick comparison of timing plan or geometric alternatives. The AAP can also execute the AAP2NEMA program which can display the optimized signal timing for either a single ring configuration or in the NEMA dual ring configuration. The AAP2NEMA program can also modify the NEMA numbering convention to match local definitions.

Program Maximum Dimension Limits

The standard version has a capacity of 100 nodes, 600 links, 7 phases, and 25 intervals. Other versions which permit larger networks and faster execution are available for "protected mode" operation on 386 and 486 computers.

Program Modelling Limitations

Spillback not explicitly modeled. Optimization based solely on "Disutility" may result in poor "perceived" progression. Optimization based on static traffic flows which do not vary over time. Phase sequence not optimized.

Other Features and Capabilities

Double cycling, multiple greens, RTOR, unsignallized intersections, bus and carpool lanes (links) and weighting, bottleneck links, shared lanes, mid-block flows, link-to-link weighting, protected and protected-permitted left turn modelling, user specified bandwidth constraints, user specified cross-street desired degree of saturation for semi-actuated control, indirect consideration of queues (spillback) via additional performance penalties.

Minimum Computer Hardware Requirements

TRANSYT-7F and T7FDIM - AT Clone 80286/80287 with 640K of free RAM. For AAP, a color monitor strongly recommended but not required.

Recommended Hardware Specifications

Minimum recommendation of a 80386/80387-20 MHz based computer with 2 MB RAM and VGA Monitor. Based on rapidly decreasing hardware costs and other available and future software requirements, a 486-33 MHz computer with 8 MB RAM and 200 MB hard disk is strongly recommended. The "protected mode" version requires a 80387/80387 or 486DX.

Operating System and Environment Requirement and Compatibility

MS-DOS 3.x through 5.0. MS-DOS 5.0 highly recommended.

many optional inputs can be easily assumed using the defaults without significant concern. Preprocessors have simplified the input effort and have thus promoted the usage of TRANSYT-7F.

Outputs

The basic reports for TRANSYT-7F include the input image; system, route and intersection performance tables for delay, stops, back of queue, and fuel consumption; flow profile plots (optional); time-space diagrams (optional); time-location diagrams (optional); platoon progression diagrams (optional); and signal timing tables. The most complex and perhaps most utilized is the performance table and the user must be able to carefully interpret these data. Timing data provides the engineer with the basic data needed for implementing the results in the field.

Preprocessors

A large number of pre-processors have been developed to reduce or eliminate the card type level of processing and (in many cases) eliminate the upstream link-to-link volume computations that must be "developed" by the user. The original preprocessor for TRANSYT-7F, T7FDIM, is included with the latest release and essentially provides the ability to edit "on screen" all card types, but the user MUST have detailed knowledge of TRANSYT-7F card types, ordering, and contents. Other proprietary preprocessors are available and can greatly simplify the data preparation effort.

The user who has infrequent use of TRANSYT-7F must usually depend upon these preprocessors or the amount of "learn or refresh time" and debugging process becomes inordinate.

The most significant advance in TRANSYT-7F utilization is the recent release of the new AAP (Arterial Analysis Package) program which provides a very user-friendly method of entering intersection and arterial data to both PASSER II and TRANSYT-7F arterial signal timing applications. This program may have a few too many "standard assumptions" for special analyses but is essential for the more common user who must thoroughly evaluate less complex arterial signal configurations.

Other proprietary preprocessors are available and are described in the McTrans and PC-TRANS catalogs.

Post-processors

PPD (Platoon Progression Diagram) is a contour plot of flow versus time and distance along an arterial. Queue build-up, dispersion, and merging is clearly shown and provides great visual insight on the flow patterns which are occurring along the arterial.

willing to expend the effort, the TRANSYT-7F manual contains highly detailed and informative documentation of how the program works in terms of the traffic flow models and relationships used throughout TRANSYT-7F.

Of more direct concern to the user are the calculation of delay, stops, queue length, fuel consumption and operating cost which are the principle elements of the measures of effectiveness (MOE's) that evaluate the results of the simulation or drive the optimization process.

Input Requirements

One daunting aspect of the TRANSYT-7F model has been the input data requirements and the fairly rigid format in which the "card deck" must be produced. "Preprocessors" are discussed below, so this section will discuss the relationship of the data requirements to the general characteristics of a study methodology that must be applied.

Inputs can be generally characterized as:

- Networkwide "common" parameters
- Optimization control parameters
- Specification of signal timing and
- Specify the traffic input data

Each are input through card "types" of which there are over 30, of which about 10 or so are input in a fairly "routine" problem. The essential elements of the input data can usually be identified as follows:

- Control card
- Node list and associated data
    - Controller timing (phasing required, timing optional)
    - Link data (geometrics and volumes and turn percentages)
    - Upstream source links
    - Bottleneck and dummy links
- Weighting, Modifier, Arterial and Plot Cards
- Run parameter and Termination Cards

The complexity of traffic data and "upstream" source links has been a common "nemesis" to TRANSYT-7F and the use of "standard turning data" must be supplemented with link-to-link flows for the platoons to be truly representative. Most other elements of data input are fairly self explanatory and need not be outlined in this summary. Suffice it to say, that if TRANSYT-7F is to be carried out a considerable amount of knowledge about the network is required, but

- Procedurally, the model now uses a "punch file" to capture intermediate "best" timing plans, allows for optimizing specific nodes more than once and now permits coding of offsets while permitting program calculation of initial splits.

- Allowable network size has been increase to 100 nodes and 600 links

Documentation, Availability and License Cost

TRANSYT-7F is documented through a comprehensive Users Guide, developed and published by the Transportation Research Center - University of Florida and distributed at cost to users of the program. It contains 9 Chapters and 4 Appendices to include an Introduction, McT7F Executive Operation, Applications, Model Description, Input Data, Advanced Coding Options, Interpretation of Results, Application Guidelines and Installation Instructions.

The manual is available for $15 separately and the program package costs $350 and is available from the McTrans (University of Florida) and PC-TRANS (University of Kansas) software distribution centers.

Modeling Approach

TRANSYT-7F is designed to optimize signal settings by performing a macroscopic (i.e. platoons of vehicles) simulation of traffic flow within very small time increments (called steps) while signal timing parameters are varied. Optimization is performed on cycle length, offsets, and green splits through simulation of vehicle responses to varying signal settings using a hill-climbing search technique to minimize/maximize an objective function. When simulation only is applied, most parameters are input and a performance evaluation of stops, delay and fuel consumption is reported. When optimization is performed, the cycle length is either user fixed or the best cycle length is determined by TRANSYT-7F using a "quick" simulation and evaluation technique. Detailed optimization of offsets and splits is performed on the user specified or most likely "best cycle length". A more in-depth cycle, offset, and split optimization search can be made by making multiple runs with different fixed cycle lengths.

The program is characterized by a number of sub-models and algorithms which assist with the primary simulation of platoons of vehicles in the network and the optimization process. The users "control" over these can be very indirect and the user might proceed without a great amount of specific knowledge about traffic flow theory, flow balancing, permitted movement submodel, shared and permitted lane algorithms, and platoon dispersion. If the user is

Program/Package Name TRANSYT-7F

Developer Transportation and Road Research Laboratory through TRANSYT Version 9, TRANSYT-7F enhanced and upgraded by University of Florida Transportation Research Center (TRC).

Brief Description TRANSYT-7F (TRAffic Network StudY Tool, Version 7F) is designed to optimize traffic signal systems for arterials or networks on the basis of cycle length, offsets, and green splits adjustments to improve progression opportunities, or to reduce delay, stops and fuel consumption, or a combination of progression, delay and stops. The program accepts user input on signal timing phase patterns, geometric conditions, driver behavior characteristics and design hour vehicle volumes.

Application Areas The program is applied at the network (sub area) and/or corridor (arterial) level wherein a consistent set of traffic conditions is apparent and the system hardware can be integrated and coordinated with respect to fixed cycle length and coordinated offsets. For this reason, when actuated traffic signals (or other signals that are not coordinated) are in the network, additional steps are required to force the actuated signals to behave "as fixed time signals" in order to get a simulation/optimization to work.

Product History Developed in 1968 by TRRL and proceeded by introduction of Versions 1-6 for applications primarily in the European continent. Version 7F, converted from TRANSYT Version 7 to work with right side driving, non-metric measures, and the hardware specifications and terminology for the United States, was introduced in 1978. Version 7F has since been upgraded using "release" numbers with Release 7 being made available in late 1992.

Current Version/Release Version 7F - Release 7. Release 7 is highlighted by a number of significant enhancements which include:

- A new Executive menu to handle file operations in the DOS environment

- Significant improvements towards optimizing progression opportunities, handling of overlap phases, using a newer HCM method for random delay estimates, improving the split algorithm to employ user specified degrees of saturation and revising the stops algorithm for better accuracy near saturation.

<u>**Minimum Computer Hardware Requirements**</u>	An AT 286 or higher system with 640 KB is the minimum. The LEART module requires color EGA or better.
<u>**Recommended Hardware Specifications**</u>	An AT Clone 386sx or better with 1 MB is recommended if larger arterial systems are being optimized.
<u>**Operating System and Environment Requirement and Compatibility**</u>	MS-DOS 3.x or higher.
<u>**Program Language**</u>	Source code not normally available to users.

PASSETUP	Turbo Pascal
PASSER II	Turbo Pascal

a HCM type adjustment of volumes and saturation flow and for computation of minimum green times. The AAP provides for a common TRANSYT-7F and PASSER II preprocessor and reduces the time required for data coding, but does make a number of assumptions.

Post-processors

PASSER II's own operating shell for input and output, PASSETUP, displays the program outputs to screen or transmits output to a printer. The LEART program displays an animation of the signal timing and the movement of vehicles through the arterial. There is little correlation between the LEART animation and PASSER II output except for signal timing and entry volumes. The AAP AAP2NEMA program can display the signal timing in either a single ring or dual ring controller configuration. The AAP can also take the PASSER II generated phasing patterns and signal timing and pass them to TRANSYT-7F for further optimization.

The LEART program might also be described as a postprocessor, but while it describes the arterial in graphics format using individual vehicle displays of the current system status, the results of the vehicle performance and queuing are not very well correlated with the PASSER II output. In fact, the number of lanes displayed by LEART can differ from that input to PASSER II. Since PASSER II does not simulate individual vehicles, separate "LEART" algorithms are used to display vehicle progression. LEART is therefore more of a progression display than a serious engineering tool.

Program Maximum Dimension Limits

A total of 20 intersections with 2 to 6 phases sequences can be simulated and a total of 8 intersections can be "shown" in the LEART module.

Program Modelling Limitations

Ignores progression opportunities which may occur within subsegments of the arterial. No explicit consideration is given to spillback. Left turn lanes have same length as through lanes. Optimization process may select a phase sequence at an intersection that is only marginally better than an existing phase sequence. Bandwidth optimization can result in cycle lengths which can cause high degrees of saturation and delay. Webster timing split can provide green time to cross-street that can be better utilized by arterial street if a higher degree of saturation is acceptable for the cross-street.

percentage of green time that is within the calculated "band" in each direction. The best performing bandwidth is then selected from among those possible with the phasing being tested, using the measure of bandwidth "efficiency" defined as sum of both through bands divided by twice the cycle length.

The user can, if desired, optimize the results for a particular direction of traffic flow on the arterial by specifying either direction as the "optimized flow direction".

Input Requirements

The program requires all of the standard traffic flow and geometric data, in the form of capacity for each lane group. PASSER II requires an understanding of "permitted phase sequencing" which may be allowed for the signal system on the arterial to be analyzed. While at first the terminology is "new", it really boils down to which types of sequencing (with overlap or without overlap) will be allowed and if left turn phases are used, whether the "permitted vs protected" option is selected over the "protected plus permitted" option. These two options result in 8 possible phasing patterns and a maximum of 4 may be "selected" for evaluation on the arterial with only one being selected for the side street.

The program uses the NEMA movement numbering convention and care must be taken to understand the differences between overlap and non-overlap options. Both the PASSER II preprocessor, PASETUP, and the AAP program provides a significant amount of assistance in this area.

Some other "embedded data" changes are also permitted at the user's discretion, but they are not usually changed by the infrequent user.

Outputs

The output for this program is by its nature relatively simple and limited in quantity. The "selected" optimal phase pattern is identified and the associated signal data of cycle length and bandwidth performance is summarized. The intersection performance level in terms of a V/C ratio, average delay, and the minimum delay cycle is then summarized. Using NEMA phase mumbering designations, the signal phasing patterns are detailed with splits and sequences, concluding with average delay and fuel consumption. The arterial system is summarized with average intersection delay, total delay, fuel consumption, and the number of stops.

Preprocessors

PASSER II's own operating shell for input and output, PASSETUP, is user-friendly and permits a wider option of inputs as compared to the AAP program. PASSETUP also has an ASSISTANT module for

TRAFFIC MODEL PROGRAM SUMMARIES

Program/Package Name PASSER II

Developer Texas Transportation Institute

Brief Description PASSER II is a bandwidth based arterial signal timing optimization program which has the unique ability to optimize phase sequence. Cycle lengths and splits are optimized using Webster's method and the program develops optimized offsets for a series of interconnected signals. Actuated signals are not treated by the program.

Application Areas The program is utilized to optimize signal timing on an arterial system by maximizing bandwidth efficiency. The program does not analyze a network of signals.

Product History The program was initially developed in the 1970's in Texas to respond to the ability of newer controllers to be setup on a coordinated basis with a number of optional phasing and split sequences which a number of other traffic programs could not handle. It has evolved from a 1980 mainframe version (PASSER II 80) to the current version which operates in the PC environment and also runs under the Arterial Analysis Package (AAP).

Current Version/Release PASSER II-90

Documentation, Acquisition and License Cost PASSER II and the User Guide is available at a cost of $150 for the program and $15 for the User Guide from McTrans (University of Florida) and PC-TRANS (University of Kansas).

Modeling Approach PASSER II is a deterministic, time-series, search-and-find, bandwidth optimization model in which the user provides minimum and maximum cycle length, permitted phasing options, left turn phase protection type, hourly design traffic volumes, and geometric data. A maximum of four possible phase sequences are specified for the arterial (or individual node) and limits to one the allowable phase sequences for the cross street. With a limit on the models operation, the program can be used to "simulate" an existing condition.

The program uses Webster's method for signal splits, and bandwidth optimization to determine the arterial offsets. Since neither individual vehicles nor platoons are "tracked", the program relies upon an algorithm that calculates the probability of queue clearance and the

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INTRODUCTION

This Traffic Model Handbook provides information on a number of the more widely used traffic models. The traffic models summarized are listed below.

PASSER II	ROADSIM
TRANSYT-7F	PASSER III
TRAF-NETSIM	MAXBAND
CORFLO NETFLO 1 and 2	SOAP
CORFLO FREFLO	TIMACS
FRESIM	FREQ
PROG.D (Document, not a program)	

For each of the traffic model program packages, the following information is generally provided. Sample inputs and outputs are provided in Appendix I.

Program/Package Name	Preprocessors
Developer	Post-processors
Brief Description	Program Maximum Dimension Limits
Application Areas	Program Modelling Limitations
Product History	Other Features and Capabilities
Current Version/Releases	Minimum Computer Hardware Requirements
Documentation, Availability and Cost	Recommended Hardware Specifications
Modeling Approach	Operating System and Environment Requirement and Compatibility
Input Requirements	
Outputs	Program Language(s)

Selected models in this handbook deal with integrated signal systems, urban network simulation and their integration with the freeway system. In deciding which traffic model(s) is appropriate for inclusion in a project study, it is helpful to compare the models side-by-side in terms of their capabilities or program features. The following summary comparisons tables were therefore deemed appropriate and are presented in Appendix II.

(1) TRANSYT-7F (Network and Arterial) versus PASSER II (Arterial) Signal Timing
(2) TRAF-NETSIM vs. CORFLO NETFLO 1 vs. CORFLO NETFLO 2 Urban Network Simulation
(3) FRESIM versus FREFLO Freeway Network Simulation

Appendix III contains traffic model specific references and is a subset of Appendix V.

Appendix IV contains an alphabetized list of traffic modelling references without any abstracts.

Appendix V contains an alphabetized list of traffic modelling references with abstracts.

TABLE OF CONTENTS

SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yards	0.836	square meters	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	ml
gal	gallons	3.785	liters	l
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3

NOTE: Volumes greater than 1000 l shall be shown in m^3.

Symbol	When You Know	Multiply By	To Find	Symbol
		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams	Mg
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5(F-32)/9 or (F-32)/1.8	Celcius temperature	°C
		ILLUMINATION		
fc	foot-candles	10.76	lux	l
fl	foot-Lamberts	3.426	candela/m^2	cd/m^2
		FORCE and PRESSURE or STRESS		
lbf	poundforce	4.45	newtons	N
psi	poundforce per square inch	6.89	kilopascals	kPa

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	ac
ha	hectares	2.47	acres	mi^2
km^2	square kilometers	0.386	square miles	
		VOLUME		
ml	milliliters	0.034	fluid ounces	fl oz
l	liters	0.264	gallons	gal
m^3	cubic meters	35.71	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
		MASS		
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg	megagrams	1.103	short tons (2000 lb)	T
		TEMPERATURE (exact)		
°C	Celcius temperature	1.8C + 32	Fahrenheit temperature	°F
		ILLUMINATION		
lx	lux	0.0929	foot-candles	fc
cd/m^2	candela/m^2	0.2919	foot-Lamberts	fl
		FORCE and PRESSURE or STRESS		
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	psi

* SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380.

(Revised August 1992)

Technical Report Documentation ,

1. Report No. FHWA-SA-93-050	2 PB94-111879	3. Recipient's Catalog No.
4. Title and Subtitle Traffic Models Overview Handbook		5. Report Date June 1993
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7. Author(s) James R. Mekemson, Ph.D., P.E., Edward T. Herlihy, and Shui-Ying Wong, P.E.		8. Performing Organization Report No. ESDI-113
9. Performing Organization Name and Address VICOR Associates, Inc. 9210 Lee Avenue Manassas, Virginia 22110-5513		10. Work Unit No. (TRAIS)
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12. Sponsoring Agency Name and Address U.S.Department of Transportation Federal Highway Administration Office of Traffic Management & IVHS Washington, D.C. 20590		13. Type of Report and Period Covered Overview, Technical Overview, References and Abstracts October, 1991 - March, 1993
		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

This Handbook provides an overview of a number of Traffic Models for performing traffic signal timing optimization mainly for arterials and networks and for performing evaluations of traffic operations and geometric design plans for intersections, arterials, urban street networks, and freeways using simulation models. The simulation models reviewed encompass both macroscopic and microscopic models. The traffic models reviewed include: PASSER II, TRANSYT-7F, TRAF-NETSIM, CORFLO (NETFLO 1 & 2 and FREFLO), FRESIM, ROADSIM, PASSER III, MAXBAND, SOAP, TIMACS, and FREQ. The purpose of the Handbook is to provide the transportation professional with information sufficient for deciding if a particular traffic model would be suitable for their applications and an idea on how much effort and resources would be required to apply the model effectively.

Appendices contain "Selected Traffic Model Inputs and Outputs", "Traffic Model Summary Comparison Tables", "Traffic Model Specific References", "Traffic Modelling References", and "Traffic Model References and Abstracts".

17. Key Words Traffic Models, Signal Timing, Simulation, Optimization, Intersections, Arterials, Freeways, Computer Models	18. Distribution Statement No restriction.

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(INPUT.DATA)
                    TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
PASSER II-90     MULTIPHASE ARTERIAL PROGRESSION - 145101      VER 1.0   DEC 90

                         **** INPUT DATA CONTINUED ****
**********************************************************************
  **** INTERSECTION  1      1st Street
       DISTANCE  0 TO  1      SPEED      DISTANCE  1 TO  0      SPEED
           0. FT              0. MPH         0. FT                0. MPH

       A SIDE QUEUE CLEARANCE              B SIDE QUEUE CLEARANCE
                0 SECS                              0 SECS

 ARTERIAL PERMISSIBLE PHASE SEQUENCE            CROSS ST PHASE SEQUENCE
  DUAL LEFTS    (1+5)     NO OVERLAP              DUAL THRUS    (4+8)
                                                    NO OVERLAP
```

		ARTERIAL STREET				CROSS STREET			
PHASE	(NEMA)	5[5]	6	1[5]	2	3[1]	4	7[1]	8
VOLUMES	(VPH)	600	1275	100	1400	0	539	0	620
SAT FLOW RATE	(VPHG)	3420	5400	1710	5400	1710	3551	1710	3567
MINIMUM PHASE	(SEC)	10	15	10	15	0	10	0	10

```
(INPUT.DATA)
                    TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
PASSER II-90     MULTIPHASE ARTERIAL PROGRESSION - 145101      VER 1.0   DEC 90

                         **** INPUT DATA CONTINUED ****
**********************************************************************
  **** INTERSECTION  2      2nd Street
       DISTANCE  1 TO  2      SPEED      DISTANCE  2 TO  1      SPEED
         1800. FT            30. MPH       1800. FT              30. MPH

       A SIDE QUEUE CLEARANCE              B SIDE QUEUE CLEARANCE
                0 SECS                              0 SECS

 ARTERIAL PERMISSIBLE PHASE SEQUENCE            CROSS ST PHASE SEQUENCE
                                                  DUAL THRUS    (4+8)
                                                    NO OVERLAP
  LT 5 LEADS    (2+5)   WITH OVERLAP
```

		ARTERIAL STREET				CROSS STREET			
PHASE	(NEMA)	5[5]	6	1[1]	2	3[1]	4	7[4]	8
VOLUMES	(VPH)	255	1420	0	1225	0	255	255	0
SAT FLOW RATE	(VPHG)	1710	5400	0	5400	0	1530	1710	0
MINIMUM PHASE	(SEC)	10	15	0	15	0	10	0	0

```
(INPUT.DATA)
                 TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
PASSER II-90      MULTIPHASE ARTERIAL PROGRESSION - 145101      VER 1.0   DEC 90

                        **** INPUT DATA CONTINUED ****
 *********************************************************************
   **** INTERSECTION  3      3rd Street
        DISTANCE  2 TO  3      SPEED      DISTANCE  3 TO  2      SPEED
          1000. FT             30. MPH      1000. FT             30. MPH

        A SIDE QUEUE CLEARANCE             B SIDE QUEUE CLEARANCE
                 0 SECS                             0 SECS

 ARTERIAL PERMISSIBLE PHASE SEQUENCE          CROSS ST PHASE SEQUENCE
  DUAL LEFTS    (1+5)     NO OVERLAP            DUAL THRUS    (4+8)
                                                  NO OVERLAP


                              ARTERIAL STREET            CROSS STREET
PHASE          (NEMA)  5[5]     6    1[5]     2    3[1]     4    7[1]      8
VOLUMES        (VPH)    200  1610     300  1080       0   200       0    355
SAT FLOW RATE  (VPHG)  1710  5400    3420  5400    1710  1577    1710   1606
MINIMUM PHASE  (SEC)     10    15      10    15       0    10       0     10


(ERROR.MSG)
                 TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
PASSER II-90      MULTIPHASE ARTERIAL PROGRESSION - 145101      VER 1.0   DEC 90

                        **** CODING ERROR MESSAGES ****

         NO APPARENT CODING ERRORS


(ART.SUMY)
                 TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
PASSER II-90      MULTIPHASE ARTERIAL PROGRESSION - 145101      VER 1.0   DEC 90

                    **** BEST PROGRESSION SOLUTION SUMMARY ****
OS             Main Avenue                  DISTRICT Va 03/31/92    RUN NO.  1

         CYCLE LENGTH  = 90 SECS       (MAXIMIN CYCLE =  72 SECS)
         EFFICIENCY    =   .21         (FAIR PROGRESSION)
         ATTAINABILITY =   .55         (MAJOR CHANGE REQ'D)

         BAND A        = 18 SECS       AVERAGE SPEED  =  30 MPH
         BAND B        = 20 SECS       AVERAGE SPEED  =  30 MPH

   NOTE: ARTERIAL PROGRESSION EVALUATION CRITERIA
         -----------------------------------------------
         EFFICIENCY     0.00 - 0.12 - "POOR PROGRESSION"
                        0.13 - 0.24 - "FAIR PROGRESSION"
                        0.25 - 0.36 - "GOOD PROGRESSION"
                        0.37 - 1.00 - "GREAT PROGRESSION"

         ATTAINABILITY 1.00 - 0.99 - "INCREASE MIN THRU PHASE"
                        0.99 - 0.70 - "FINE-TUNING NEEDED"
                        0.69 - 0.00 - "MAJOR CHANGES NEEDED"
```

(INT.SUMY)

90 TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

PASSER II-90 MULTIPHASE ARTERIAL PROGRESSION - 145101 VER 1.0 DEC 90

**** INTERSECTION PERFORMANCE SUMMARY ****

CYCLE LENGTH = 90 SECS SYSTEM MAXIMIN CYCLE = 72 SECS

INT NO	CROSS STREET INTERSECTION	PHASE ART	PHASE CRS	MIN. CYCLE	DELAY (SECS)	INTERSECTION V/C RATIO	AVERAGE DELAY (SECS/VEH)	INT NO
1	1st Street	1	2	72		.87	28.5	1
2	2nd Street	3	2	57		.77	18.0	2
3	3rd Street	1	2	69		.85	25.3	3

NOTE: PHASE SEQUENCE CODE FOR ARTERIAL (ART) CROSS STREET (CRS)

1 - LEFT TURN FIRST OR DUAL LEFTS LEADING OR DUAL LEFTS (1+5)
2 - THROUGH FIRST OR DUAL THRUS LEADING OR DUAL THRUS (2+6)
3 - LEADING GREEN OR NO. 5 LEADING OR LT 5 LEADS (2+5)
4 - LAGGING GREEN OR NO. 1 LEADING OR LT 1 LEADS (1+6)

(BEST.SOLN)

TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

PASSER II-90 MULTIPHASE ARTERIAL PROGRESSION - 145101 VER 1.0 DEC 90

OS Main Avenue DISTRICT Va 03/31/92 RUN NO. 1

BEST SOLUTION

CYCLE LENGTH = 90 SECS BAND A = 18 SECS BAND B = 20 SECS

BAND: .21 EFFICIENCY .55 ATTAINABILITY

AVERAGE PROGRESSION SPEED - BAND A = 30 MPH BAND B = 30 MPH

```
(BEST.SOLN)
                 TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
PASSER II-90      MULTIPHASE ARTERIAL PROGRESSION - 145101     VER 1.0  DEC 90

**** INTERSECTION  1    1st Street    OFFSET=    .0 SECONDS,    .0 %
     ARTERIAL      PHASE SEQUENCE IS DUAL LEFTS    (1+5)
     CROSS STREET PHASE SEQUENCE IS DUAL THRUS     (4+8)
                                 ARTERIAL              CROSS STREET
CONCURRENT PHASES       1+5    1+6    2+6   TOTAL   4+8    3+8    3+7   TOTAL
PHASE TIME (SECS)      24.5     .0   34.5    59.0  31.0     .0     .0    31.0
PHASE TIME (%)         27.2     .0   38.3    65.6  34.4     .0     .0    34.4
---------------------- MEASURES OF EFFECTIVENESS ---------------------
MOVEMENT/  V/C           TOTAL    AVERAGE          PROB.  QUEUE
NODE NOS.  RATIO  (LOS)  DELAY     DELAY    (LOS)  CLEAR.  (LOS)   STOPS
            (%)         (VEH-HR)  (SEC/VEH)         (%)           (VEH/HR)  (%)
 NB THRU :   61    (B)      4.74      27.5    (C)      99     (B)     490. ( 79)

 SB THRU :   57    (A)      3.98      26.6    (C)     100     (A)     422. ( 78)

 EB THRU :   75    (C)     10.75      27.6    (C)      97     (B)    1288. ( 92)
    LEFT :   75    (C)      5.94      35.7    (D)      91     (B)     531. ( 89)
 WB THRU :   68    (B)      9.66      27.3    (C)      99     (B)    1136. ( 89)
    LEFT :   25    (A)       .78      28.1    (C)     100     (A)      74. ( 74)
NODE   1 :   75   (MAX)    35.85      28.5             91    (MIN)   3941. ( 87)
-----------------------------------------------------------------------

(BEST.SOLN)
                 TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
PASSER II-90      MULTIPHASE ARTERIAL PROGRESSION - 145101     VER 1.0  DEC 90

**** INTERSECTION  2    2nd Street    OFFSET= 48.0 SECONDS, 53.3 %
     ARTERIAL      PHASE SEQUENCE IS LT 5 LEADS    (2+5)
     CROSS STREET PHASE SEQUENCE IS DUAL THRUS     (4+8)
                                 ARTERIAL              CROSS STREET
CONCURRENT PHASES       2+5    2+6    1+6   TOTAL   4+8    3+8    3+7   TOTAL
PHASE TIME (SECS)      25.3   41.6     .0    66.9  23.1     .0     .0    23.1
PHASE TIME (%)         28.1   46.2     .0    74.3  25.7     .0     .0    25.7
---------------------- MEASURES OF EFFECTIVENESS ---------------------
MOVEMENT/  V/C           TOTAL    AVERAGE          PROB.  QUEUE
NODE NOS.  RATIO  (LOS)  DELAY     DELAY    (LOS)  CLEAR.  (LOS)   STOPS
            (%)         (VEH-HR)  (SEC/VEH)         (%)           (VEH/HR)  (%)


 SB THRU :   76    (C)      3.02      42.7    (D)      76     (C)     262. (103)
    LEFT :   56    (A)      2.30      32.4    (C)       0     (E)     218. ( 85)
 EB THRU :   32    (A)       .53       1.6    (A)     100     (A)     162. ( 13)
    LEFT :   61    (B)      2.32      32.8    (D)      96     (B)     215. ( 84)
 WB THRU :   62    (B)      8.85      22.4    (C)     100     (A)    1122. ( 79)

NODE   2 :   76   (MAX)    17.02      18.0              0    (MIN)   1979. ( 58)
-----------------------------------------------------------------------
```

```
(BEST.SOLN)
                    TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
PASSER II-90       MULTIPHASE ARTERIAL PROGRESSION - 145101       VER 1.0   DEC 90

**** INTERSECTION  3    3rd Street     OFFSET= 46.8 SECONDS, 52.0 %
     ARTERIAL      PHASE SEQUENCE IS DUAL LEFTS     (1+5)
     CROSS STREET PHASE SEQUENCE IS DUAL THRUS     (4+8)
                                  ARTERIAL               CROSS STREET
CONCURRENT PHASES        1+5    1+6    2+6   TOTAL   4+8    3+8    3+7   TOTAL
PHASE TIME (SECS)       18.4     .0   40.8    59.2  30.8     .0     .0    30.8
PHASE TIME (%)          20.4     .0   45.3    65.8  34.2     .0     .0    34.2
---------------------- MEASURES OF EFFECTIVENESS --------------------
MOVEMENT/  V/C          TOTAL   AVERAGE          PROB. QUEUE
NODE NOS. RATIO  (LOS)  DELAY    DELAY   (LOS)  CLEAR.  (LOS)    STOPS
           (%)        (VEH-HR) (SEC/VEH)          (%)          (VEH/HR)  (%)
 NB THRU :  78    (C)     3.59     36.4    (D)     80     (C)     328. ( 92)

 SB THRU :  44    (A)     1.42     25.5    (C)    100     (A)     149. ( 74)

 EB THRU :  48    (A)     5.81     19.4    (B)    100     (A)     974. ( 90)
    LEFT :  70    (C)     2.36     42.5    (D)     83     (C)     190. ( 95)
 WB THRU :  72    (C)    10.25     22.9    (C)     99     (B)    1470. ( 91)
    LEFT :  53    (A)     2.94     35.2    (D)    100     (A)     252. ( 84)
NODE   3 :  78  (MAX)    26.37     25.3            80   (MIN)    3363. ( 90)
--------------------------------------------------------------------


(ART.MOE)
                    TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
PASSER II-90       MULTIPHASE ARTERIAL PROGRESSION - 145101       VER 1.0   DEC 90

*** PASSER II-90 BEST SOLUTION SUMMARY - TOTAL SYSTEM PERFORMANCE ***

OS            Main Avenue                   DISTRICT Va 03/31/92      RUN NO.  1


CYCLE LENGTH =   90 SECS       BAND A =   18 SECS     BAND B =   20 SECS

BAND:    .21 EFFICIENCY    .55 ATTAINABILITY

AVERAGE PROGRESSION SPEED :
BAND A =   30 MPH     BAND B =   30 MPH

-----------------------------------------------------------------------
PERFORMANCE    TOTAL       TOTAL    AVERAGE     TOTAL        FUEL     MAX MIN
MEASURES      VEHICLES     DELAY     DELAY      STOPS     CONSUMPTION  CYCLE
              (VEH/HR)   (VEH-HR) (SEC/VEH)  (VEH/HR)(%)   (GAL/HR)    (SEC)
-----------------------------------------------------------------------
TOTAL        : 11689.      79.2      24.4    9282.4( 79)    175.2        72
-----------------------------------------------------------------------
```

(PIN.SET)

TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

PASSER II-90 MULTIPHASE ARTERIAL PROGRESSION - 145101 VER 1.0 DEC 90

**** SUMMARY OF PASSER II-90 BEST SIGNAL TIMING SOLUTION ****

OS Main Avenue DISTRICT Va 03/31/92 RUN NO. 1

CYCLE = 90. SECONDS SPLIT = 1 2 3. OFFSET = 1 2 3.

Main Avenue OS

MAST INT = 1 SYS INT = 1 SYS OFFSET = .0 REF MOVMNT = 0 REF PNT = BEGIN

INTRSC 1 : 1st Street COORD PHASE : 0 OFFSET : .0 SEC : .0%

*-[MASTER AND SYSTEM INTERSECTION]

DUAL-RING PHASE #	5	6	1	2	3	4	7	8
PHASE SPLIT (SEC)	24.5	34.5	24.5	34.5	.0	31.0	.0	31.0
PHASE SPLIT (%)	27.%	38.%	27.%	38.%	0.%	34.%	0.%	34.%
PHASE REVERSAL	--	--	--	--	4	3	8	7
LEFT TURN	LEAD	--	LEAD	--	LAG	--	LAG	--

CONCURRENT PHASES	1+5	1+6	2+6	4+8	3+8	3+7	MAIN	CROSS
DURATION (SEC)	24.5	.0	34.5	31.0	.0	.0	59.0	31.0
CYCLE COUNT (SEC)	.0	24.5	24.5	59.0	.0	.0	.0	59.0
CYCLE COUNT (%)	0.%	27.%	27.%	66.%	0.%	0.%	0.%	66.%

(PIN.SET)

TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

PASSER II-90 MULTIPHASE ARTERIAL PROGRESSION - 145101 VER 1.0 DEC 90

**** SUMMARY OF PASSER II-90 BEST SIGNAL TIMING SOLUTION ****

OS Main Avenue DISTRICT Va 03/31/92 RUN NO. 1

CYCLE = 90. SECONDS SPLIT = 1 2 3. OFFSET = 1 2 3.

Main Avenue OS

MAST INT = 1 SYS INT = 1 SYS OFFSET = .0 REF MOVMNT = 0 REF PNT = BEGIN

INTRSC 2 : 2nd Street COORD PHASE : 0 OFFSET : 48.0 SEC : 53.3%

DUAL-RING PHASE #	5	6	1	2	3	4	7	8
PHASE SPLIT (SEC)	25.3	41.6	.0	66.9	.0	23.1	.0	23.1
PHASE SPLIT (%)	28.%	46.%	0.%	74.%	0.%	26.%	0.%	26.%
PHASE REVERSAL	--	--	2	1	4	3	8	7
LEFT TURN	LEAD	--	LAG	--	LAG	--	LAG	--

CONCURRENT PHASES	2+5	2+6	1+6	4+8	3+8	3+7	MAIN	CROSS
DURATION (SEC)	25.3	41.6	.0	23.1	.0	.0	66.9	23.1
CYCLE COUNT (SEC)	48.0	73.3	24.9	24.9	48.0	48.0	48.0	24.9
CYCLE COUNT (%)	53.%	81.%	28.%	28.%	53.%	53.%	53.%	28.%

```
(PIN.SET)
              TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
PASSER II-90      MULTIPHASE ARTERIAL PROGRESSION - 145101      VER 1.0   DEC 90

       **** SUMMARY OF PASSER II-90 BEST SIGNAL TIMING SOLUTION ****
                Main Avenue                   DISTRICT Va 03/31/92    RUN NO.  1
OS

CYCLE =  90. SECONDS               SPLIT = 1 2 3.              OFFSET = 1 2 3.

 Main Avenue OS
MAST INT =  1 SYS INT =  1 SYS OFFSET =    .0 REF MOVMNT = 0 REF PNT = BEGIN

INTRSC  3 : 3rd Street            COORD PHASE : 0 OFFSET :  46.8   SEC :  52.0%

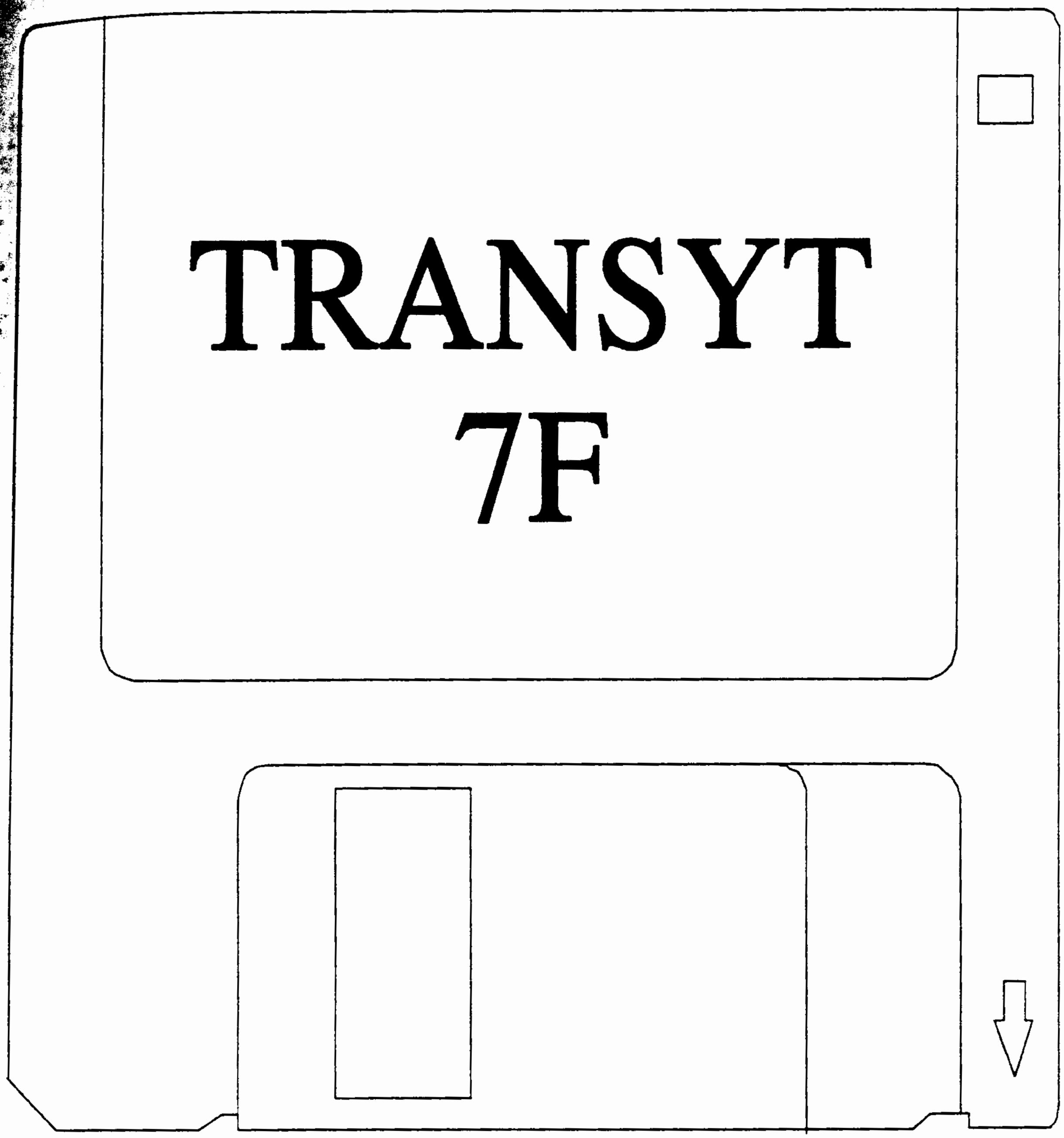
DUAL-RING PHASE #         5       6       1       2       3       4       7       8
PHASE SPLIT (SEC)      18.4    40.8    18.4    40.8      .0    30.8      .0    30.8
PHASE SPLIT (%)        20.%    45.%    20.%    45.%     0.%    34.%     0.%    34.%
PHASE REVERSAL           --      --      --      --       4       3       8       7
LEFT TURN              LEAD      --    LEAD      --     LAG      --     LAG      --

CONCURRENT PHASES       1+5     1+6     2+6     4+8     3+8     3+7    MAIN   CROSS
DURATION     (SEC)     18.4      .0    40.8    30.8      .0      .0    59.2    30.8
CYCLE COUNT  (SEC)     46.8    65.2    65.2    16.0    46.8    46.8    46.8    16.0
CYCLE COUNT  ( % )     52.%    72.%    72.%    18.%    52.%    52.%    52.%    18.%
```

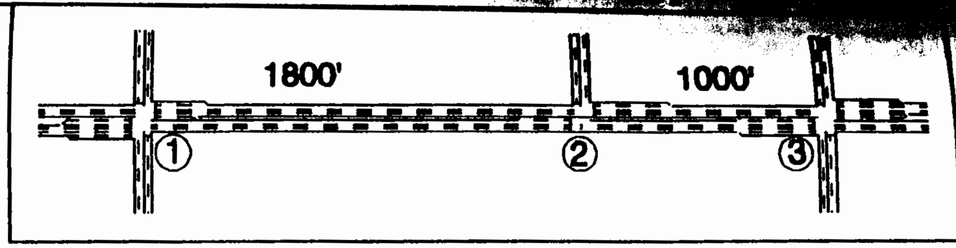
```
(TS.DIAGM)
              TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
PASSER II-90      MULTIPHASE ARTERIAL PROGRESSION - 145101      VER 1.0   DEC 90

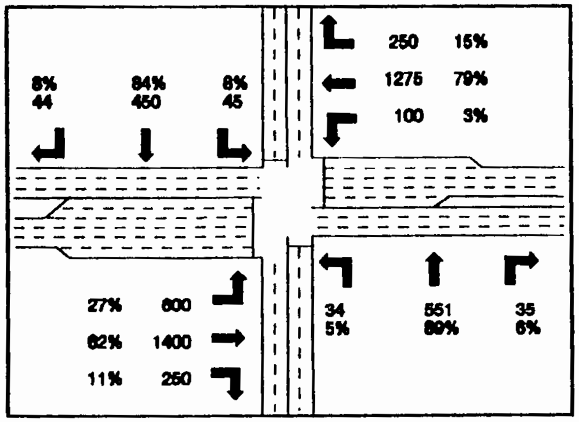
                                                 03/31/92  CYCLE =  90 SECONDS
RUN NO   1  DISTRICT Va  Main Avenue
            HORIZONTAL SCALE 1 INCH =    30 SECS   (1 inch = 10 characters)
            VERTICAL   SCALE 1 INCH = 1000 FEET    (1 inch = 6 lines)
                                                 |
INT  3  I
3rd Str IXXXXX               ======XXXXXXXXX|XXXX            ======XXXXXXXXXXXXX
 46.8S  I                                   |
        I                               ..  |.
        I                                   |
        I                           .  .  . | .
INT  2  I                                   |
2nd Str IXXXXXXXX          ////////XXXXXX|XXXXXXX         ////////XXXXXXXXXXXXX
 48.0S  I                                   |
        I                        .    .     |.    .
        I                                   |
        I                     .    .        |  .    .
        I                                   |
        I                  .    .           |    .    .
        I                                   |
        I                .    .             |      .    .
        I                                   |
INT  1  I             .    .                |          .    .
1st Str I========XXXXXXXXXXX                |=======XXXXXXXXXXX         ========XX
  0.0S
                 /A/                                          \B\
               30 MPH                                       30 MPH
           18 SECOND BAND                              20 SECOND BAND

        === DUAL LEFTS   (1+5)                     XXX DUAL THRUS   (2+6)
        /// LT 5 LEADS   (2+5)                     \\\ LT 1 LEADS   (1+6)
```

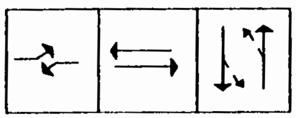

TRANSYT
7F

TRANSYT Output for [illegible]



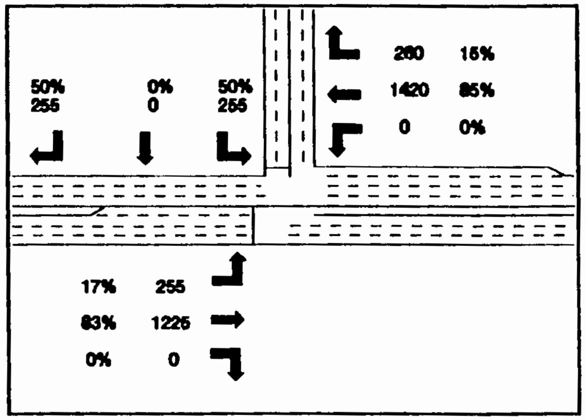


Node 1, 1st Street

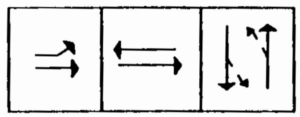


25 sec 34 sec 31 sec.
Offset = 0 sec. Cycle = 90 sec.

Phase Sequence LT|G for EW|NS. Protected Dual Lefts (1+5) followed by Throughs (2+6) for the EW movements and Green Ball (4+8) for the NS movements.

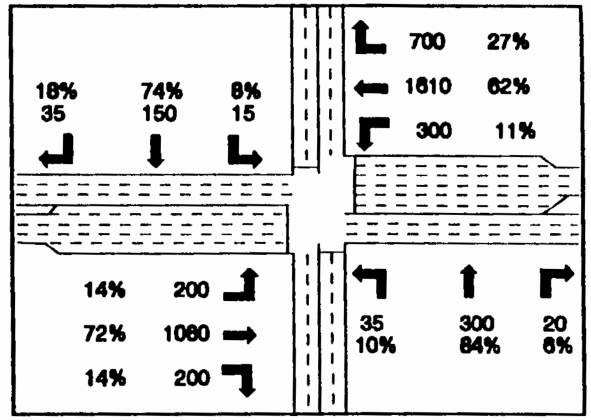


Node 2, 2nd Street

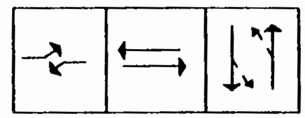


25 sec 42 sec 23 sec
Offset = 48 secs. Cycle = 90 sec.

Phase Sequence ER|G for EW|NS. Leading Left (2+5) for the EB movement followed by Throughs (2+6) for the EW movements and Green Ball (4+8) for the NS movements.



Node 3, 3rd Street



18 sec 41 sec 31 sec
Offset = 47 sec. Cycle = 90 sec.

Phase Sequence LT|G for EW|NS. Protected Dual Lefts (1+5) followed by Throughs (2+6) for the EW movements and Green Ball (4+8) for the NS movements.

Editor's Note: The TRANSYT output was produced by a pre-release version of TRANSYT and therefore results may not be reproducible using a later pre-release or release version.

```
*************************************************************************
*                                                                       *
* Release 7.00                  (TRANSYT-7F)                Prerelease *
*                                                                       *
*                TRAFFIC SIGNAL SYSTEM OPTIMIZATION                     *
*                                                                       *
*                             PROGRAM                                   *
*                                                                       *
* Sponsored by:                                             Developed by: *
*                                                                       *
* U.S. Department of Transportation              University of Florida *
* Federal Highway Administration        Transportation Research Center *
*                                                                       *
*         Software Maintenance and User Support Furnished by:           *
*        Center for Microcomputers in Transportation (McTrans)          *
*        Transportation Research Center, University of Florida          *
*            512 Weil Hall, Gainesville, FL 32611-2083 USA              *
*                          (904) 392-0378                               *
*                                                                       *
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*        TRANSYT-7F Copyright 1980-1991, University of Florida.         *
*                        All Rights Reserved.                           *
*                                                                       *
*************************************************************************

Date of Run:  9/23/92  Start Time of Run:   14:52:49

----------------------------------------------------
I N P U T   D A T A   R E P O R T   F O R   R U N   1
----------------------------------------------------


FIELDS:
  1    2    3    4    5    6    7    8    9   10   11   12   13   14   15   16
 ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ----
Main Avenue      OSO               CASE NUMBER   1.
  1   90   90   10    0    0    3    3    1    1    0   60    0    0    0    0

---  2 --- NOTE - THE CYCLE INCREMENT IS IGNORED IN A SINGLE CYCLE RUN.

+++ 106 +++ WARNING + THE SEC/STEPS FACTOR IN FIELD 6 IS TOO SMALL FOR CYCLE
                      LENGTHS ABOVE  60 SECONDS. IT WILL BE INCREASED TO
                      ALLOW A MAXIMUM OF 60 STEPS/CYCLE.

  2    1    2    3    0    0    0    0    0    0    0    0    0    0    0    0
```

FIELDS:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
3	3	8	11	7	4	12	5	2	9	1	6	10	0	0	0
7	108	103	0	0	0	104	107	0	0	0	308	303	0	0	0
7	304	307	0	0	0	0	0	0	0	0	0	0	0	0	0
10	1	0	0	0	0	0	0	0	3	95	25	100	100	125	120

+++ 115 +++ WARNING + ORIENTATION FLAG IGNORED DUE TO NEMA CARD.

INTERSECTION: 1st Street

INTERSECTION 1

13	1	0	1	19	4	38	4	21	4	0	0	0	0	0	0
21	1	1	1	2	0	10	105	101	0	0	0	0	0	0	0
22	1	3	3	4	0	15	102	106	109	110	0	0	0	0	0
23	1	5	5	6	0	10	108	-103	104	-107	0	0	0	0	0
28	108	100	3567	586	0	0	0	25	0	0	0	0	0	0	0
28	103	100	0	34	0	0	0	25	0	0	0	0	0	0	0
29	103	0	0	0	2	0	0	0	104	0	0	0	0	0	0
28	104	100	3551	494	0	0	0	25	0	0	0	0	0	0	0
28	107	100	0	45	0	0	0	25	0	0	0	0	0	0	0
29	107	0	0	0	2	0	0	0	108	0	0	0	0	0	0
28	102	1000	5400	1400	0	0	0	30	0	0	0	0	0	0	0
28	105	1000	3420	600	0	0	0	30	0	0	0	0	0	0	0
28	109	1000	1530	250	0	0	0	30	0	0	0	0	0	0	0
28	106	1800	5400	1275	0	206	1027	30	0	0	0	212	247	30	0
28	101	1800	1710	100	0	206	100	30	0	0	0	0	0	0	0
28	110	1800	1530	250	0	206	250	30	0	0	0	0	0	0	0

INTERSECTION: 2nd Street

INTERSECTION 2

13	2	63	1	19	4	38	4	21	4	0	0	0	0	0	0
21	2	1	1	2	0	10	202	205	0	0	0	0	0	0	0
22	2	3	3	4	0	15	202	206	210	0	0	0	0	0	0
23	2	5	5	6	0	10	204	207	212	0	0	0	0	0	0
28	204	0	1800	10	0	0	0	0	0	0	0	0	0	0	0
28	207	0	1710	255	0	0	0	0	0	0	0	0	0	0	0
28	212	0	1530	255	0	0	0	0	0	0	0	0	0	0	0
28	202	1800	5400	1225	0	102	1145	30	107	45	30	108	35	30	0
28	205	1800	1710	255	0	102	255	30	0	0	0	0	0	0	0
28	206	1000	5400	1420	0	306	1350	30	303	35	30	304	35	30	0
28	210	1000	1530	260	0	306	260	30	0	0	0	0	0	0	0

FIELDS:

INTERSECTION: 3rd Street

INTERSECTION 3

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
13	3	47	1	14	4	39	4	25	4	0	0	0	0	0	0
21	3	1	1	2	0	10	305	301	0	0	0	0	0	0	0
22	3	3	3	4	0	15	302	306	309	310	0	0	0	0	0
23	3	5	5	6	0	10	308	-303	304	-307	0	0	0	0	0
28	308	100	1606	320	0	0	0	25	0	0	0	0	0	0	0
28	303	100	0	35	0	0	0	25	0	0	0	0	0	0	0
29	303	0	0	0	2	0	0	0	304	0	0	0	0	0	0
28	304	100	1577	185	0	0	0	25	0	0	0	0	0	0	0
28	307	100	0	15	0	0	0	25	0	0	0	0	0	0	0
29	307	0	0	0	2	0	0	0	308	0	0	0	0	0	0
28	302	1000	5400	1080	0	202	825	30	207	255	30	0	0	0	0
28	305	1000	1710	200	0	202	200	30	0	0	0	0	0	0	0
28	309	1000	1530	200	0	202	200	30	0	0	0	0	0	0	0
28	306	100	5400	1610	0	0	0	30	0	0	0	0	0	0	0
28	301	100	3420	300	0	0	0	30	0	0	0	0	0	0	0
28	310	100	3060	700	0	0	0	30	0	0	0	0	0	0	0

PLOT AND OPTION CARDS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

--- 72 --- NOTE - A CARD TYPE 52 CAUSES RUN TO BE OPTIMIZED USING THE DEFAULT NORMAL OPTIMIZATION STEP SIZES. IF CARD TYPE 4 WAS CODED, IT IS IGNORED.

--- 70 --- NOTE - NO ERRORS DETECTED. TRANSYT-7F PERFORMS FINAL PROCESSING. IF ANY ERRORS ARE DETECTED, FURTHER PROCESSING IS SUSPENDED.

FIELDS:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

--- 74 --- NOTE - THERE ARE A TOTAL OF 3 NODES AND 27 LINKS, INCLUDING BOTTLENECKS, IF ANY, IN THIS RUN.

--- 77 --- NOTE - THERE WERE A TOTAL OF 2 WARNING MESSAGES ISSUED IN THE ABOVE REPORT.

<PERFORMANCE WITH OPTIMAL SETTINGS>

MOVEMENT/ NODE NOS.		V/C (%)	TOTAL TRAVEL (v-mi)	TRAVEL TIME TOTAL (v-hr)	TRAVEL TIME AVG. (sec/v)	TOTAL DELAY (v-hr)	AVG. DELAY (sec/v)	UNIFORM STOPS NO. (%)	MAX BACK OF QUEUE	EST.CAP.	FUEL CONS. (gal)
NB	THRUP:	75	10.92	6.15	37.8	5.71	35.1	513.(88)	13>	8C	6.62
	LEFTS:	12	.63	.25	26.1	.22	23.4	26.(75)	108	108S	.35
SB	THRUP:	66	9.21	4.83	35.2	4.46	32.5	423.(86)	11>	8C	5.29
	LEFTS:	19	.84	.33	26.6	.30	23.9	35.(79)	104	104S	.48
EB	THRU :	61	265.33	16.81	43.2	7.92	20.4	1022.(73)	27	120	22.34
	LEFT :	83	113.71	10.75	64.5	6.94	41.6	545.(91)	14	80	12.75
	RGHT :	39	47.38	2.83	40.7	1.24	17.9	161.(64)	4	40	3.74
WB	THRU :	56	434.94	20.47	57.8	5.89	16.6	561.(44)	14	216	25.33
	LEFT :	28	34.11	2.20	79.0	1.05	37.9	97.(97)	2	72	2.71
	RGHT :	39	85.28	3.76	54.2	.90	13.0	76.(31)	2	72	4.60
NODE	1:	83	1002.36	68.37		34.62	24.8	3460.(69)			84.21
SB	THRU :	2	.00	.07	25.9	.07	25.9	7.(73)	0	0	.09
	LEFT :	64	.00	2.37	33.4	2.37	33.4	217.(85)	6>	0	2.93
	RGHT :	71	.00	2.63	37.1	2.63	37.1	222.(87)	6>	0	3.15
EB	THRU :	33	417.89	14.34	42.1	.33	1.0	127.(10)	5	216	18.19
	LEFT :	71	86.99	5.06	71.4	2.14	30.2	156.(61)	5	72	6.01
WB	THRU :	62	269.12	11.25	28.5	2.23	5.7	257.(18)	11	120	14.15
	RGHT :	40	49.27	1.90	26.3	.25	3.4	24.(9)	1	40	2.35
NODE	2:	71	823.27	37.62		10.01	9.8	1010.(27)			46.87
NB	THRUP:	83	5.97	4.26	48.0	4.02	45.3	285.(89)	7>	4C	4.30
	LEFTS:	12	.65	.23	23.2	.20	20.5	23.(65)	308	308S	.32
SB	THRUP:	48	3.45	1.56	30.4	1.42	27.7	146.(79)	4	4	1.75
	LEFTS:	8	.28	.10	23.2	.09	20.5	10.(64)	304	304S	.14
EB	THRU :	46	204.68	11.20	37.3	4.33	14.4	535.(50)	14	120	14.55
	LEFT :	75	37.90	3.95	71.2	2.68	48.3	198.(99)	5	40	4.61
	RGHT :	30	37.90	2.21	39.8	.94	17.0	91.(45)	2	40	2.75
WB	THRU :	69	30.01	10.21	22.8	9.21	20.6	1202.(75)	32>	12C	14.55
	LEFT :	56	5.59	3.19	38.3	3.01	36.1	266.(89)	7	8	3.89
	RGHT :	53	13.05	4.02	20.7	3.58	18.4	475.(68)	13>	8C	5.76
NODE	3:	83	339.49	40.94		29.49	22.9	3230.(70)			52.61

All MOEs are in units per hour.

SYSTEM-WIDE PERFORMANCE: ALL NODES

PERFORMANCE MEASURES	UNITS	SYSTEM TOTALS
Total Travel	veh-mi/hr	2165
Total Travel Time	veh-hr/hr	147
Total Uniform Delay	veh-hr/hr	68
Total Random Delay	veh-hr/hr	7
Total Delay	veh-hr/hr	74
Average Delay	sec/veh	20.0
Passenger Delay	pax-hr/hr	89
Stops: Total	veh/hr	7700
Percentage	%	58
System Speed	mph	15.3
Fuel Consumption	gal/hr	184
Operating Cost	$/hr	1204
Performance Index	DI	76.3

Performance Index (PI): Disutility Index (DI):
Disutility Index Delay + Stops

NO. OF SIMULATIONS = 154 NO. OF LINKS = 2370 ELAPSED TIME = 47.6 SEC.

TRANSYT-7F TRAFFIC SIGNAL TIMING TABLES

NETWORK-WIDE SIGNAL TIMING PARAMETERS

SYSTEM CYCLE LENGTH = 90 SECONDS

MASTER OFFSET REFERENCE LOCATION = INTERSECTION NO. 1 START OF INTERVAL 1.

Key to Interval Types:
F : Fixed green.
V : Variable green.
Y : Yellow.
R : All-red.

An 'M' by an interval length means this is the minimum time available.

ERSECTION CONTROLLER SETTINGS

ERSECTION 1 PRETIMED - SPLITS OPTIMIZED

terval Number :	1	2	3	4	5	6
ntvl Length(sec):	19	4	38	4	21	4
ntvl Length (%):	21	4	44	4	23	4
in Settings (%):	100/0	21	25	69	73	96
hase Start (No.):	1		2		3	
Interval Type :	V	Y	V	Y	V	Y
Splits (sec):	23		42		25	
Splits (%):	25		48		27	
LINKS MOVING :	105		102		108	
	101		106		-103	
			109		104	
			110		-107	

Offset = 0 sec 0 %.

This is the master controller.

+++ 193 +++ WARNING + THE OFFSET FALLS WITHIN 1% OF AN INTERVAL CHANGE POINT AT THE START OF INTERVAL NO. 1.

INTERSECTION 2 PRETIMED - SPLITS OPTIMIZED

Interval Number :	1	2	3	4	5	6
Intvl Length(sec):	19	4	38	4	21	4
Intvl Length (%):	21	4	44	4	23	4
Pin Settings (%):	100/0	21	25	69	73	96
Phase Start (No.):	1		2		3	
Interval Type :	V	Y	V	Y	V	Y
Splits (sec):	23		42		25	
Splits (%):	25		48		27	
LINKS MOVING :	202		202		204	
	205		206		207	
			210		212	

Offset = 63 sec 70 %.

INTERSECTION	3 PRETIMED - SPLITS OPTIMIZED					
Interval Number :	1	2	3	4	5	6
Intvl Length(sec):	14	4	39	4	25	4
Intvl Length (%):	16	4	44	4	28	4
Pin Settings (%):	100/0	16	20	64	68	96
Phase Start (No.):	1		2		3	
Interval Type :	V	Y	V	Y	V	Y
Splits (sec):	18		43		29	
Splits (%):	20		48		32	
LINKS MOVING :	305		302		308	
	301		306		-303	
			309		304	
			310		-307	

Offset = 47 sec 52 %.

INPUT DATA REPORT FOR ROUTE NO. 1

60 3 1 3 67 1 1 1 1 1 0 0 0 0 0 3

TITLE

Main Avenue OSO

61 102 106 202 206 302 306 THE DOWN DIRECTION IS EAST BOUND.
0 0 0 0 0 0 0 0 0

+++ 125 +++ WARNING + TIME LOCATION PLOTS CAN ONLY BE PROCESSED FOR AN ARTERY.
NO TIME LOCATION PLOT WILL BE PRINTED.

```
        < T R A N S Y T - 7 F   T I M E - S P A C E   D I A G R A M >

ROUTE NO.  1

ROUTE TITLE:
Main Avenue         OSO              THE DOWN DIRECTION IS EAST  BOUND.

Time Axis: sec    Time Scale =    3 sec/char,  Dist. Scale =    67 ft/line

                 1         2         3         4         5         6
NODE    123456789012345678901234567890123456789012345678901234567890 DISTANCE
       :-------------------------------------------------------------------
   1   :XXXXXXXX              XXXXXXXXXXXXXXXX              XXXXXXXX     0 ft
       |                             |
       |                             |
       |                             |
       |                             |
       |                             |
       |                             |
       |                             |
       |                             |
       |                             |
       |                             |
       |                             |
       |                             |
       |                             |
       |                             |
       |                             |
       |                             |
       |                             |
       |                             |
       |                             |
       |                             |
       |                             |
       |                             |
       |                             |
       |                             |
       |                             |
   2   :             XXXXXXXX\\\\\\\\              XXXXXXXX\\\\\\\\  1800 ft
       |                             |
       |                             |
       |                             |
       |                             |
       |                             |
       |                             |
       |                             |
       |                             |
       |                             |
       |                             |
       |                             |
       |                             |
       |                             |
   3   :      XXXXXXXXXXXXXXXX              XXXXXXXXXXXXXXXX        2800 ft
       :-------------------------------------------------------------------
NODE    123456789012345678901234567890123456789012345678901234567890 DISTANCE
                 1         2         3         4         5         6

        Scale Conversions:                       \\\ Green in Down Direction
        Time/inch =  3 * 10 (at 10 char/inch)        Green in Both Directions
        Dist/inch =  67 * 6 (at 6 lines/inch)    /// Green in Up   Direction
        Avg. Time Displacement =  636.36/speed   XXX Red in Both Directions
```

< T R A N S Y T - 7 F   F L O W   P R O F I L E   D I A G R A M S >

ROUTE TITLE:

Main Avenue   OSO   THE DOWN DIRECTION IS EAST BOUND.

SYMBOL KEYS:

Headings:

```
      Link : The link number plotted.
  Max Flow : Highest flow rate achieved on the link.
Plt. index : Platooning index.
       PVG : Percentage of arrivals on effective green.
```

Flow Profile Symbols (vertical axis is in vph):

```
         I : Arrivals which queue, normally on red on unopposed links or
             during periods of heavy opposing flow on opposed links during.
             the permitted phase(s)
         S : Departures from queue, normally at the saturation flow rate
             for "protected" links, or maximum flow rate for permitted,
             opposed links.
         O : Arrivals and departures on green, when below S's or I's, these
             arrivals join the back of the queue.
```

Time Scale (horizontal axis):

```
   (BLANK) : Protected or unopposed green, yellow and all-red intervals.
         . : Permitted, opposed green, yellow and all-red intervals.
         * : Red intervals.
        :: : The beginning (1st) and end (2nd) of the thru band.
         N : The numbers across the bottom are a time scale in steps.
```

Notes concering FPDs:

1. To convert TRANSYT-7F's timing units of "steps" to seconds, count the steps, then multiply as follows:
   SECONDS = STEPS * 1.50.

2. The flow profile diagram shows actual green plus yellow and all red. Offsets are adjusted to master controller if any.

3. In the 80-column output format, the "downbound" links are plotted continuously first, then the "upbound" links are plotted continuously.

```
CYCLE:   90 Seconds,   60 Steps

LINK   102 MAX FLOW  5400 VPH PLT. INDEX  .00  PVG 42%

6000+
    :
    :                  SSSSSSSSSSS
    :                  SSSSSSSSSSS
    :                  SSSSSSSSSSS
    :                  SSSSSSSSSSS
4500+                  SSSSSSSSSSS
    :                  SSSSSSSSSSS
    :                  SSSSSSSSSSS
    :                  SSSSSSSSSSS
    :                 SSSSSSSSSSSS
    :                 SSSSSSSSSSSS
3000+                 SSSSSSSSSSSS
    :                 SSSSSSSSSSSSS
    :                 SSSSSSSSSSSSS
    :                 SSSSSSSSSSSSS
    :                 SSSSSSSSSSSSS
    :                 SSSSSSSSSSSSS
1500+IIIIIIIIIIIIIIIIIOOOOOOOOOOOOOOOOOOOOOOOOOOIIIIIIIIIIIIIIIII
    :IIIIIIIIIIIIIIIIIOOOOOOOOOOOOOOOOOOOOOOOOOOIIIIIIIIIIIIIIIII
    :IIIIIIIIIIIIIIIIIOOOOOOOOOOOOOOOOOOOOOOOOOOIIIIIIIIIIIIIIIII
    :IIIIIIIIIIIIIIIIIOOOOOOOOOOOOOOOOOOOOOOOOOOIIIIIIIIIIIIIIIII
    :IIIIIIIIIIIIIIIIIOOOOOOOOOOOOOOOOOOOOOOOOOOIIIIIIIIIIIIIIIII
    :IIIIIIIIIIIIIIIIIOOOOOOOOOOOOOOOOOOOOOOOOOOIIIIIIIIIIIIIIIII
     ***************                             ****************
     123456789012345678901234567890123456789012345678901234567890

LINK   202 MAX FLOW  5400 VPH PLT. INDEX  .72  PVG 89%

6000+
    :
    :                                            SS
    :                                            SS
    :                                            SS
    :                                            SS
4500+                                            SSS
    :                                            SSS
    :                                            SSS
    :                                            SSS
    :                                            SSS
    :                                            SSS  OOO
3000+                                            SSSOOOOOO
    :                                            SSOOOOOOOO
    :                                            SOOOOOOOOOOO
    :                                            OOOOOOOOOOOOOO
    :                                           IOOOOOOOOOOOOOOOO
    :OOOO                                      IIOOOOOOOOOOOOOOOO
1500+OOOOOO                                    IIOOOOOOOOOOOOOOOO
    :OOOOOOOOO                                IIIOOOOOOOOOOOOOOOO
    :OOOOOOOOOOOO                             IIIOOOOOOOOOOOOOOOO
    :OOOOOOOOOOOOOOOO                        IIIIOOOOOOOOOOOOOOOO
    :OOOOOOOOOOOOOOOOOOOOOO                 IIIIIOOOOOOOOOOOOOOOO
    :OOOOOOOOOOOOOOOOOOOOOOOOOIIIIII        IIIIIOOOOOOOOOOOOOOOO
                               ****************
     123456789012345678901234567890123456789012345678901234567890
```

```
CYCLE:   90 Seconds,   60 Steps

LINK   302 MAX FLOW  5400 VPH PLT. INDEX  .44  PVG 56%

6000+
    :
    :                                              SSSSS
    :                                              SSSSS
    :                                              SSSSS
    :                                              SSSSS
4500+                                              SSSSS
    :                                              SSSSS
    :                                              SSSSS
    :                                              SSSSSS
    :                                             SSSSSSS
    :                                             SSSSSSS
3000+                                             SSSSSSS
    :                                             SSSSSSS
    :                                             SSSSSSS
    :                                             SSSSSSS
    : OOOOOOO                                     SSSSSSS
    :OOOOOOOOOOO                                  SSSSSSS      OO
1500+OOOOOOOOOOOOIII                              SOSSSSS     OOO
    :OOOOOOOOOOOOIIIIIII                        IIOOOSSSS     OOO
    :OOOOOOOOOOOOIIIIIIIIIII                   IIIOOOOOSS    OOOO
    :OOOOOOOOOOOOIIIIIIIIIIIIIIII            IIIIIOOOOOOO    OOOO
    :OOOOOOOOOOOOIIIIIIIIIIIIIIIIIIIIII     IIIIIIOOOOOOOOOO OOOO
    :OOOOOOOOOOOOIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIOOOOOOOOOOOOOOO
                  ******************************
     123456789012345678901234567890123456789012345678901234567890

LINK   106 MAX FLOW  5400 VPH PLT. INDEX  .50  PVG 56%

6000+
    :
    :                  SSSSS
    :                  SSSSS
    :                  SSSSSS
    :                  SSSSSS
4500+                  SSSSSS
    :                  SSSSSS
    :                  SSSSSS
    :                  SSSSSS
    :                 SSSSSSS
    :                 SSSSSSS
3000+                 SSSSSSS
    :                 SSSSSSS
    :                 SSSSSSS        OOOOO
    :                 SSSSSSS     OOOOOOOOOOO
    :                 SSSSSSS   OOOOOOOOOOOOOOOO
    :                 SSSSSSS OOOOOOOOOOOOOOOOOOIII
1500+                 SSSSSSSOOOOOOOOOOOOOOOOOOOIIIII         I
    :                 SSSSSSOOOOOOOOOOOOOOOOOOOOIIIIIIIIIIIIIIIII
    :III              SSSSSSOOOOOOOOOOOOOOOOOOOOIIIIIIIIIIIIIIIII
    :IIIIII           SSSSSOOOOOOOOOOOOOOOOOOOOOIIIIIIIIIIIIIIIII
    :IIIIIIIIII       SSSSOOOOOOOOOOOOOOOOOOOOOOIIIIIIIIIIIIIIIII
    :IIIIIIIIIIIIIIIIOOSSSOOOOOOOOOOOOOOOOOOOOOOIIIIIIIIIIIIIIIII
     ***************                             ****************
     123456789012345678901234567890123456789012345678901234567890
```

```
LINK   206 MAX FLOW  5400 VPH PLT. INDEX  .87  PVG 85%

6000+
    :
    :SSSS
    :SSSS
    :SSSS
    :SSSS
4500+SSSS
    :SSSS    OOO
    :SSSS  OOOOOO
    :SSSSSOOOOOOO
    :SSSOOOOOOOOOO                                              S
    :SSOOOOOOOOOOO                                              S
3000+SSOOOOOOOOOOOO                                             S
    :SOOOOOOOOOOOOOO                                            S
    :OOOOOOOOOOOOOOOO                                           S
    :OOOOOOOOOOOOOOOOO                                          S
    :OOOOOOOOOOOOOOOOOOO                                        O
    :OOOOOOOOOOOOOOOOOOOOOO                                     O
1500+OOOOOOOOOOOOOOOOOOOOOOOO                                   O
    :OOOOOOOOOOOOOOOOOOOOOOOOO I                               IO
    :OOOOOOOOOOOOOOOOOOOOOOOOOIII                              IO
    :OOOOOOOOOOOOOOOOOOOOOOOOOIIIII                            IO
    :OOOOOOOOOOOOOOOOOOOOOOOOOIIIIIIIII                       IIO
    :OOOOOOOOOOOOOOOOOOOOOOOOOIIIIIIIIIIIIIIIIII              IIO
                          *******************************
     123456789012345678901234567890123456789012345678901234567890

LINK   306 MAX FLOW  5400 VPH PLT. INDEX  .00  PVG 43%

6000+
    :
    :                                              SSSSSSSSSSSSS
    :                                              SSSSSSSSSSSSS
    :                                              SSSSSSSSSSSSS
    :                                              SSSSSSSSSSSSS
4500+                                              SSSSSSSSSSSSS
    :                                              SSSSSSSSSSSSS
    :                                              SSSSSSSSSSSSS
    :                                              SSSSSSSSSSSSS
    :                                             SSSSSSSSSSSSSSS
    :                                             SSSSSSSSSSSSSSS
3000+                                             SSSSSSSSSSSSSSS
    :                                             SSSSSSSSSSSSSSS
    :                                             SSSSSSSSSSSSSSS
    :                                             SSSSSSSSSSSSSSS
    :                                             SSSSSSSSSSSSSSS
    :                                             SSSSSSSSSSSSSSS
1500+OOOOOOOOOOOOIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIOOOOOOOOOOOOOOO
    :OOOOOOOOOOOOIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIOOOOOOOOOOOOOOO
    :OOOOOOOOOOOOIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIOOOOOOOOOOOOOOO
    :OOOOOOOOOOOOIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIOOOOOOOOOOOOOOO
    :OOOOOOOOOOOOIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIOOOOOOOOOOOOOOO
    :OOOOOOOOOOOOIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIOOOOOOOOOOOOOOO
                  ******************************
     123456789012345678901234567890123456789012345678901234567890
```

SYMBOL KEYS:

Headings:

Link : The link number plotted.
Max Flow : Highest flow rate achieved on the link.
Plt. index : Platooning index.
PVG : Percentage of arrivals on effective green.

Flow Profile Symbols (vertical axis is in vph):

I : Arrivals which queue, normally on red on unopposed links or during periods of heavy opposing flow on opposed links during. the permitted phase(s)
S : Departures from queue, normally at the saturation flow rate for "protected" links, or maximum flow rate for permitted, opposed links.
O : Arrivals and departures on green, when below S's or I's, these arrivals join the back of the queue.

Time Scale (horizontal axis):

(BLANK) : Protected or unopposed green, yellow and all-red intervals.
. : Permitted, opposed green, yellow and all-red intervals.
* : Red intervals.
:: : The beginning (1st) and end (2nd) of the thru band.
N : The numbers across the bottom are a time scale in steps.

Notes concering FPDs:
1. To convert TRANSYT-7F's timing units of "steps" to seconds, count the steps, then multiply as follows:
SECONDS = STEPS * 1.50.

2. The flow profile diagram shows actual green plus yellow and all red. Offsets are adjusted to master controller if any.

<ROUTE SUMMARY REPORT>

Main Avenue OSO THE DOWN DIRECTION IS EAST BOUND.

MOVEMENT/ NODE NOS.	V/C (%)	TOTAL TRAVEL (v-mi)	TRAVEL TIME TOTAL (v-hr)	TRAVEL TIME AVG. (sec/v)	TOTAL DELAY (v-hr)	AVG. DELAY (sec/v)	UNIFORM STOPS NO. (%)	MAX BACK OF QUEUE	EST.CAP.	FUEL CONS. (gal)
102	: 61	265.33	16.81	43.2	7.92	20.4	1022.(73)	27	120	22.3
202	: 33	417.89	14.34	42.1	.33	1.0	127.(10)	5	216	18.2
302	: 46	204.68	11.20	37.3	4.33	14.4	535.(50)	14	120	14.5
Forward:	61	887.89	42.35	123	12.58	12.2	1684.(45)	SPD=21.0		55.07
106	: 56	434.94	20.47	57.8	5.89	16.6	561.(44)	14	216	25.3
206	: 62	269.12	11.25	28.5	2.23	5.7	257.(18)	11	120	14.1
306	: 69	30.01	10.21	22.8	9.21	20.6	1202.(75)	32 >	12C	14.5
Reverse:	69	734.07	41.94	109	17.33	14.5	2020.(47)	SPD=17.5		54.03

All MOEs are in units per hour.

OUTE PERFORMANCE

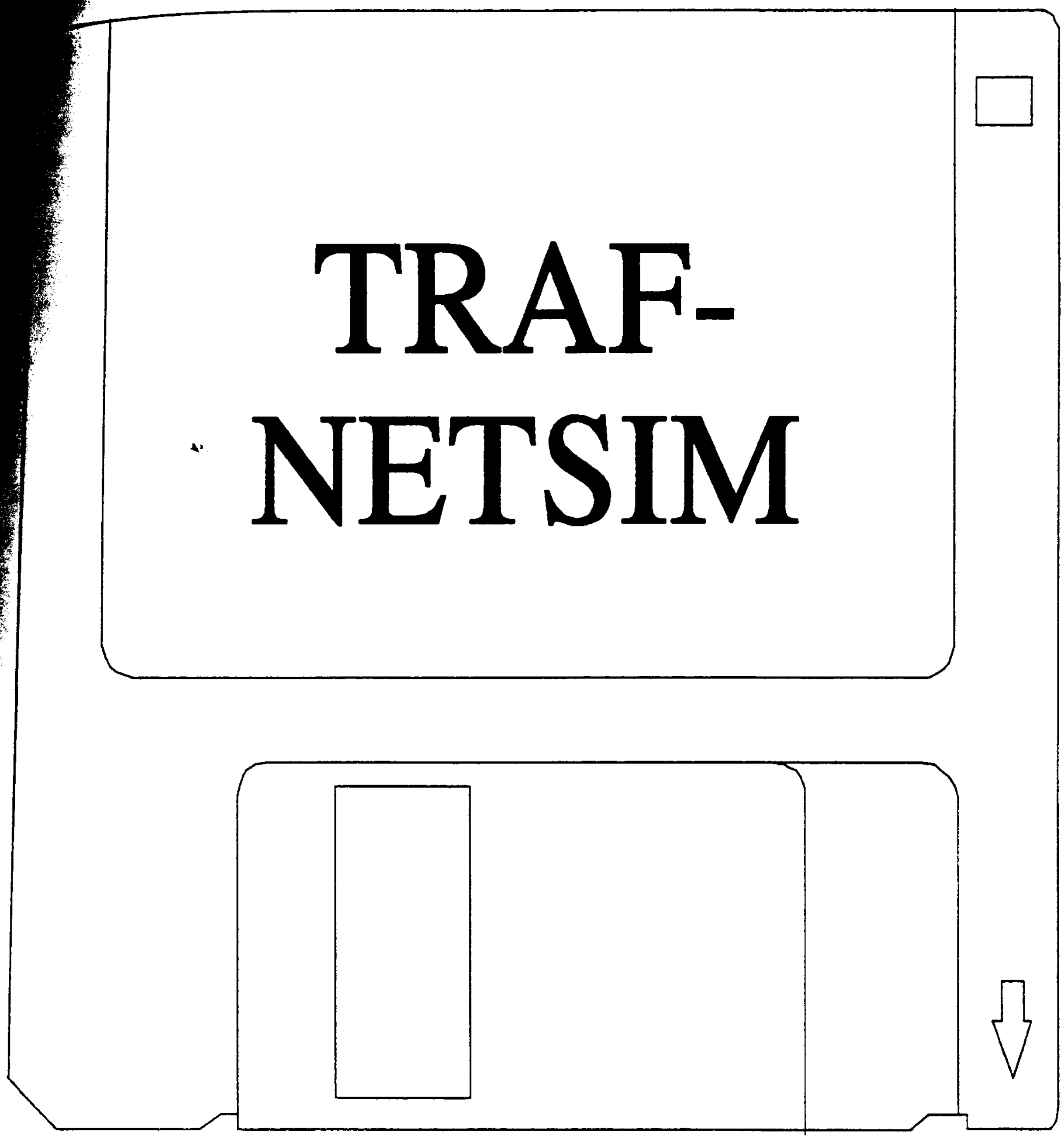
ORMANCE MEASURES	UNITS	ROUTE TOTALS
al Travel	veh-mi/hr	1622
al Travel Time	veh-hr/hr	84
. Travel Time	sec/veh	116
al Uniform Delay	veh-hr/hr	29
tal Random Delay	veh-hr/hr	1
tal Delay	veh-hr/hr	30
erage Delay	sec/veh	13.4
ssenger Delay	pax-hr/hr	36
tops: Total	veh/hr	3704
Percentage	%	46
ystem Speed	mph	19.2
uel Consumption	gal/hr	109
perating Cost	$/hr	577
isutility Index	DI	31

erformance Index (PI): Disutility Index (DI):
isutility Index Delay + Stops

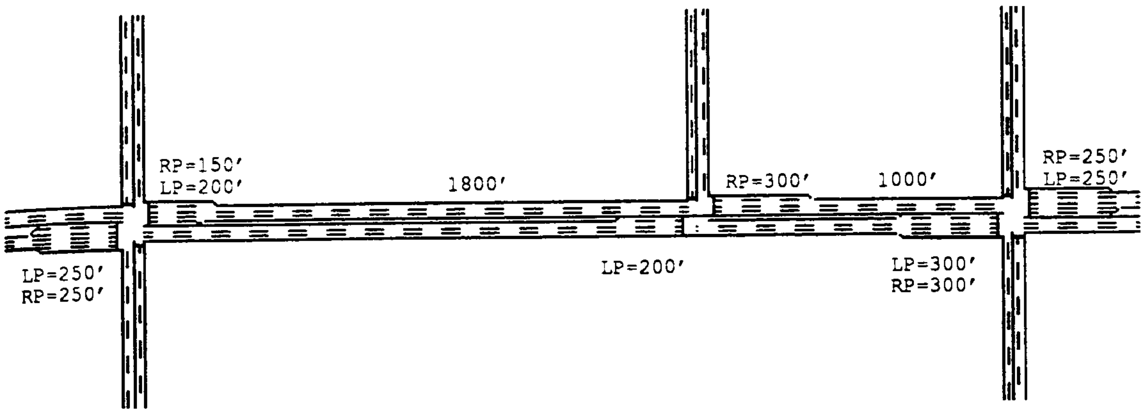
TERMINATION CARD

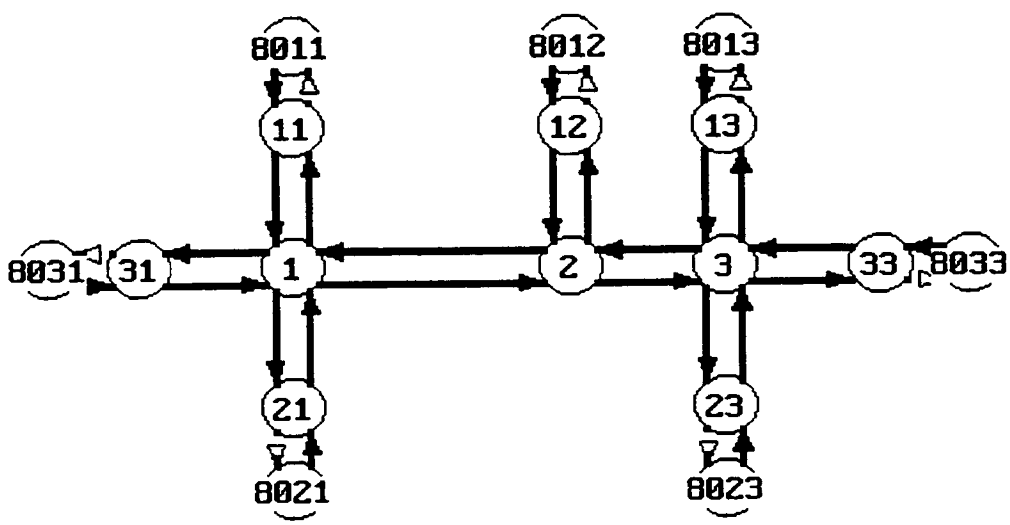
90 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

— 92 --- NOTE - END OF JOB!

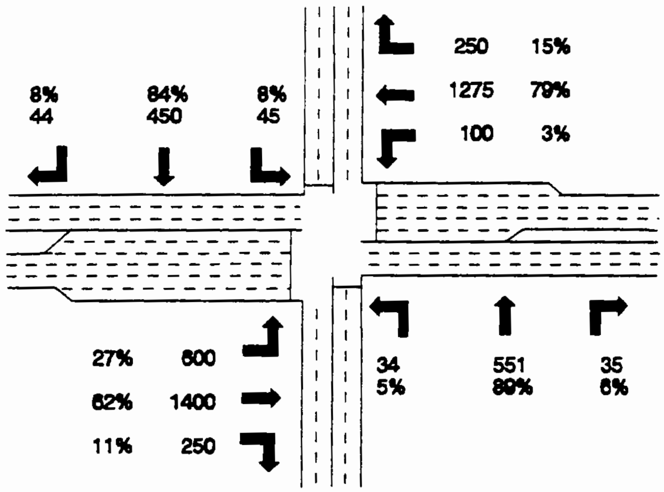

TRAF-
NETSIM

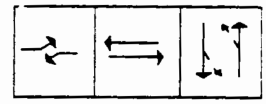
TRAF-NETSIM Simulation of PASSER Optimized Offsets and Splits





This is the same arterial network as used in the PASSER and TRANSYT sample problem and is the simulation of PASSER's optimized offsets and splits.





25 sec 34 sec 31 sec

Phasing is LT | G for EW | NS. Dual Lefts Lead (1+5) then thrus (2+6) for EW traffic followed by NS green (4+8).

Table contains the intervals and duration for each approach, the corresponding NEDIT screen, and the corresponding TRAF-NETSIM Card Types 35 and 36.

```
       11
31-------1------2
       21
```

Interval	Duration	EBL(5)	EBT(2)	WBL(1)	WBT(6)	North/South(4+8)
1	22	Green	Red	Green	Red	Red
2	3	Yellow	Red	Yellow	Red	Red
3	31	Red	Green	Red	Green	Red
4	3	Red	Yellow	Red	Yellow	Red
5	28	Red	Red	Red	Red	Green
6	3	Red	Red	Red	Red	Yellow

```
(N)ext or (P)rev:   SIGN OR PRE-TIMED SIGNAL TIMING(R)   CARD 35,36

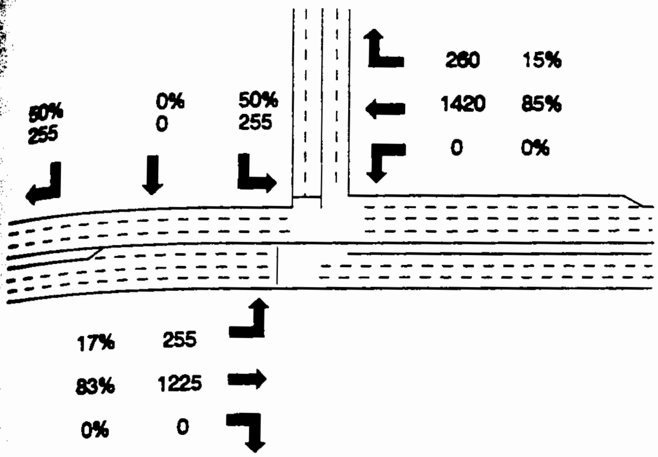
Node Number:   1 X-coord: 1100 Y-coord: 1100 Transition Green:
                                     UPSTREAM NODE OF
Offset:   0          31          2          11          21
Interval  Duration Approach 1  Approach 2  Approach 3  Approach 4  Approach 5
  No.                                CONTROL CODE
   1        22        4           4           2           2
   2         3        0           0           2           2
   3        31        9           9           2           2
   4         3        0           0           2           2
   5        28        2           2           1           1
   6         3        2           2           0           0
   7
   8
   9
  10
  11
  12
```

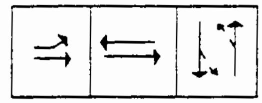
```
  1   0  31   2  11  21     22   3  31   3  28   3                      35

  1 4422 0022 9922 0022 2211 2200                          1100 1100    36
```

INTERPRETATION OF SIGNAL CODES

0	YIELD OR AMBER	5	STOP
1	GREEN	6	RED WITH GREEN DIAGONAL ARROW
2	RED	7	NO TURNS-GREEN THRU ARROW
3	RED WITH GREEN RIGHT ARROW	8	RED WITH LEFT AND RIGHT GREEN ARROW
4	RED WITH GREEN LEFT ARROW	9	NO LEFT TURN-GREEN THRU AND RIGHT





25 sec 42 sec 23 sec

Phasing is ER | G for EW | NS. Lead Left (1+5) and then Thru's (2+6) for EW traffic followed by NS green (4+8).

Table contains the intervals and duration for each approach, the corresponding NEDIT screen, and the corresponding TRAF-NETSIM Card Types 35 and 36.

```
          12
1---------2-------3
```

Interval	Duration	EBL(5)	EBT(2)	WBL(1)	WBT(6)	North/South(4+8)
1	22	Green	Green	-	Red	Red
2	3	Yellow	Green	-	Red	Red
3	39	Red	Green	-	Green	Red
4	3	Red	Yellow	-	Yellow	Red
5	20	Red	Red	-	Red	Green
6	3	Red	Red	-	Red	Yellow

```
(N)ext or (P)rev:    SIGN OR PRE-TIMED SIGNAL TIMING(R)    CARD 35,36

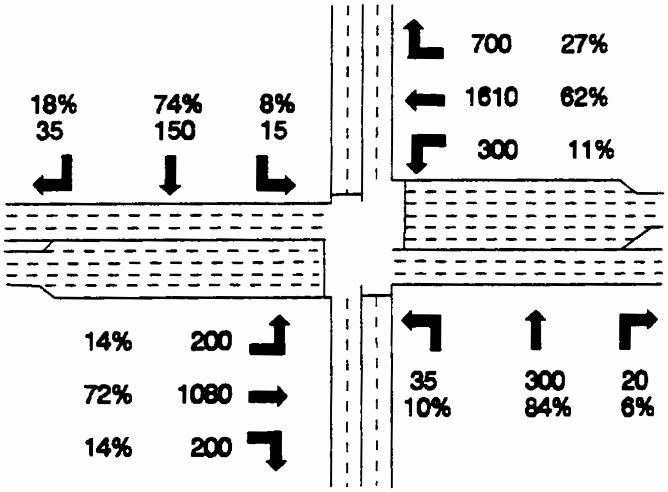
Node Number:   2 X-coord: 1280 Y-coord: 1100 Transition Green:
                                       UPSTREAM NODE OF
Offset:  48            1           3          12
Interval  Duration  Approach 1  Approach 2  Approach 3  Approach 4  Approach 5
 No.                                    CONTROL CODE
   1        22         1           2          2
   2         3         0           2          2
   3        39         9           9          2
   4         3         0           0          2
   5        20         2           2          1
   6         3         2           2          0
   7
   8
   9
  10
  11
  12
```

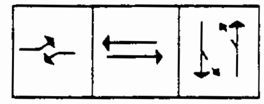
```
 2  48   1   3  12          22   3  39   3  20   3                       35

 2 122  022  992  002  221  220                           1280 1100      36
```

INTERPRETATION OF SIGNAL CODES

0	YIELD OR AMBER	5	STOP
1	GREEN	6	RED WITH GREEN DIAGONAL ARROW
2	RED	7	NO TURNS-GREEN THRU ARROW
3	RED WITH GREEN RIGHT ARROW	8	RED WITH LEFT AND RIGHT GREEN ARROW
4	RED WITH GREEN LEFT ARROW	9	NO LEFT TURN-GREEN THRU AND RIGHT





18 sec 41 sec 31 sec

Phasing is LT | G for EW | NS. Dual Lefts Lead (1+5) then thrus (2+6) for EW traffic followed by NS green (4+8).

Table contains the intervals and duration for each approach, the corresponding NEDIT screen, and the corresponding TRAF-NETSIM Card Types 35 and 36.

```
        13
2---------3-------33
        23
```

Interval	Duration	EBL(5)	EBT(2)	WBL(1)	WBT(6)	North/South(4+8)
1	15	Green	Red	Green	Red	Red
2	3	Yellow	Red	Yellow	Red	Red
3	38	Red	Green	Red	Green	Red
4	3	Red	Yellow	Red	Yellow	Red
5	28	Red	Red	Red	Red	Green
6	3	Red	Red	Red	Red	Yellow

```
(N)ext or (P)rev:    SIGN OR PRE-TIMED SIGNAL TIMING(R)    CARD 35,36

Node Number:   3 X-coord: 1380 Y-coord: 1100 Transition Green:
                                      UPSTREAM NODE OF
Offset:  47            2           33           13           23
Interval  Duration  Approach 1  Approach 2  Approach 3  Approach 4  Approach 5
  No.                                   CONTROL CODE
   1         15         4           4           2           2
   2          3         0           0           2           2
   3         38         9           9           2           2
   4          3         0           0           2           2
   5         28         2           2           1           1
   6          3         2           2           0           0
   7
   8
   9
  10
  11
  12
```

```
 3  47   2  33  13  23       15   3  38   3  28   3                         35
 3 4422 0022 9922 0022 2211 2200                              1380 1100     36
```

INTERPRETATION OF SIGNAL CODES

0	YIELD OR AMBER	5	STOP
1	GREEN	6	RED WITH GREEN DIAGONAL ARROW
2	RED	7	NO TURNS-GREEN THRU ARROW
3	RED WITH GREEN RIGHT ARROW	8	RED WITH LEFT AND RIGHT GREEN ARROW
4	RED WITH GREEN LEFT ARROW	9	NO LEFT TURN-GREEN THRU AND RIGHT

TRAF-NETSIM Simulation of PASSER Optimized Offsets and Splits

***Editor's Note:** The TRAF-NETSIM output was produced by a pre-release version 3.10 of TRAF-NETSIM and therefore results may not be reproducible using the final release version.*

```
TTTTTTTTTTT  RRRRRRRRR       AAAAAAA    FFFFFFFFFFF
TTTTTTTTTTT  RRRRRRRRRR     AAAAAAAAA   FFFFFFFFFFF
TTTTTTTTTTT  RRRRRRRRRRR  AAAAAAAAAAA   FFFFFFFFFFF
    TTT      RRR     RRR  AAA     AAA   FFF
    TTT      RRR     RRR  AAA     AAA   FFF
    TTT      RRRRRRRRRRR  AAAAAAAAAAA   FFFFFFF
    TTT      RRRRRRRRRR   AAAAAAAAAAA   FFFFFFF
    TTT      RRR RRR      AAA     AAA   FFF
    TTT      RRR  RRR     AAA     AAA   FFF
    TTT      RRR   RRR    AAA     AAA   FFF
    TTT      RRR    RRR   AAA     AAA   FFF
    TTT      RRR     RRR  AAA     AAA   FFF
```

MICRO-COMPUTER PROTECTED-MODE VERSION
(REQUIRES 80386 AND 80387 OR ABOVE)

VERSION 3.10
RELEASE DATE MAY 1992

TRAF SIMULATION MODEL

DEVELOPED FOR

U. S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
INTELLIGENT VEHICLE HIGHWAY SYSTEM RESEARCH DIVISION

```
*******************************************************************************************************************************

                                                        START OF CASE    1

*******************************************************************************************************************************
                                           CARD FILE LIST
SEQ.# :----+----1----+----2----+----3----+----4----+----5----+----6----+----7----+----8

    1 :3 NODE ARTERIAL NETWORK FOR TRAINING COURSE                                          0
    2 :FIXED TIMED SIGNALS AT NODES 1, 2, AND 3                                             0
    3 :                                                                                     0
    4 :              8011   8012   8013         N                                          0
    5 :               11     12     13          ^                                          0
    6 :  8031--31----1-----2-----3---33--8033   |                                          0
    7 :               21            23          |                                          0
    8 :              8021          8023         |                                          0
    9 :                                                                                     0
   10 :Phasing LT/G  ER/G  LT/G    FWD--->                                                  0
   11 :Offsets  0     48    47     Cycle = 90                                               0
   12 :PASSER splits and offsets.                                                           0
   13 :                                                                                     0
   14 :SMART ENGINEER                                3  27   92SMART ENGINEERS, INC.     1     0
   15 :   0    1            9                              0 0   3 700   0    7581    7781    1
   16 :7200                                                                                 2
   17 :                    90                                                                3
   18 :          180054001800                                  1   OOSS                      4
   19 :  11    1SB 1st St.     12    2SB 2nd St.     13    3SB 3rd St.                       5
   20 :  21    1NB 1st St.                           23    3NB 3rd St.                      10
   21 :  31    1EB Main-1st     1    2EB Main-2nd     2    3EB Main-3rd                     10
   22 :  33    3WB Main-3rd     3    2WB Main-2nd     2    1WB Main-1st                     10
   23 :  31    11000 250 250 3 2 1              11   2  21      2  20   20   35 00        11
   24 :   2    11800 150 200 3 1 1              21  31  11     31  20   20   35 00        11
   25 :  21    11000         2                  31  11   2     11  20   20   25 00        11
   26 :  11    11000         2                   2  21  31     21  20   20   25 00        11
   27 :   1    21800 200     3 1                12   3           3  20   20   35 10        11
   28 :   3    21000     300 3   1                   1  12          20   20   35 00        11
   29 :  12    21000         2      41           3       1          20   20   25 00        11
   30 :   2    31000 300 300 3 1 1              13  33  23     33  20   20   35 00        11
   31 :  33    31000 250 250 3 2 1              23   2  13      2  20   20   35 00        11
   32 :  23    31000         2                   2  13  33     13  20   20   25 00        11
   33 :  13    31000         2                  33  23   2     23  20   20   25 00        11
   34 :8011  11   0          2                       1              20   20        00        11
   35 :   1  111000          2                    8011              20   20   25 00        11
   36 :8012  12   0          2                       2              20   20        00        11
   37 :   2  121000          2                    8012              20   20   25 00        11
   38 :8013  13   0          2                       3              20   20        00        11
   39 :   3  131000          2                    8013              20   20   25 00        11
   40 :8021  21   0          2                       1              20   20        00        11
   41 :   1  211000          2                    8021              20   20   25 00        11
   42 :8023  23   0          2                       3              20   20        00        11
   43 :   3  231000          2                    8023              20   20   25 00        11
   44 :8031  31   0          3                       1              20   20        00        11
   45 :   1  311000          3                    8031              20   20   25 00        11
SEQ.# :----+----1----+----2----+----3----+----4----+----5----+----6----+----7----+----8
```

```
SEQ.# :----+----1----+----2----+----3----+----4----+----5----+----6----+----7----+----8
   46 :8033  33   0         3                     3              20  20    00        11
   47 :   3  331000         3                  8033              20  20 25 00        11
   48 :  31   1  27  62  11   0       0                                              21
   49 :   2   1   6  79  15   0       0                                              21
   50 :  11   1   8  84   8   0       0                                              21
   51 :  21   1   5  89   6   0       0                                              21
   52 :   1   2  17  83   0   0       0                                              21
   53 :   3   2   0  85  15   0       0                                              21
   54 :  12   2  50   0  50   0       0                                              21
   55 :   2   3  14  72  14   0       0                                              21
   56 :  33   3  11  62  27   0       0                                              21
   57 :  13   3   8  74  18   0       0                                              21
   58 :  23   3  10  85   5   0       0                                              21
   59 :8011  11     100       0       0                                              21
   60 :   1  11   0 100   0   0       0                                              21
   61 :8012  12     100       0       0                                              21
   62 :   2  12   0 100   0   0       0                                              21
   63 :8013  13   0 100   0   0                                                      21
   64 :   3  13   0 100   0   0       0                                              21
   65 :8021  21   0 100   0   0                                                      21
   66 :   1  21   0 100   0   0       0                                              21
   67 :8023  23   0 100   0   0                                                      21
   68 :   3  23   0 100   0   0       0                                              21
   69 :8033  33     100       0       0                                              21
   70 :   3  33   0 100   0   0       0                                              21
   71 :8031  31     100       0       0                                              21
   72 :   1  31   0 100   0   0       0                                              21
   73 :   1   0  31   2  11  21      22   3  31   3  28   3                          35
   74 :   2  48   1   3  12          22   3  39   3  20   3                          35
   75 :   3  47   2  33  13  23      15   3  38   3  28   3                          35
   76 :  11       18011                                                              35
   77 :  12       28012                                                              35
   78 :  13       38013                                                              35
   79 :  21       18021                                                              35
   80 :  23       38023                                                              35
   81 :  31       18031                                                              35
   82 :  33       38033                                                              35
   83 :   1 4422 0022 9922 0022 2211 2200                                1100 1100   36
   84 :   2 122   022  992  002  221  220                                1280 1100   36
   85 :   3 4422 0022 9922 0022 2211 2200                                1380 1100   36
   86 :  11 11                                                           1100 1200   36
   87 :  12 11                                                           1280 1200   36
   88 :  13 11                                                           1380 1200   36
   89 :  21 11                                                           1100 1000   36
   90 :  23 11                                                           1380 1000   36
   91 :  31 11                                                           1000 1100   36
   92 :  33 11                                                           1480 1100   36
   93 :8011   11 540       8013  13 200        8033  332610                          50
   94 :8023   23 355       8012  12 510        8021  21 620                          50
   95 :8031  312250                                                                  50
   96 :   31   1   2   3  33               0      33   3   2   1  31               0 90
   97 :                                                                             170
   98 :    1                                                                        210
```

TRAF SIMULATION MODEL

DEVELOPED FOR

U. S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
INTELLIGENT VEHICLE HIGHWAY SYSTEM RESEARCH DIVISION

```
*************************************************************************************************************
                                        START OF CASE  1
*************************************************************************************************************

     3 NODE ARTERIAL NETWORK FOR TRAINING COURSE
     FIXED TIMED SIGNALS AT NODES 1, 2, AND 3

                  8011   8012   8013               N
                   11     12     13                ^
       8031--31----1-----2-----3---33--8033        |
                   21            23                |
                  8021          8023               |

     Phasing LT/G  ER/G  LT/G    FWD--->
     Offsets  0     48    47     Cycle = 90
     PASSER splits and offsets.
```

RUN CONTROL DATA

```
VALUE                          RUN PARAMETERS AND OPTIONS

   1      RUN IDENTIFICATION NUMBER
   0      NEXT CASE CODE = (0,1) IF ANOTHER CASE (DOES NOT, DOES) FOLLOW
   1      RUN TYPE CODE = ( 1, 2, 3) TO RUN (SIMULATION, ASSIGNMENT, BOTH)
                          (-1,-2,-3) TO CHECK (SIMULATION, ASSIGNMENT, BOTH) ONLY

          NETSIM ENVIRONMENTAL OPTIONS
          ----------------------------
   0      FUEL/EMISSION RATE TABLES ARE NOT PRINTED
   0      SIMULATION:  PERFORMED                          ENVIRONMENTAL MEASURES:  CALCULATED
          RATE TABLES: EMBEDDED                           TRAJECTORY FILE:         NOT WRITTEN
   0      INPUT  UNITS CODE = (0,1) IF INPUT IS IN (ENGLISH, METRIC) UNITS
   0      OUTPUT UNITS CODE = (0,1,2,3) IF OUTPUT IS IN (SAME AS INPUT, ENGLISH, METRIC, BOTH) UNITS
 700      CLOCK TIME AT START OF SIMULATION (HHMM)
   0      SIGNAL TRANSITION CODE = (0,1,2,3) IF (NO, IMMEDIATE, 2-CYCLE, 3-CYCLE) TRANSITION WAS REQUESTED
7781      RANDOM NUMBER SEED
7581      RANDOM NUMBER SEED TO GENERATE TRAFFIC STREAM FOR NETSIM OR LEVEL I SIMULATION

7200      DURATION (SEC) OF TIME PERIOD NO.  1
  90      LENGTH OF A TIME INTERVAL, SECONDS
   6      MAXIMUM INITIALIZATION TIME, NUMBER OF TIME INTERVALS
   0      NUMBER OF TIME INTERVALS BETWEEN SUCCESSIVE STANDARD OUTPUTS
1800      TIME INTERMEDIATE OUTPUT WILL BEGIN AT INTERVALS OF 1800 SECS. FOR 5400 SECS. FOR MICROSCOPIC MODELS
   1      NETSIM MOVEMENT-SPECIFIC OUTPUT CODE = (0,1) (IF NOT, IF) REQUESTED FOR NETSIM SUBNETWORK
   0      NETSIM GRAPHICS OUTPUT CODE = (0,1) IF GRAPHICS OUTPUT (IS NOT, IS) REQUESTED
```

... CODE = (0,1) IF GRAPHICS OUTPUT (IS NOT, IS) REQUESTED FOR NETSIM SUBNETWORK ... (IF NOT, IF) REQUESTED FOR MICROSCOPIC MODELS ... SECS.

****

TIME PERIOD 1 - NETSIM DATA

****

NETSIM LINKS

LINK	LENGTH FT / M	-LANES- FUL L	PKT L	PKT R	GRD PCT	LINK TYPE	-CHANNEL- CUR B234567	DESTINATION NODE LEFT	THRU	RGHT	DIAG	OPP. NODE	LOST TIME SEC	Q DIS HDWY. SEC	FREE SPEED MPH/KMPH	RTOR CODE	PED CODE	LANE ALIGN -MENT	STREET NAME
(31, 1)	1000/ 305	3	2	1	0	1*	0000000	11	2	21	0	2	2.0	2.0	35/ 56	0	0	1-1*	EB Main-1st
(2, 1)	1800/ 549	3	1	1	0	1*	0000000	21	31	11	0	31	2.0	2.0	35/ 56	0	0	1-1*	WB Main-1st
(21, 1)	1000/ 305	2	0	0	0	1*	0000000	31	11	2	0	11	2.0	2.0	25/ 40	0	0	1-1*	NB 1st St.
(11, 1)	1000/ 305	2	0	0	0	1*	0000000	2	21	31	0	21	2.0	2.0	25/ 40	0	0	1-1*	SB 1st St.
(1, 2)	1800/ 549	3	1	0	0	1*	0000000	12	3	0	0	3	2.0	2.0	35/ 56	1	0	1-1*	EB Main-2nd
(3, 2)	1000/ 305	3	0	1	0	1*	0000000	0	1	12	0	0	2.0	2.0	35/ 56	0	0	1-1*	WB Main-2nd
(12, 2)	1000/ 305	2	0	0	0	1*	4100000	3	0	1	0	0	2.0	2.0	25/ 40	0	0	1-1*	SB 2nd St.
(2, 3)	1000/ 305	3	1	1	0	1*	0000000	13	33	23	0	33	2.0	2.0	35/ 56	0	0	1-1*	EB Main-3rd
(33, 3)	1000/ 305	3	2	1	0	1*	0000000	23	2	13	0	2	2.0	2.0	35/ 56	0	0	1-1*	WB Main-3rd
(23, 3)	1000/ 305	2	0	0	0	1*	0000000	2	13	33	0	13	2.0	2.0	25/ 40	0	0	1-1*	NB 3rd St.
(13, 3)	1000/ 305	2	0	0	0	1*	0000000	33	23	2	0	23	2.0	2.0	25/ 40	0	0	1-1*	SB 3rd St.
(8011, 11)	0/ 0	2	0	0	0	1*	0000000	0	1	0	0	0	2.0	2.0	0/ 0	0	0	1-1*	
(1, 11)	1000/ 305	2	0	0	0	1*	0000000	0	8011	0	0	0	2.0	2.0	25/ 40	0	0	1-1*	
(8012, 12)	0/ 0	2	0	0	0	1*	0000000	0	2	0	0	0	2.0	2.0	0/ 0	0	0	1-1*	
(2, 12)	1000/ 305	2	0	0	0	1*	0000000	0	8012	0	0	0	2.0	2.0	25/ 40	0	0	1-1*	
(8013, 13)	0/ 0	2	0	0	0	1*	0000000	0	3	0	0	0	2.0	2.0	0/ 0	0	0	1-1*	
(3, 13)	1000/ 305	2	0	0	0	1*	0000000	0	8013	0	0	0	2.0	2.0	25/ 40	0	0	1-1*	
(8021, 21)	0/ 0	2	0	0	0	1*	0000000	0	1	0	0	0	2.0	2.0	0/ 0	0	0	1-1*	
(1, 21)	1000/ 305	2	0	0	0	1*	0000000	0	8021	0	0	0	2.0	2.0	25/ 40	0	0	1-1*	
(8023, 23)	0/ 0	2	0	0	0	1*	0000000	0	3	0	0	0	2.0	2.0	0/ 0	0	0	1-1*	
(3, 23)	1000/ 305	2	0	0	0	1*	0000000	0	8023	0	0	0	2.0	2.0	25/ 40	0	0	1-1*	
(8031, 31)	0/ 0	3	0	0	0	1*	0000000	0	1	0	0	0	2.0	2.0	0/ 0	0	0	1-1*	
(1, 31)	1000/ 305	3	0	0	0	1*	0000000	0	8031	0	0	0	2.0	2.0	25/ 40	0	0	1-1*	
(8033, 33)	0/ 0	3	0	0	0	1*	0000000	0	3	0	0	0	2.0	2.0	0/ 0	0	0	1-1*	
(3, 33)	1000/ 305	3	0	0	0	1*	0000000	0	8033	0	0	0	2.0	2.0	25/ 40	0	0	1-1*	

* INDICATES DEFAULT VALUES WERE SPECIFIED

LINK TYPE	LANE CHANNELIZATION CODES	RTOR CODES	PEDESTRIAN CODES
IDENTIFIES THE DISTRIBUTION USED FOR QUEUE DISCHARGE AND START-UP LOST TIME CHARACTERISTICS.	0 UNRESTRICTED 1 LEFT TURNS ONLY 2 BUSES ONLY 3 CLOSED 4 RIGHT TURNS ONLY 5 CAR - POOLS 6 CAR - POOLS + BUSES	0 RTOR PERMITTED 1 RTOR PROHIBITED	0 NO PEDESTRIANS 1 LIGHT 2 MODERATE 3 HEAVY

TOTAL LINKS: 25 (ALLOWED: 500)

TOTAL NON-ENTRY NODES: 10 (ALLOWED: 250)

NETSIM TURNING MOVEMENT DATA

LINK	TURN MOVEMENT PERCENTAGES LEFT	THROUGH	RIGHT	DIAGONAL	TURN MOVEMENT POSSIBLE LEFT	THROUGH	RIGHT	DIAGONAL	POCKET LENGTH (IN FEET/METERS) LEFT		RIGHT	
(31, 1)	27	62	11	0	YES	YES	YES	NO	250/	76	250/	76
(2, 1)	6	79	15	0	YES	YES	YES	NO	150/	46	200/	61
(21, 1)	5	89	6	0	YES	YES	YES	NO	0/	0	0/	0
(11, 1)	8	84	8	0	YES	YES	YES	NO	0/	0	0/	0
(1, 2)	17	83	0	0	YES	YES	NO	NO	200/	61	0/	0
(3, 2)	0	85	15	0	NO	YES	YES	NO	0/	0	300/	91
(12, 2)	50	0	50	0	YES	NO	YES	NO	0/	0	0/	0
(2, 3)	14	72	14	0	YES	YES	YES	NO	300/	91	300/	91
(33, 3)	11	62	27	0	YES	YES	YES	NO	250/	76	250/	76
(23, 3)	10	85	5	0	YES	YES	YES	NO	0/	0	0/	0
(13, 3)	8	74	18	0	YES	YES	YES	NO	0/	0	0/	0
(8011, 11)	0	100	0	0	NO	YES	NO	NO	0/	0	0/	0
(1, 11)	0	100	0	0	NO	YES	NO	NO	0/	0	0/	0
(8012, 12)	0	100	0	0	NO	YES	NO	NO	0/	0	0/	0
(2, 12)	0	100	0	0	NO	YES	NO	NO	0/	0	0/	0
(8013, 13)	0	100	0	0	NO	YES	NO	NO	0/	0	0/	0
(3, 13)	0	100	0	0	NO	YES	NO	NO	0/	0	0/	0
(8021, 21)	0	100	0	0	NO	YES	NO	NO	0/	0	0/	0
(1, 21)	0	100	0	0	NO	YES	NO	NO	0/	0	0/	0
(8023, 23)	0	100	0	0	NO	YES	NO	NO	0/	0	0/	0
(3, 23)	0	100	0	0	NO	YES	NO	NO	0/	0	0/	0
(8031, 31)	0	100	0	0	NO	YES	NO	NO	0/	0	0/	0
(1, 31)	0	100	0	0	NO	YES	NO	NO	0/	0	0/	0
(8033, 33)	0	100	0	0	NO	YES	NO	NO	0/	0	0/	0
(3, 33)	0	100	0	0	NO	YES	NO	NO	0/	0	0/	0

SPECIFIED FIXED-TIME SIGNAL CONTROL, AND SIGN CONTROL, CODES

NODE 1

OFFSET 0 SEC CYCLE LENGTH 90 SEC

INTERVAL NUMBER	DURATION (SEC)	(PCT)	APPROACHES (31, 1)	(2, 1)	(11, 1)	(21, 1)
1	22	24	4	4	2	2
2	3	3	0	0	2	2
3	31	34	9	9	2	2
4	3	3	0	0	2	2
5	28	31	2	2	1	1
6	3	3	2	2	0	0

NODE 2

OFFSET 48 SEC — CYCLE LENGTH 90 SEC

INTERVAL NUMBER	DURATION (SEC)	DURATION (PCT)	APPROACHES (1, 2)	(3, 2)	(12, 2)
1	22	24	1	2	2
2	3	3	0	2	2
3	39	43	9	9	2
4	3	3	0	0	2
5	20	22	2	2	1
6	3	3	2	2	0

NODE 3

OFFSET 47 SEC — CYCLE LENGTH 90 SEC

INTERVAL NUMBER	DURATION (SEC)	DURATION (PCT)	APPROACHES (2, 3)	(33, 3)	(13, 3)	(23, 3)
1	15	16	4	4	2	2
2	3	3	0	0	2	2
3	38	42	9	9	2	2
4	3	3	0	0	2	2
5	28	31	2	2	1	1
6	3	3	2	2	0	0

NODE 11 IS UNDER SIGN CONTROL

INTERVAL NUMBER	DURATION (SEC)	DURATION (PCT)	APPROACHES (1, 11)	(8011, 11)
1	0	100	1	1

NODE 12 IS UNDER SIGN CONTROL

INTERVAL NUMBER	DURATION (SEC)	DURATION (PCT)	APPROACHES (2, 12)	(8012, 12)
1	0	100	1	1

NODE 13 IS UNDER SIGN CONTROL

INTERVAL NUMBER	DURATION (SEC)	DURATION (PCT)	APPROACHES (3, 13)	(8013, 13)
1	0	100	1	1

NODE 21 IS UNDER SIGN CONTROL

INTERVAL NUMBER	DURATION (SEC)	DURATION (PCT)	APPROACHES (1, 21)	(8021, 21)
1	0	100	1	1

NODE 23 IS UNDER SIGN CONTROL

INTERVAL NUMBER	DURATION (SEC)	DURATION (PCT)	APPROACHES (3, 23)	(8023, 23)
1	0	100	1	1

NODE 31 IS UNDER SIGN CONTROL

INTERVAL NUMBER	DURATION (SEC)	DURATION (PCT)	APPROACHES (1, 31)	(8031, 31)
1	0	100	1	1

NODE 33 IS UNDER SIGN CONTROL

INTERVAL NUMBER	DURATION (SEC)	DURATION (PCT)	APPROACHES (3, 33)	APPROACHES (8033, 33)
1	0	100	1	1

INTERPRETATION OF SIGNAL CODES

0	YIELD OR AMBER
1	GREEN
2	RED
3	RED WITH GREEN RIGHT ARROW
4	RED WITH GREEN LEFT ARROW
5	STOP
6	RED WITH GREEN DIAGONAL ARROW
7	NO TURNS-GREEN THRU ARROW
8	RED WITH LEFT AND RIGHT GREEN ARROW
9	NO LEFT TURN-GREEN THRU AND RIGHT

TRAFFIC CONTROL TABLE - SIGNS AND FIXED TIME SIGNALS

CONTROL CODES GO = PROTECTED
NOGO = NOT PERMITTED
AMBR = AMBER
PERM = PERMITTED NOT PROTECTED
PROT = PROTECTED
STOP = STOP SIGN
YLD = YIELD SIGN

NODE 1 FIXED TIME CONTROL OFFSET = 0 SECONDS CYCLE LENGTH = 90 SECONDS

INTERVAL	DURATION	(31, 1) LEFT	THRU	RITE	DIAG	(2, 1) LEFT	THRU	RITE	DIAG	(11, 1) LEFT	THRU	RITE	DIAG	(21, 1) LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG
1	22	PROT	NOGO	NOGO		PROT	NOGO	NOGO		NOGO	NOGO	NOGO		NOGO	NOGO	NOGO					
2	3	AMBR	NOGO	NOGO		AMBR	NOGO	NOGO		NOGO	NOGO	NOGO		NOGO	NOGO	NOGO					
3	31	NOGO	GO	GO		NOGO	GO	GO		NOGO	NOGO	NOGO		NOGO	NOGO	NOGO					
4	3	NOGO	AMBR	AMBR		NOGO	AMBR	AMBR		NOGO	NOGO	NOGO		NOGO	NOGO	NOGO					
5	28	NOGO	NOGO	NOGO		NOGO	NOGO	NOGO		PERM	GO	GO		PERM	GO	GO					
6	3	NOGO	NOGO	NOGO		NOGO	NOGO	NOGO		AMBR	AMBR	AMBR		AMBR	AMBR	AMBR					

NODE 2 FIXED TIME CONTROL OFFSET = 48 SECONDS CYCLE LENGTH = 90 SECONDS

INTERVAL	DURATION	(1, 2) LEFT	THRU	RITE	DIAG	(3, 2) LEFT	THRU	RITE	DIAG	(12, 2) LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG
1	22	PROT	GO				NOGO	NOGO		NOGO		NOGO									
2	3	AMBR	GO				NOGO	NOGO		NOGO		NOGO									
3	39	NOGO	GO				GO	GO		NOGO		NOGO									
4	3	NOGO	AMBR				AMBR	AMBR		NOGO		NOGO									
5	20	NOGO	NOGO				NOGO	NOGO		PROT		GO									
6	3	NOGO	NOGO				NOGO	NOGO		AMBR		AMBR									

NODE 3 FIXED TIME CONTROL OFFSET = 47 SECONDS CYCLE LENGTH = 90 SECONDS

INTERVAL	DURATION	APPROACHES (2, 3)				(33, 3)				(13, 3)				(23, 3)							
		LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG
1	15	PROT	NOGO	NOGO		PROT	NOGO	NOGO		NOGO	NOGO	NOGO		NOGO	NOGO	NOGO					
2	3	AMBR	NOGO	NOGO		AMBR	NOGO	NOGO		NOGO	NOGO	NOGO		NOGO	NOGO	NOGO					
3	38	NOGO	GO	GO		NOGO	GO	GO		NOGO	NOGO	NOGO		NOGO	NOGO	NOGO					
4	3	NOGO	AMBR	AMBR		NOGO	AMBR	AMBR		NOGO	NOGO	NOGO		NOGO	NOGO	NOGO					
5	28	NOGO	NOGO	NOGO		NOGO	NOGO	NOGO		PERM	GO	GO		PERM	GO	GO					
6	3	NOGO	NOGO	NOGO		NOGO	NOGO	NOGO		AMBR	AMBR	AMBR		AMBR	AMBR	AMBR					

NODE 11 SIGN CONTROL

INTERVAL	DURATION	APPROACHES (1, 11)				(8011, 11)															
		LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG
1	0		GO				GO														

NODE 12 SIGN CONTROL

INTERVAL	DURATION	APPROACHES (2, 12)				(8012, 12)															
		LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG
1	0		GO				GO														

NODE 13 SIGN CONTROL

INTERVAL	DURATION	APPROACHES (3, 13)				(8013, 13)															
		LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG
1	0		GO				GO														

NODE 21 SIGN CONTROL

INTERVAL	DURATION	APPROACHES (1, 21)				(8021, 21)															
		LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG
1	0		GO				GO														

NODE 23 SIGN CONTROL

INTERVAL	DURATION	APPROACHES (3, 23)				(8023, 23)															
		LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG
1	0		GO				GO														

NODE 31 SIGN CONTROL

INTERVAL	DURATION	(1, 31) LEFT	THRU	RITE	DIAG	(8031, 31) LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG
1	0		GO				GO														

NODE 33 SIGN CONTROL

INTERVAL	DURATION	(3, 33) LEFT	THRU	RITE	DIAG	(8033, 33) LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG
1	0		GO				GO														

ENTRY LINK VOLUMES

LINK	FLOW RATE (VEH/HOUR)	TRUCKS (PERCENT)	CAR POOLS (PERCENT)
(8011, 11)	540	0	0
(8013, 13)	200	0	0
(8033, 33)	2610	0	0
(8023, 23)	355	0	0
(8012, 12)	510	0	0
(8021, 21)	620	0	0
(8031, 31)	2250	0	0

VEHICLE TYPE SPECIFICATIONS

VEHICLE TYPE	LENGTH FEET/METERS	MAXIMUM ACCELERATION (MPH/SEC)/(KMPH/SEC)	MAXIMUM SPEED (MPH)/(KMPH)	Q DSCHG HDWY FACTOR (PCT)	AVG. OCCUP.	FLEET COMPONENT PERCENTAGES AUTO	TRUCK	CARPOOL	BUS
1**	17.0/ 5.2	5.5/ 8.8	75.0/ 120.7	100	1.3	100	0	0	0
2**	34.0/ 10.4	3.0/ 4.8	60.0/ 96.6	120	1.2	0	100	0	0
3**	17.0/ 5.2	5.5/ 8.8	75.0/ 120.7	100	3.5	0	0	100	0
4**	47.0/ 14.3	2.0/ 3.3	50.0/ 80.5	120	25.0	0	0	0	100

** INDICATES THAT ALL PARAMETERS FOR VEHICLE TYPE ASSUME DEFAULT VALUES

SECTION DATA TABLE

SECTION NUMBER	SECTION CONFIGURATION	SEQUENCE OF NODES DEFINING SECTION				
1	0	31	1	2	3	33
2	0	33	3	2	1	31

CONFIGURATION CODES

0 LINEAR
1 CONVERGENT
2 DIVERGENT
3 CONVERGENT AND DIVERGENT

INITIALIZATION STATISTICS

TIME INTERVAL NUMBER	SUBNETWORK TYPE	PRIOR CONTENT (VEHICLES)	CURRENT CONTENT (VEHICLES)	PERCENT DIFFERENCE	
1	NETSIM	0	162	10000	
2	NETSIM	162	245	51	
3	NETSIM	245	282	15	
4	NETSIM	282	289	2	
5	NETSIM	289	277	4	EQUILIBRIUM ATTAINED

ALL EXISTING SUBNETWORKS REACHED EQUILIBRIUM

NETSIM INTERMEDIATE LINK STATISTICS AT TIME 7:30: 0

ELAPSED TIME IS 0:30: 0 (1800 SECONDS), TIME PERIOD 1 ELAPSED TIME IS 1800 SECONDS

LINK	VEHICLE CONTENT BY TURN MOVEMENT LEFT	THRU	RIGHT	DIAG	QUEUES BY LANE 1	2	3	4	5	6	7	VEHICLES DISCHARGED	VEHICLE STOPS	CONTROL DEVICE INDICATIONS INT	LEFT	THRU	RIGHT	DIAG	AMBR	TIME ACTV
(31, 1)	16	28	2	0	4	6	5	0	1	6	6	1124	971	1	PROT	NOGO	NOGO	-	OFF	0
(2, 1)	4	48	0	0	11	9	7	0	0	0	3	863	669	1	PROT	NOGO	NOGO	-	OFF	0
(21, 1)	0	4	1	0	0	0	0	0	0	0	0	311	245	1	NOGO	NOGO	NOGO	-	OFF	0
(11, 1)	0	3	1	0	0	0	0	0	0	0	0	271	219	1	NOGO	NOGO	NOGO	-	OFF	0
(1, 2)	8	10	0	0	0	0	2	0	0	0	3	761	234	3	NOGO	GO	-	-	OFF	17
(3, 2)	0	29	2	0	2	0	2	0	0	0	0	884	578	3	-	GO	GO	-	OFF	17
(12, 2)	5	0	3	0	1	2	0	0	0	0	0	257	215	3	NOGO	-	NOGO	-	OFF	17
(2, 3)	4	12	3	0	0	0	0	0	0	0	1	754	586	3	NOGO	GO	GO	-	OFF	25
(33, 3)	3	31	7	0	1	9	2	0	0	1	1	1307	1232	3	NOGO	GO	GO	-	OFF	25
(23, 3)	1	6	0	0	2	2	0	0	0	0	0	177	139	3	NOGO	NOGO	NOGO	-	OFF	25
(13, 3)	0	2	2	0	1	2	0	0	0	0	0	100	78	3	NOGO	NOGO	NOGO	-	OFF	25
(8011, 11)	0	0	0	0	0	0	0	0	0	0	0	270	0	1	-	GO	-	-	OFF	0
(1, 11)	0	16	0	0	0	0	0	0	0	0	0	668	0	1	-	GO	-	-	OFF	0
(8012, 12)	0	0	0	0	0	0	0	0	0	0	0	256	0	1	-	GO	-	-	OFF	0
(2, 12)	0	1	0	0	0	0	0	0	0	0	0	261	0	1	-	GO	-	-	OFF	0
(8013, 13)	0	0	0	0	0	0	0	0	0	0	0	100	0	1	-	GO	-	-	OFF	0
(3, 13)	0	10	0	0	0	0	0	0	0	0	0	592	0	1	-	GO	-	-	OFF	0
(8021, 21)	0	0	0	0	0	0	0	0	0	0	0	310	0	1	-	GO	-	-	OFF	0
(1, 21)	0	12	0	0	0	0	0	0	0	0	0	410	0	1	-	GO	-	-	OFF	0
(8023, 23)	0	0	0	0	0	0	0	0	0	0	0	177	0	1	-	GO	-	-	OFF	0
(3, 23)	0	5	0	0	0	0	0	0	0	0	0	309	0	1	-	GO	-	-	OFF	0
(8031, 31)	0	0	0	0	0	0	0	0	0	0	0	1125	0	1	-	GO	-	-	OFF	0
(1, 31)	0	2	0	0	0	0	0	0	0	0	0	729	0	1	-	GO	-	-	OFF	0
(8033, 33)	0	0	0	0	0	0	0	0	0	0	0	1314	0	1	-	GO	-	-	OFF	0
(3, 33)	0	19	0	0	0	0	0	0	0	0	0	560	0	1	-	GO	-	-	OFF	0

NETSIM INTERMEDIATE LINK STATISTICS AT TIME 8: 0: 0

ELAPSED TIME IS 1: 0: 0 (3600 SECONDS), TIME PERIOD 1 ELAPSED TIME IS 3600 SECONDS

LINK	VEHICLE-CONTENT BY TURN MOVEMENT LEFT	THRU	RIGHT	DIAG	QUEUES BY LANE 1	2	3	4	5	6	7	VEHICLES DISCHARGED	VEHICLE STOPS	CONTROL DEVICE INDICATIONS INT	LEFT	THRU	RIGHT	DIAG	AMBR	TIME ACTV
(31, 1)	16	31	1	0	7	8	9	0	0	5	4	2247	1956	1	PROT	NOGO	NOGO	-	OFF	0
(2, 1)	3	21	5	0	4	2	0	0	0	1	2	1714	1264	1	PROT	NOGO	NOGO	-	OFF	0
(21, 1)	0	6	0	0	0	1	0	0	0	0	0	621	524	1	NOGO	NOGO	NOGO	-	OFF	0
(11, 1)	3	6	0	0	0	4	0	0	0	0	0	536	450	1	NOGO	NOGO	NOGO	-	OFF	0
(1, 2)	7	19	0	0	0	0	0	0	0	0	3	1512	464	3	NOGO	GO	-	-	OFF	17
(3, 2)	0	24	4	0	0	0	0	0	0	0	0	1726	1039	3	-	GO	GO	-	OFF	17
(12, 2)	4	0	5	0	1	4	0	0	0	0	0	511	418	3	NOGO	-	NOGO	-	OFF	17
(2, 3)	5	16	1	0	0	0	1	0	0	0	1	1483	1155	3	NOGO	GO	GO	-	OFF	25
(33, 3)	6	32	4	0	2	4	6	0	0	2	2	2620	2284	3	NOGO	GO	GO	-	OFF	25
(23, 3)	2	5	0	0	3	1	0	0	0	0	0	355	271	3	NOGO	NOGO	NOGO	-	OFF	25
(13, 3)	0	3	0	0	2	0	0	0	0	0	0	201	158	3	NOGO	NOGO	NOGO	-	OFF	25
(8011, 11)	0	0	0	0	0	0	0	0	0	0	0	540	0	1	-	GO	-	-	OFF	0
(1, 11)	0	12	0	0	0	0	0	0	0	0	0	1351	0	1	-	GO	-	-	OFF	0
(8012, 12)	0	0	0	0	0	0	0	0	0	0	0	511	0	1	-	GO	-	-	OFF	0
(2, 12)	0	4	0	0	0	0	0	0	0	0	0	545	0	1	-	GO	-	-	OFF	0
(8013, 13)	0	0	0	0	0	0	0	0	0	0	0	200	0	1	-	GO	-	-	OFF	0
(3, 13)	0	10	0	0	0	0	0	0	0	0	0	1215	0	1	-	GO	-	-	OFF	0
(8021, 21)	0	0	0	0	0	0	0	0	0	0	0	621	0	1	-	GO	-	-	OFF	0
(1, 21)	0	10	0	0	0	0	0	0	0	0	0	808	0	1	-	GO	-	-	OFF	0
(8023, 23)	0	0	0	0	0	0	0	0	0	0	0	355	0	1	-	GO	-	-	OFF	0
(3, 23)	0	3	0	0	0	0	0	0	0	0	0	658	0	1	-	GO	-	-	OFF	0
(8031, 31)	0	0	0	0	0	0	0	0	0	0	0	2250	0	1	-	GO	-	-	OFF	0
(1, 31)	0	0	0	0	0	0	0	0	0	0	0	1446	0	1	-	GO	-	-	OFF	0
(8033, 33)	0	0	0	0	0	0	0	0	0	0	0	2628	0	1	-	GO	-	-	OFF	0
(3, 33)	0	22	0	0	0	0	0	0	0	0	0	1069	0	1	-	GO	-	-	OFF	0

NETSIM INTERMEDIATE LINK STATISTICS AT TIME 8:30: 0

ELAPSED TIME IS 1:30: 0 (5400 SECONDS), TIME PERIOD 1 ELAPSED TIME IS 5400 SECONDS

LINK	VEHICLE - CONTENT BY TURN MOVEMENT LEFT	THRU	RIGHT	DIAG	QUEUES BY LANE 1	2	3	4	5	6	7	VEHICLES DISCHARGED	VEHICLE STOPS	CONTROL DEVICE INDICATIONS INT	LEFT	THRU	RIGHT	DIAG	AMBR	TIME ACTV
(31, 1)	22	21	1	0	4	4	3	0	0	8	8	3376	2867	1	PROT	NOGO	NOGO	-	OFF	0
(2, 1)	4	27	5	0	6	4	2	0	0	2	3	2575	1968	1	PROT	NOGO	NOGO	-	OFF	0
(21, 1)	1	5	0	0	0	0	0	0	0	0	0	931	783	1	NOGO	NOGO	NOGO	-	OFF	0
(11, 1)	1	6	0	0	0	2	0	0	0	0	0	809	681	1	NOGO	NOGO	NOGO	-	OFF	0
(1, 2)	8	14	0	0	0	0	0	0	0	0	5	2252	682	3	NOGO	GO	-	-	OFF	17
(3, 2)	0	34	3	0	1	3	2	0	0	0	0	2589	1569	3	-	GO	GO	-	OFF	17
(12, 2)	5	0	4	0	2	2	0	0	0	0	0	766	624	3	NOGO	-	NOGO	-	OFF	17
(2, 3)	7	7	1	0	0	0	0	0	0	0	3	2234	1730	3	NOGO	GO	GO	-	OFF	25
(33, 3)	2	26	4	0	0	0	6	0	0	0	0	3944	3435	3	NOGO	GO	GO	-	OFF	25
(23, 3)	1	6	0	0	2	2	0	0	0	0	0	532	409	3	NOGO	NOGO	NOGO	-	OFF	25
(13, 3)	1	2	1	0	0	2	0	0	0	0	0	300	233	3	NOGO	NOGO	NOGO	-	OFF	25
(8011, 11)	0	0	0	0	0	0	0	0	0	0	0	811	0	1	-	GO	-	-	OFF	0
(1, 11)	0	16	0	0	0	0	0	0	0	0	0	2069	0	1	-	GO	-	-	OFF	0
(8012, 12)	0	0	0	0	0	0	0	0	0	0	0	766	0	1	-	GO	-	-	OFF	0
(2, 12)	0	4	0	0	0	0	0	0	0	0	0	791	0	1	-	GO	-	-	OFF	0
(8013, 13)	0	0	0	0	0	0	0	0	0	0	0	300	0	1	-	GO	-	-	OFF	0
(3, 13)	0	7	0	0	0	0	0	0	0	0	0	1822	0	1	-	GO	-	-	OFF	0
(8021, 21)	0	0	0	0	0	0	0	0	0	0	0	931	0	1	-	GO	-	-	OFF	0
(1, 21)	0	13	0	0	0	0	0	0	0	0	0	1199	0	1	-	GO	-	-	OFF	0
(8023, 23)	0	0	0	0	0	0	0	0	0	0	0	532	0	1	-	GO	-	-	OFF	0
(3, 23)	0	3	0	0	0	0	0	0	0	0	0	989	0	1	-	GO	-	-	OFF	0
(8031, 31)	0	0	0	0	0	0	0	0	0	0	0	3375	0	1	-	GO	-	-	OFF	0
(1, 31)	0	3	0	0	0	0	0	0	0	0	0	2164	0	1	-	GO	-	-	OFF	0
(8033, 33)	0	0	0	0	0	0	0	0	0	0	0	3942	0	1	-	GO	-	-	OFF	0
(3, 33)	0	25	0	0	0	0	0	0	0	0	0	1610	0	1	-	GO	-	-	OFF	0

NETSIM INTERMEDIATE LINK STATISTICS AT TIME 9: 0: 0

ELAPSED TIME IS 2: 0: 0 (7200 SECONDS), TIME PERIOD 1 ELAPSED TIME IS 7200 SECONDS

LINK	VEHICLE - CONTENT BY TURN MOVEMENT LEFT	THRU	RIGHT	DIAG	QUEUES BY LANE 1	2	3	4	5	6	7	VEHICLES DISCHARGED	VEHICLE STOPS	CONTROL DEVICE INDICATIONS INT	LEFT	THRU	RIGHT	DIAG	AMBR	TIME ACTV
(31, 1)	19	29	3	0	5	8	7	0	1	7	6	4494	3814	1	PROT	NOGO	NOGO	-	OFF	0
(2, 1)	2	20	2	0	4	3	1	0	0	0	2	3451	2566	1	PROT	NOGO	NOGO	-	OFF	0
(21, 1)	1	5	1	0	0	2	0	0	0	0	0	1240	1045	1	NOGO	NOGO	NOGO	-	OFF	0
(11, 1)	0	5	0	0	1	0	0	0	0	0	0	1081	904	1	NOGO	NOGO	NOGO	-	OFF	0
(1, 2)	5	16	0	0	0	0	0	0	0	0	3	2997	898	3	NOGO	GO	-	-	OFF	17
(3, 2)	0	22	8	0	0	0	3	0	0	0	0	3421	2088	3	-	GO	GO	-	OFF	17
(12, 2)	7	0	3	0	1	5	0	0	0	0	0	1020	825	3	NOGO	-	NOGO	-	OFF	17
(2, 3)	2	20	1	0	1	1	3	0	0	0	0	2949	2289	3	NOGO	GO	GO	-	OFF	25
(33, 3)	3	36	11	0	8	6	12	0	0	0	0	5239	4460	3	NOGO	GO	GO	-	OFF	25
(23, 3)	1	6	0	0	1	2	0	0	0	0	0	710	537	3	NOGO	NOGO	NOGO	-	OFF	25
(13, 3)	1	2	0	0	1	1	0	0	0	0	0	401	313	3	NOGO	NOGO	NOGO	-	OFF	25
(8011, 11)	0	0	0	0	0	0	0	0	0	0	0	1081	0	1	-	GO	-	-	OFF	0
(1, 11)	0	13	0	0	0	0	0	0	0	0	0	2813	0	1	-	GO	-	-	OFF	0
(8012, 12)	0	0	0	0	0	0	0	0	0	0	0	1021	0	1	-	GO	-	-	OFF	0
(2, 12)	0	5	0	0	0	0	0	0	0	0	0	1034	0	1	-	GO	-	-	OFF	0
(8013, 13)	0	0	0	0	0	0	0	0	0	0	0	400	0	1	-	GO	-	-	OFF	0
(3, 13)	0	7	0	0	0	0	0	0	0	0	0	2431	0	1	-	GO	-	-	OFF	0
(8021, 21)	0	0	0	0	0	0	0	0	0	0	0	1241	0	1	-	GO	-	-	OFF	0
(1, 21)	0	13	0	0	0	0	0	0	0	0	0	1585	0	1	-	GO	-	-	OFF	0
(8023, 23)	0	0	0	0	0	0	0	0	0	0	0	710	0	1	-	GO	-	-	OFF	0
(3, 23)	0	5	0	0	0	0	0	0	0	0	0	1293	0	1	-	GO	-	-	OFF	0
(8031, 31)	0	0	0	0	0	0	0	0	0	0	0	4500	0	1	-	GO	-	-	OFF	0
(1, 31)	0	2	0	0	0	0	0	0	0	0	0	2869	0	1	-	GO	-	-	OFF	0
(8033, 33)	0	1	0	0	0	0	0	0	0	0	0	5255	0	1	-	GO	-	-	OFF	0
(3, 33)	0	27	0	0	0	0	0	0	0	0	0	2157	0	1	-	GO	-	-	OFF	0

CUMULATIVE NETSIM STATISTICS AT TIME 9: 0: 0

ELAPSED TIME IS 2: 0: 0 (7200 SECONDS), TIME PERIOD 1 ELAPSED TIME IS 7200 SECONDS

LINK	VEHICLE MILES	VEHICLE TRIPS	VEHICLE MINUTES MOVE TIME	VEHICLE MINUTES DELAY TIME	VEHICLE MINUTES TOTAL TIME	RATIO MOVE/ TOTAL	MINUTES/MILE TOTAL TIME	MINUTES/MILE DELAY TIME	SECONDS / VEHICLE TOTAL TIME	SECONDS / VEHICLE DELAY TIME	SECONDS / VEHICLE QUEUE TIME	SECONDS / VEHICLE STOP TIME	AVERAGE VALUES STOPS (%)	AVERAGE VALUES VOLUME VPH	AVERAGE VALUES SPEED MPH
(31, 1)	851.14	4494	1468.6	3227.3	4695.9	0.31	5.52	3.79	62.7	43.1	29.5	27.0	84	2247	10.9
(2, 1)	1176.48	3451	2030.0	2813.2	4843.2	0.42	4.12	2.39	84.2	48.9	31.1	28.0	74	1725	14.6
(21, 1)	234.85	1240	558.6	765.1	1323.6	0.42	5.64	3.26	64.0	37.0	28.7	26.4	84	620	10.6
(11, 1)	204.73	1081	486.9	662.8	1149.7	0.42	5.62	3.24	63.8	36.8	29.1	27.2	83	540	10.7
(1, 2)	1021.48	2997	1762.6	992.2	2754.8	0.64	2.70	0.97	55.2	19.9	9.0	8.6	29	1498	22.2
(3, 2)	647.70	3421	1117.6	1843.6	2961.2	0.38	4.57	2.85	51.9	32.3	21.7	20.1	61	1710	13.1
(12, 2)	193.18	1020	459.5	477.5	937.0	0.49	4.85	2.47	55.1	28.1	21.3	20.1	80	510	12.4
(2, 3)	558.52	2949	963.7	1617.0	2580.7	0.37	4.62	2.90	52.5	32.9	23.8	21.9	77	1474	13.0
(33, 3)	992.23	5239	1712.1	4077.1	5789.2	0.30	5.83	4.11	66.3	46.7	29.2	25.7	85	2619	10.3
(23, 3)	134.47	710	319.8	336.6	656.5	0.49	4.88	2.50	55.5	28.4	22.0	21.0	75	355	12.3
(13, 3)	75.95	401	180.6	186.1	366.8	0.49	4.83	2.45	54.9	27.8	22.0	21.5	78	200	12.4
(8011, 11)		1081												540	
(1, 11)	529.26	2813	1258.8	262.4	1521.1	0.83	2.87	0.50	32.4	5.6	0.0	0.0	0	1406	20.9
(8012, 12)		1021												510	
(2, 12)	195.83	1034	465.8	75.0	540.8	0.86	2.76	0.38	31.4	4.4	0.0	0.0	0	517	21.7
(8013, 13)		400												200	
(3, 13)	451.28	2431	1073.3	192.6	1265.9	0.85	2.81	0.43	31.2	4.8	0.0	0.0	0	1215	21.4
(8021, 21)		1241												620	
(1, 21)	297.07	1585	706.5	121.1	827.7	0.85	2.79	0.41	31.3	4.6	0.0	0.0	0	792	21.5
(8023, 23)		710												355	
(3, 23)	242.11	1293	575.8	101.7	677.5	0.85	2.80	0.42	31.4	4.7	0.0	0.0	0	646	21.4
(8031, 31)		4500												2250	
(1, 31)	543.14	2869	1291.8	279.4	1571.2	0.82	2.89	0.51	32.9	5.8	0.0	0.0	0	1434	20.7
(8033, 33)		5255												2627	
(3, 33)	408.44	2157	971.4	199.8	1171.3	0.83	2.87	0.49	32.6	5.6	0.0	0.0	0	1078	20.9
SUBNETWORK=	8757.86	14182	290.06	303.84	593.90	0.49	4.07	2.08	2.51	1.29	0.80	0.73	139.2 PER TRIP		14.7
			-- VEHICLE - HOURS --						--- MINUTES / VEHICLE-TRIP ---						

LINK	AVERAGE OCCUPANCY (VEHICLE)	-- CONGESTION -- STORAGE (%)	PHASE FAILURE	1	AVE[illegible] 2	3	4	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
(31, 1)	39.5	23.2	4	5	5	5	0	0	2	2	16	14	18	0	6	9	9
(2, 1)	40.8	15.6	14	5	5	4	0	0	1	1	25	24	24	0	0	8	7
(21, 1)	11.5	12.6	3	3	3	0	0	0	0	0	8	10	0	0	0	0	0
(11, 1)	10.0	11.0	11	2	3	0	0	0	0	0	7	8	0	0	0	0	0
(1, 2)	23.3	9.2	0	0	0	0	0	0	0	4	3	3	3	0	0	0	10
(3, 2)	25.0	16.6	0	3	4	4	0	0	0	0	10	12	14	0	0	0	5
(12, 2)	8.3	9.1	0	1	2	0	0	0	0	0	7	8	0	0	0	0	0
(2, 3)	22.1	13.5	7	3	3	3	0	0	0	2	10	10	11	0	0	5	13
(33, 3)	48.7	28.6	23	5	7	9	0	2	1	1	26	23	27	0	12	7	7
(23, 3)	6.0	6.6	0	1	1	0	0	0	0	0	5	5	0	0	0	0	0
(13, 3)	3.5	3.9	0	1	1	0	0	0	0	0	4	3	0	0	0	0	0
(8011, 11) (1, 11)	13.1	14.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(8012, 12) (2, 12)	5.0	5.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(8013, 13) (3, 13)	11.0	12.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(8021, 21) (1, 21)	7.3	8.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(8023, 23) (3, 23)	6.1	6.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(8031, 31) (1, 31)	13.4	9.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(8033, 33) (3, 33)	10.1	7.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SUBNETWORK=	304.8	13.0	62														

NETSIM PERSON MEASURES OF EFFECTIVENESS

LINK	PERSON MILE	PERSON TRIPS	DELAY PERSON-MIN	TRAVEL TIME PERSON-MIN
(31, 1)	1106.5	5842.2	4195.4	6104.6
(2, 1)	1529.4	4486.3	3657.2	6296.2
(21, 1)	305.3	1612.0	994.6	1720.7
(11, 1)	266.2	1405.3	861.6	1494.7
(1, 2)	1327.9	3896.1	1289.9	3581.2
(3, 2)	842.0	4447.3	2396.6	3849.5
(12, 2)	251.1	1326.0	620.7	1218.0
(2, 3)	726.1	3833.7	2102.1	3354.9
(33, 3)	1289.9	6810.7	5300.2	7525.9
(23, 3)	174.8	923.0	437.6	853.4
(13, 3)	98.7	521.3	242.0	476.8
(8011, 11)				
(1, 11)	688.0	3656.9	341.1	1977.5
(8012, 12)				
(2, 12)	254.6	1344.2	97.5	703.0
(8013, 13)				
(3, 13)	586.7	3160.3	250.4	1645.7
(8021, 21)				
(1, 21)	386.2	2060.5	157.4	1075.9
(8023, 23)				
(3, 23)	314.7	1680.9	132.2	880.8
(8031, 31)				
(1, 31)	706.1	3729.7	363.2	2042.6
(8033, 33)				
(3, 33)	531.0	2804.1	259.8	1522.6

NETSIM MOVEMENT SPECIFIC STATISTICS

LINK	VEHICLE-MILE LEFT	VEHICLE-MILE THRU	VEHICLE-MILE RIGHT	VEHICLE-TRIPS LEFT	VEHICLE-TRIPS THRU	VEHICLE-TRIPS RIGHT	SPEED (MPH) LEFT	SPEED (MPH) THRU	SPEED (MPH) RIGHT	STOPS (PCT) LEFT	STOPS (PCT) THRU	STOPS (PCT) RIGHT
(31, 1)	225.38	536.55	89.20	1190	2833	471	11.4	10.0	18.0	80.9	89.3	68.4
(2, 1)	69.20	926.93	180.34	203	2719	529	13.3	14.2	17.9	96.1	74.3	66.2
(21, 1)	12.50	207.39	14.96	66	1095	79	9.0	10.6	12.6	95.5	83.7	82.3
(11, 1)	16.10	172.92	15.72	85	913	83	8.3	10.8	12.7	97.6	83.2	73.5
(1, 2)	181.66	839.82	0.00	533	2464	0	12.7	26.6	0.0	94.4	16.0	0.0
(3, 2)	0.00	553.04	94.67	0	2921	500	0.0	12.3	21.3	0.0	60.8	62.4
(12, 2)	93.56	0.00	99.62	494	0	526	10.5	0.0	14.9	81.4	0.0	80.4
(2, 3)	82.95	396.21	79.36	438	2092	419	11.1	12.4	21.5	90.0	75.4	75.7
(33, 3)	113.07	618.18	260.98	597	3264	1378	9.7	9.3	14.4	89.4	88.9	74.2
(23, 3)	13.07	115.91	5.49	69	612	29	12.4	12.2	14.4	72.5	76.3	69.0
(13, 3)	8.14	53.41	14.39	43	282	76	10.1	12.2	15.3	95.3	75.2	78.9
(8011, 11)				0	1081	0						
(1, 11)	0.00	529.26	0.00	0	2813	0	0.0	20.9	0.0	0.0	0.0	0.0
(8012, 12)				0	1021	0						
(2, 12)	0.00	195.83	0.00	0	1034	0	0.0	21.7	0.0	0.0	0.0	0.0
(8013, 13)				0	400	0						
(3, 13)	0.00	451.28	0.00	0	2431	0	0.0	21.4	0.0	0.0	0.0	0.0
(8021, 21)				0	1241	0						
(1, 21)	0.00	297.07	0.00	0	1585	0	0.0	21.5	0.0	0.0	0.0	0.0
(8023, 23)				0	710	0						
(3, 23)	0.00	242.11	0.00	0	1293	0	0.0	21.4	0.0	0.0	0.0	0.0
(8031, 31)				0	4500	0						
(1, 31)	0.00	543.14	0.00	0	2869	0	0.0	20.7	0.0	0.0	0.0	0.0
(8033, 33)				0	5255	0						
(3, 33)	0.00	408.44	0.00	0	2157	0	0.0	20.9	0.0	0.0	0.0	0.0

NETSIM VEHICLE-MINUTE STATISTICS BY TURN MOVEMENT

V E H I C L E - M I N U T E S

LINK	MOVING TIME LEFT	MOVING TIME THRU	MOVING TIME RIGHT	DELAY TIME LEFT	DELAY TIME THRU	DELAY TIME RIGHT	TOTAL TIME LEFT	TOTAL TIME THRU	TOTAL TIME RIGHT	RATIO MOVE/TOTAL LEFT	RATIO MOVE/TOTAL THRU	RATIO MOVE/TOTAL RIGHT
(31, 1)	388.89	925.82	153.92	802.11	2281.52	143.63	1191.00	3207.33	297.55	0.33	0.29	0.52
(2, 1)	119.41	1599.41	311.18	193.59	2326.74	292.87	313.00	3926.15	604.05	0.38	0.41	0.52
(21, 1)	29.73	493.24	35.59	53.92	675.62	35.51	83.65	1168.87	71.10	0.36	0.42	0.50
(11, 1)	38.29	411.26	37.39	77.65	548.26	36.90	115.93	959.52	74.28	0.33	0.43	0.50
(1, 2)	313.53	1449.41	0.00	543.85	447.99	0.00	857.38	1897.40	0.00	0.37	0.76	0.00
(3, 2)	0.00	954.58	163.40	0.00	1739.96	103.23	0.00	2694.53	266.63	0.00	0.35	0.61
(12, 2)	222.52	0.00	236.94	312.28	0.00	165.21	534.80	0.00	402.15	0.42	0.00	0.59
(2, 3)	143.14	683.66	136.93	303.43	1229.09	84.47	446.57	1912.75	221.40	0.32	0.36	0.62
(33, 3)	195.10	1066.67	450.33	503.07	2936.42	637.61	698.17	4003.08	1087.93	0.28	0.27	0.41
(23, 3)	31.08	275.68	13.06	32.04	294.82	9.77	63.12	570.50	22.83	0.49	0.48	0.57
(13, 3)	19.37	127.03	34.23	28.80	135.22	22.10	48.17	262.25	56.33	0.40	0.48	0.61
(8011, 11)												
(1, 11)	0.00	1267.12	0.00	0.00	254.02	0.00	0.00	1521.13	0.00	0.00	0.83	0.00
(8012, 12)												
(2, 12)	0.00	465.77	0.00	0.00	74.98	0.00	0.00	540.75	0.00	0.00	0.86	0.00
(8013, 13)												
(3, 13)	0.00	1095.05	0.00	0.00	170.87	0.00	0.00	1265.92	0.00	0.00	0.87	0.00
(8021, 21)												
(1, 21)	0.00	713.96	0.00	0.00	113.69	0.00	0.00	827.65	0.00	0.00	0.86	0.00
(8023, 23)												
(3, 23)	0.00	582.43	0.00	0.00	95.12	0.00	0.00	677.55	0.00	0.00	0.86	0.00
(8031, 31)												
(1, 31)	0.00	1292.34	0.00	0.00	278.86	0.00	0.00	1571.20	0.00	0.00	0.82	0.00
(8033, 33)												
(3, 33)	0.00	971.62	0.00	0.00	199.65	0.00	0.00	1171.27	0.00	0.00	0.83	0.00

NETSIM SECONDS PER VEHICLE STATISTICS BY TURN MOVEMENT

S E C O N D S   P E R   V E H I C L E

LINK	TOTAL TIME LEFT	TOTAL TIME THRU	TOTAL TIME RIGHT	DELAY TIME LEFT	DELAY TIME THRU	DELAY TIME RIGHT	QUEUE TIME LEFT	QUEUE TIME THRU	QUEUE TIME RIGHT	STOP TIME LEFT	STOP TIME THRU	STOP TIME RIGHT
(31, 1)	60.1	67.9	37.9	40.4	48.3	18.3	28.1	33.8	7.6	26.4	30.6	6.8
(2, 1)	92.5	86.6	68.5	57.2	51.3	33.2	41.6	33.3	15.9	39.0	29.9	14.1
(21, 1)	76.0	64.0	54.0	49.0	37.0	27.0	40.6	28.7	18.5	37.8	26.5	16.5
(11, 1)	81.8	63.1	53.7	54.8	36.0	26.7	46.7	28.4	18.6	44.2	26.5	16.7
(1, 2)	96.5	46.2	0.0	61.2	10.9	0.0	45.6	1.0	0.0	43.8	0.9	0.0
(3, 2)	0.0	55.3	32.0	0.0	35.7	12.4	0.0	25.0	2.1	0.0	23.3	1.7
(12, 2)	65.0	0.0	45.9	37.9	0.0	18.8	31.0	0.0	12.2	29.4	0.0	11.3
(2, 3)	61.2	54.9	31.7	41.6	35.3	12.1	32.4	25.9	4.3	30.8	23.7	3.7
(33, 3)	70.2	73.6	47.4	50.6	54.0	27.8	35.6	36.4	9.2	32.9	32.5	6.6
(23, 3)	54.9	55.9	47.2	27.9	28.9	20.2	20.9	22.5	15.3	19.6	21.4	14.2
(13, 3)	67.2	55.8	44.5	40.2	28.8	17.4	34.6	23.0	11.4	33.9	22.4	10.8
(8011, 11)												
(1, 11)	0.0	32.4	0.0	0.0	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(8012, 12)												
(2, 12)	0.0	31.4	0.0	0.0	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(8013, 13)												
(3, 13)	0.0	31.2	0.0	0.0	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(8021, 21)												
(1, 21)	0.0	31.3	0.0	0.0	4.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(8023, 23)												
(3, 23)	0.0	31.4	0.0	0.0	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(8031, 31)												
(1, 31)	0.0	32.9	0.0	0.0	5.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(8033, 33)												
(3, 33)	0.0	32.6	0.0	0.0	5.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0

NETSIM SECTION SPECIFIC STATISTICS

SECTION	VEHICLE MILES	VEHICLE TRIPS	VEHICLE-MINUTES DELAY TIME	VEHICLE-MINUTES TOTAL TIME	AVERAGE VALUES TRAVEL TIME (SEC/VEH-TRIP)	AVERAGE VALUES SPEED (MPH)	AVERAGE VALUES STOPS (PER TRIP)	AVERAGE VALUES CONTENT (VEH)
1	2839.58	12597	6036.32	11202.65	53.4	15.2	0.6	94
2	3359.55	14980	9013.28	15164.75	60.7	13.3	0.6	125

CUMULATIVE VALUES OF FUEL CONSUMPTION AND OF EMISSIONS

LINK	FUEL CONSUMPTION						VEHICLE EMISSION RATES (KG/MILE.HOUR)		
	GALLONS			M.P.G.					
VEHICLE TYPE-	AUTO	TRUCK	BUS	AUTO	TRUCK	BUS	HC	CO	NO X
(31, 1)	104.6	0.0	0.0	8.1	0.0	0.0	0.633	13.068	3.005
(2, 1)	104.5	0.0	0.0	11.2	0.0	0.0	0.349	6.280	1.473
(21, 1)	24.8	0.0	0.0	9.5	0.0	0.0	0.142	2.332	0.482
(11, 1)	21.3	0.0	0.0	9.6	0.0	0.0	0.122	1.948	0.412
(1, 2)	80.2	0.0	0.0	12.7	0.0	0.0	0.260	4.555	1.277
(3, 2)	68.7	0.0	0.0	9.4	0.0	0.0	0.409	7.819	1.945
(12, 2)	18.2	0.0	0.0	10.5	0.0	0.0	0.102	1.552	0.351
(2, 3)	51.3	0.0	0.0	11.0	0.0	0.0	0.312	5.696	1.272
(33, 3)	127.1	0.0	0.0	7.8	0.0	0.0	0.766	15.877	3.546
(23, 3)	12.8	0.0	0.0	10.5	0.0	0.0	0.071	1.081	0.247
(13, 3)	7.0	0.0	0.0	10.7	0.0	0.0	0.039	0.567	0.134
(8011, 11)									
(1, 11)	40.9	0.0	0.0	12.6	0.0	0.0	0.216	3.285	0.845
(8012, 12)									
(2, 12)	14.9	0.0	0.0	12.5	0.0	0.0	0.079	1.235	0.322
(8013, 13)									
(3, 13)	34.5	0.0	0.0	12.6	0.0	0.0	0.183	2.837	0.729
(8021, 21)									
(1, 21)	22.7	0.0	0.0	12.8	0.0	0.0	0.120	1.864	0.481
(8023, 23)									
(3, 23)	18.6	0.0	0.0	12.6	0.0	0.0	0.099	1.555	0.398
(8031, 31)									
(1, 31)	41.4	0.0	0.0	13.0	0.0	0.0	0.218	3.307	0.843
(8033, 33)									
(3, 33)	29.7	0.0	0.0	13.7	0.0	0.0	0.156	2.370	0.583
SUBNETWORK-	823.2	0.0	0.0	10.5	0.0	0.0	0.243	4.383	1.048

EMISSION STATISTICS FOR TRUCKS AND BUSES ARE NOT AVAILABLE

TOTAL CPU TIME FOR THIS RUN = 660.37 SECONDS (33 Mhz. 486)

LAST CASE PROCESSED

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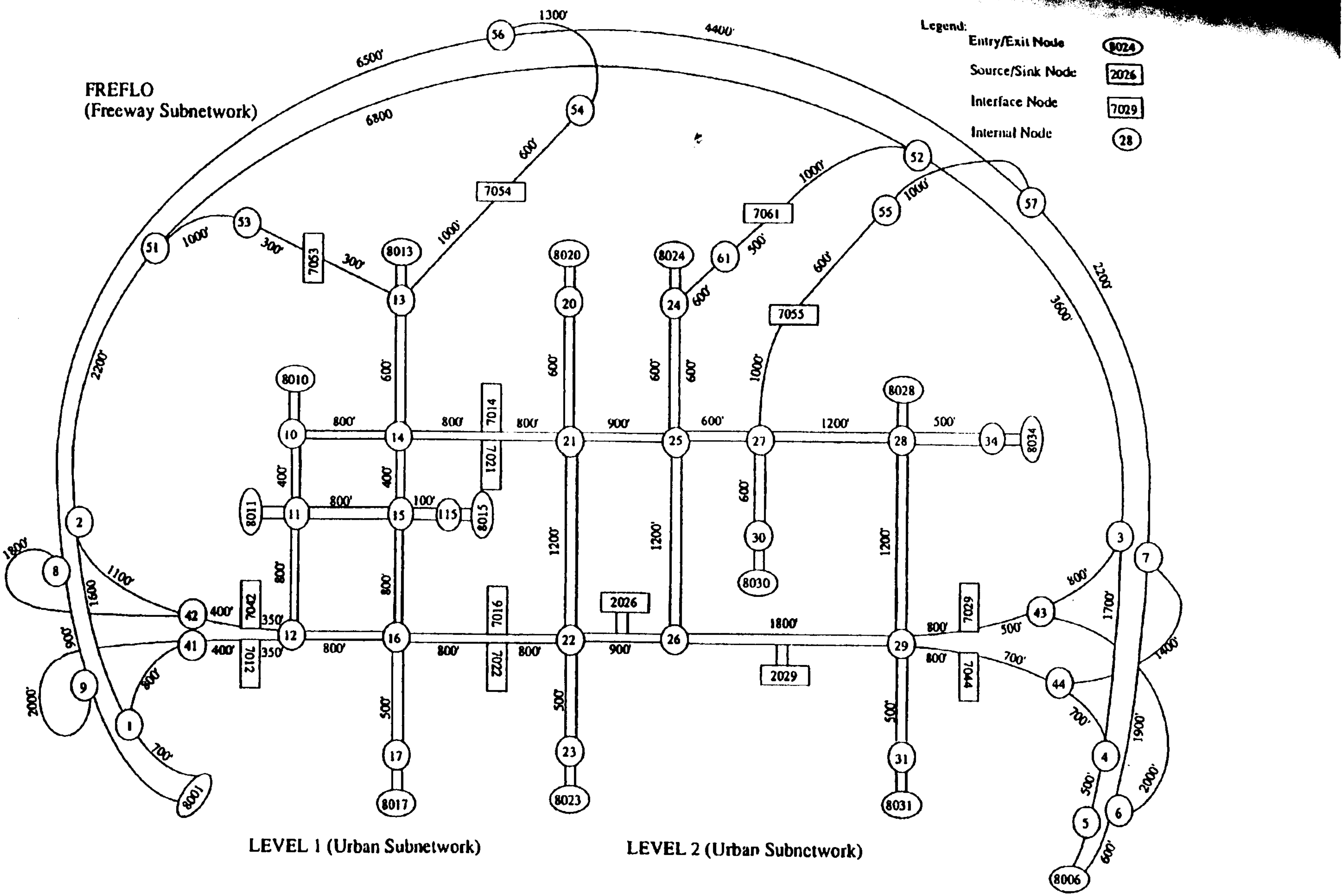
CORFLO
NETFLO 1
NETFLO 2
FREFLO


FREFLO
(Freeway Subnetwork)
Legend:
Entry/Exit Node
Source/Sink Node
Interface Node
Internal Node
LEVEL 1 (Urban Subnetwork)
LEVEL 2 (Urban Subnetwork)

Editor's Note: The output was produced by a pre-release version of CORFLO and therefore results may not be reproducible using a later pre-release or release version. Large portions of the output were deleted for the sake of brevity.

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TTTTTTTTTTT  RRRRRRRRR       AAAAAAA     FFFFFFFFFFF
TTTTTTTTTTT  RRRRRRRRRR    AAAAAAAAA     FFFFFFFFFFF
TTTTTTTTTTT  RRRRRRRRRRR  AAAAAAAAAAA   FFFFFFFFFFF
    TTT      RRR      RRR AAA      AAA  FFF
    TTT      RRR      RRR AAA      AAA  FFF
    TTT      RRRRRRRRRRR  AAAAAAAAAAA   FFFFFFF
    TTT      RRRRRRRRRR   AAAAAAAAAAA   FFFFFFF
    TTT      RRR RRR      AAA      AAA  FFF
    TTT      RRR  RRR     AAA      AAA  FFF
    TTT      RRR   RRR    AAA      AAA  FFF
    TTT      RRR    RRR   AAA      AAA  FFF
    TTT      RRR     RRR  AAA      AAA  FFF
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MICRO-COMPUTER PROTECTED-MODE VERSION
(REQUIRES 80386 AND 80387 OR ABOVE)

VERSION 3.10
RELEASE DATE MAY 1992

TRAF SIMULATION MODEL

DEVELOPED FOR

U. S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
INTELLIGENT VEHICLE HIGHWAY SYSTEM RESEARCH DIVISION

****

TIME PERIOD 1 - FREEWAY DATA

****

FREEWAY LINKS

LINK	LENGTH FT / M	-NUMBER OF LANES- REGULAR	SPECIAL	SPEED DENSITY RELATION	SPECIAL PURPOSE LANE USE BUSES	CARPOOLS	NOMINAL CAPACITY (VEH/LN/HR)	FREE SPEED MPH/KMPH	THROUGH NODE FIRST	SECOND	RAMP NODE ON	OFF
(8001, 1)	700/ 213	3	0	CUBIC	NO	NO	1800	55 / 89	2	41	0	0
(1, 2)	1600/ 488	3	0	CUBIC	NO	NO	1800	55 / 89	51	0	0	0
(2, 51)	2200/ 671	3	0	CUBIC	NO	NO	2000	55 / 89	52	53	0	0
(51, 52)	6800/2073	3	0	CUBIC	NO	NO	2000	55 / 89	3	0	0	0
(52, 3)	3600/1097	3	0	CUBIC	NO	NO	2000	55 / 89	4	43	0	0

FREEWAY SUBNETWORK PARAMETERS

RELAXATION TIME COEFFICIENT 75 SECONDS/MILE OR 46 SECONDS/KM

ANTICIPATION COEFFICIENT (EE-2) 25 MILES**2/HOUR OR 64 KM**2/HOUR

TIME SLICE DURATION 4 SECONDS

JAM DENSITY + 180 (VEH/LANE-MILE) OR 112 (VEH/LANE-KM)

COEFFICIENTS FOR SPEED-DENSITY RELATIONSHIP

RELATIONSHIP 1

COEFFICIENT 1	107	(MILES/HOUR)		OR	172	(KM/HOUR)
COEFFICIENT 2	-231	(MILES/HOUR) (LANE-MILE/VEH)		OR	-598	(KM/HOUR) (LANE-KM/VEH)
COEFFICIENT 3	215	(MILES/HOUR) (LANE-MILE/VEH)**2		OR	896	(KM/HOUR) (LANE-KM/VEH)**2
COEFFICIENT 4	-74	(MILES/HOUR) (LANE-MILE/VEH)**3		OR	-496	(KM/HOUR) (LANE-KM/VEH)**3

RELATIONSHIP 2

COEFFICIENT 1	80	(HOURS/MILE)	OR	49	(HOURS/KM)
COEFFICIENT 2	474	(HOURS/MILE) (LANE-MILE/VEH)	OR	474	(HOURS/KM) (LANE-KM/VEH)
COEFFICIENT 3	-591	(HOURS/MILE) (LANE-MILE/VEH)**2	OR	-951	(HOURS/KM) (LANE-KM/VEH)**2
COEFFICIENT 4	466	(HOURS/MILE) (LANE-MILE/VEH)**3	OR	1206	(HOURS/KM) (LANE-KM/VEH)**3

RELATIONSHIP 3 +

COEFFICIENT 1	25.	(VEH/LANE-MILE)	OR	16	(VEH/LANE-KM)
COEFFICIENT 2	50.	(VEH/LANE-MILE)	OR	31	(VEH/LANE-KM)
COEFFICIENT 3	35.	(MILES/HOUR)	OR	56	(KM/HOUR)
COEFFICIENT 4	40.	(MILES/HOUR)	OR	64	(KM/HOUR)
COEFFICIENT 5	2.	(DIMENSIONLESS)	OR	2	(DIMENSIONLESS)

+INDICATES A DEFAULT VALUE, ASSIGNED INTERNALLY BY THE MODEL

****

TIME PERIOD 1 - LEVEL 1 DATA

****

LEVEL I LINKS

LINK	LENGTH FT / M	-LANES- FUL L	PKT L	PKT R	GRD PCT	LINK TYPE	-CHANNEL- CUR B23456	DESTINATION NODE LEFT	THRU	RGHT	DIAG	OPP. NODE	LOST TIME SEC	Q DIS HDWY. SEC	FREE SPEED MPH/KMPH	RTOR CODE	PED CODE
(8011, 11)	0/ 0	3	0	0	0	1*	001000	10	15	12	0	15	2.5	2.2	0/ 0	0	0
(15, 11)	800/ 244	2	1	0	0	1*	000000	12	8011	10	0	8011	2.5	2.2	25/ 40	1	0
(12, 11)	800/ 244	2	0	1	0	1*	000000	8011	10	15	0	10	2.5	2.2	30/ 48	0	0
(10, 11)	400/ 122	2	0	1	3	1*	000000	15	12	8011	0	12	2.5	2.2	30/ 48	0	0
(7012, 12)	350/ 107	3	0	0	0	1*	001000	11	16	0	0	16	2.5	2.2	35/ 56	0	0
(16, 12)	800/ 244	2	0	1	0	1*	000000	0	7042	11	0	0	2.5	2.2	35/ 56	0	0
(11, 12)	800/ 244	2	0	0	0	1*	000000	16	0	7042	0	0	2.5	2.2	30/ 48	1	0

* INDICATES A DEFAULT VALUE, ASSIGNED INTERNALLY BY THE MODEL

LINK TYPE

IDENTIFIES THE DISTRIBUTION USED FOR QUEUE DISCHARGE AND START-UP LOST TIME CHARACTERISTICS.

LANE CHANNELIZATION CODES

0 UNRESTRICTED
1 LEFT TURNS ONLY
2 BUSES ONLY
3 CLOSED
4 RIGHT TURNS ONLY
5 CAR - POOLS
6 CAR - POOLS + BUSES

RTOR CODES

0 RTOR PERMITTED
1 RTOR PROHIBITED

PEDESTRIAN CODES

0 NO PEDESTRIANS
1 LIGHT
2 MODERATE
3 HEAVY

LEVEL I TURNING MOVEMENT DATA

LINK	TURN MOVEMENT PERCENTAGES LEFT	THROUGH	RIGHT	DIAGONAL	TURN MOVEMENT POSSIBLE LEFT	THROUGH	RIGHT	DIAGONAL	BLOCKAGE (PCT)	(SECS)	POCKET LENGTH (FEET/METERS) LEFT		RIGHT	
(8011, 11)	0	0	0	0	YES	YES	YES	NO	0	0	0/	0	0/	0
(15, 11)	0	0	0	0	YES	YES	YES	NO	0	0	120/	37	0/	0
(12, 11)	0	0	0	0	YES	YES	YES	NO	0	0	0/	0	120/	37
(10, 11)	0	0	0	0	YES	YES	YES	NO	0	0	0/	0	100/	30
(7012, 12)	0	0	0	0	YES	YES	NO	NO	0	0	0/	0	0/	0
(16, 12)	0	0	0	0	NO	YES	YES	NO	0	0	0/	0	160/	49
(11, 12)	0	0	0	0	YES	NO	YES	NO	0	0	0/	0	0/	0

SPECIFIED FIXED-TIME SIGNAL CONTROL, AND SIGN CONTROL, CODES

OFFSET 0 SEC NODE 12 CYCLE LENGTH 50 SEC

INTERVAL NUMBER	DURATION (SEC)	DURATION (PCT)	APPROACHES (7012, 12)	(16, 12)	(11, 12)
1	30	60	9	1	2
2	12	24	2	2	1
3	1	2	2	2	2
4	7	14	4	2	3

NODE 13 IS UNDER SIGN CONTROL

INTERVAL NUMBER	DURATION (SEC)	DURATION (PCT)	APPROACHES (8013, 13)	(14, 13)	(7053, 13)
1	0	100	1	1	5

INTERPRETATION OF SIGNAL CODES

0	YIELD OR AMBER
1	GREEN
2	RED
3	RED WITH GREEN RIGHT ARROW
4	RED WITH GREEN LEFT ARROW
5	STOP
6	RED WITH GREEN DIAGONAL ARROW
7	NO TURNS-GREEN THRU ARROW
8	RED WITH LEFT AND RIGHT GREEN ARROW
9	NO LEFT TURN-GREEN THRU AND RIGHT

TRAFFIC CONTROL TABLE - SIGNS AND FIXED TIME SIGNALS

CONTROL CODES
GO = PROTECTED
PERM = PERMITTED NOT PROTECTED
STOP = STOP SIGN
NOGO = NOT PERMITTED
PROT = PROTECTED
YLD = YIELD SIGN

NODE 12 FIXED TIME CONTROL OFFSET = 0 SECONDS CYCLE LENGTH = 50 SECONDS

PHASE	DURATION	(7012, 12) LEFT	THRU	RITE	DIAG	(16, 12) LEFT	THRU	RITE	DIAG	(11, 12) LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG
1	30	NOGO	GO				GO	GO		NOGO		NOGO									
2	13	NOGO	NOGO				NOGO	NOGO		PROT		GO									
3	7	PROT	NOGO				NOGO	NOGO		NOGO		GO									

NODE 13 SIGN CONTROL

PHASE	DURATION	(8013, 13) LEFT	THRU	RITE	DIAG	(14, 13) LEFT	THRU	RITE	DIAG	(7053, 13) LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG
1	0	PROT	GO				GO	GO		STOP		STOP									

ACTUATED CONTROLLER PHASE SPECIFICATIONS

NODE	PHASE	COORDINATED NON-ACTUATED YIELD POINT (SEC)	COORDINATED NON-ACTUATED DURATION OF YIELD INT (SEC)	COORDINATED ACTUATED FORCE-OFF POINT (SEC)	COORDINATED ACTUATED MIN INITIAL INTERVAL (SEC)	NON-COORDINATED NON-ACTUATED DURATION (SEC)	NON-COORDINATED ACTUATED MIN INITIAL INTERVAL (SEC)	NON-COORDINATED ACTUATED MAX EXTENSION BEYOND INITIAL INT (SEC)
14	1	0	40					
	2			60	15			

TRAFFIC CONTROL TABLE - ACTUATED CONTROLLERS

CONTROL CODES GO = PROTECTED
NOGO = NOT PERMITTED
PERM = PERMITTED NOT PROTECTED
PROT = PROTECTED

NODE 14 COORDINATED ACTUATED CONTROLLER

CYCLE LENGTH = 100 SECONDS

PHASE	(10, 14) LEFT	(10, 14) THRU	(10, 14) RITE	(10, 14) DIAG	(7014, 14) LEFT	(7014, 14) THRU	(7014, 14) RITE	(7014, 14) DIAG	(15, 14) LEFT	(15, 14) THRU	(15, 14) RITE	(15, 14) DIAG	(13, 14) LEFT	(13, 14) THRU	(13, 14) RITE	(13, 14) DIAG	LEFT	THRU	RITE	DIAG
1	NOGO	NOGO	NOGO		NOGO	NOGO	NOGO		PERM	GO	GO		PERM	GO	GO					
2	PERM	GO	GO		PERM	GO	GO		NOGO	NOGO	NOGO		NOGO	NOGO	NOGO					

DETECTOR SPECIFICATIONS

NODE	PHASE	APPROACH	LANE	DISTANCE FROM STOPLINE (FEET / METERS)
14	2	(10, 14)	1	60 / 18
		(10, 14)	2	60 / 18
		(7014, 14)	1	60 / 18
		(7014, 14)	2	60 / 18
		(7014, 14)	6	60 / 18

TIME PERIOD 1 - LEVEL 2 DATA

LEVEL II LINKS

LINK	LENGTH FT / M	-LANES- FULL	PKT L	PKT R	GRD PCT	-CHANNEL- CUR B23456	DESTINATION NODE LEFT	THRU	RGHT	DIAG	OPP. NODE	LOST TIME SEC	Q DIS HDWY. SEC	FREE SPEED MPH/KMPH	RTOR CODE	PED CODE
(21, 25)	900/ 274	2	1	0	0	000000	24	27	26	0	27	2.5*	2.2*	35/ 56	1	0
(27, 25)	600/ 183	2	1	1	0	000000	26	21	24	0	21	2.5*	2.2*	35/ 56	1	0
(26, 25)	1200/ 366	2	0	0	0	000000	21	24	27	0	24	2.5*	2.2*	30/ 48	1	0
(24, 25)	600/ 183	2	0	0	0	000000	27	26	21	0	26	2.5*	2.2*	30/ 48	1	0
(22, 26)	900/ 274	2	1	0	0	000000	25	29	0	0	29	2.5*	2.2*	35/ 56	0	0
(29, 26)	1800/ 549	2	0	1	0	000000	0	22	25	0	22	2.5*	2.2*	35/ 56	0	0
(25, 26)	1200/ 366	2	0	0	0	000000	29	0	22	0	0	2.5*	2.2*	30/ 48	1	0

* INDICATES A DEFAULT VALUE, ASSIGNED INTERNALLY BY THE MODEL

LANE CHANNELIZATION CODES

0 UNRESTRICTED
1 LEFT TURNS ONLY
2 BUSES ONLY
3 CLOSED
4 RIGHT TURNS ONLY
5 CAR - POOLS
6 CAR - POOLS + BUSES

RTOR CODES

0 RTOR PERMITTED
1 RTOR PROHIBITED

PEDESTRIAN CODES

0 NO PEDESTRIANS
1 LIGHT
2 MODERATE
3 HEAVY

LEVEL II TURNING MOVEMENT DATA

LINK	TURN MOVEMENT PERCENTAGES LEFT	THROUGH	RIGHT	DIAGONAL	TURN MOVEMENT POSSIBLE LEFT	THROUGH	RIGHT	DIAGONAL	BLOCKAGE (PCT)	(SECS)	POCKET LENGTH (FEET/METERS) LEFT		RIGHT	
(21, 25)	0	0	0	0	YES	YES	YES	NO	0	0	140/	43	0/	0
(27, 25)	0	0	0	0	YES	YES	YES	NO	0	0	100/	30	120/	37
(26, 25)	0	0	0	0	YES	YES	YES	NO	0	0	0/	0	0/	0
(24, 25)	0	0	0	0	YES	YES	YES	NO	0	0	0/	0	0/	0
(22, 26)	0	0	0	0	YES	YES	NO	NO	0	0	140/	43	0/	0
(29, 26)	0	0	0	0	NO	YES	YES	NO	0	0	0/	0	160/	49
(25, 26)	0	0	0	0	YES	NO	YES	NO	0	0	0/	0	0/	0

SPECIFIED FIXED-TIME SIGNAL CONTROL, AND SIGN CONTROL, CODES

NODE 25 — OFFSET 50 SEC — CYCLE LENGTH 100 SEC

INTERVAL NUMBER	DURATION (SEC)	DURATION (PCT)	APPROACHES (21, 25)	(27, 25)	(26, 25)	(24, 25)
1	42	42	1	1	2	2
2	1	1	2	2	2	2
3	42	42	2	2	1	1
4	1	1	2	2	2	2
5	14	14	4	4	3	3

NODE 26 — OFFSET 25 SEC — CYCLE LENGTH 50 SEC

INTERVAL NUMBER	DURATION (SEC)	DURATION (PCT)	APPROACHES (22, 26)	(29, 26)	(25, 26)
1	32	64	1	9	2
2	2	4	0	0	2
3	1	2	2	2	2
4	15	30	2	3	1

INTERPRETATION OF SIGNAL CODES

0	YIELD OR AMBER
1	GREEN
2	RED
3	RED WITH GREEN RIGHT ARROW
4	RED WITH GREEN LEFT ARROW
5	STOP
6	RED WITH GREEN DIAGONAL ARROW
7	NO TURNS-GREEN THRU ARROW
8	RED WITH LEFT AND RIGHT GREEN ARROW
9	NO LEFT TURN-GREEN THRU AND RIGHT

CONTROL CODES
GO = PROTECTED
PERM = PERMITTED NOT PROTECTED
STOP = STOP SIGN
NOGO = NOT PERMITTED
PROT = PROTECTED
YLD = YIELD SIGN

NODE 25 FIXED TIME CONTROL OFFSET = 50 SECONDS CYCLE LENGTH = 100 SECONDS

PHASE	DURATION	(21, 25) LEFT	THRU	RITE	DIAG	(27, 25) LEFT	THRU	RITE	DIAG	(26, 25) LEFT	THRU	RITE	DIAG	(24, 25) LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG
1	43	PERM	GO	GO		PERM	GO	GO		NOGO	NOGO	NOGO		NOGO	NOGO	NOGO					
2	43	NOGO	NOGO	NOGO		NOGO	NOGO	NOGO		PERM	GO	GO		PERM	GO	GO					
3	14	PROT	NOGO	NOGO		PROT	NOGO	NOGO		NOGO	NOGO	GO		NOGO	NOGO	GO					

NODE 26 FIXED TIME CONTROL OFFSET = 25 SECONDS CYCLE LENGTH = 50 SECONDS

PHASE	DURATION	(22, 26) LEFT	THRU	RITE	DIAG	(29, 26) LEFT	THRU	RITE	DIAG	(25, 26) LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG	LEFT	THRU	RITE	DIAG
1	35	PERM	GO				GO	GO		NOGO		NOGO									
2	15	NOGO	NOGO				NOGO	GO		PROT		GO									

MAX.NUMBER OF ASSIGNMENT ITERATIONS = 10

MAX.NUMBER OF CAPACITY CALIBRATIONS = 2

CARRY-OVER CAPACITY FACTOR (%) = 75

TYPE OF OBJECTIVE FUNCTION
(0:USER OPTIMAL, 1:SYSTEM OPTIMAL) = 0 +

IMPEDANCE FUNCTION PARAMETERS:
ALPHA = 60/100 +
BETA = 40/ 10 +

TYPE (0:FHWA, 1:MODIFIED DAVIDSON) = 0 +

(+) :INDICATES DEFAULT VALUE

REQUESTED INTERMEDIATE OUTPUT CODE = 0
1: PATH ASSIGNMENTS
2: TREE CONSTRUCTS
3: DETAILED O-D TREES
4: ALL OUTPUTS 1,2 AND 3

TRIP TABLE

FOR EACH ORIGIN NODE, TABLE PROVIDES LISTING OF PAIRS OF DATA : DESTINATION NODE/VOLUME

ORIGIN NODE (8001)	8010/ 100	8017/ 80	8020/ 30	8031/ 30	8028/ 120	8034/ 120	8006/3000	8013/ 250
	2029/ 50	8015/ 60						

INTERNAL CENTROIDS

CENTROID	LINK
2026	(26, 22)
2029	(29, 26)

PROPERTIES OF BUS STATIONS

STATION NO.	LANE SERVICED	LINK	DISTANCE FROM UPSTREAM NODE FEET	/ METERS	CAPACITY (BUSES)	MEAN DWELL (SEC)	TYPE	PERCENT OF BUSES STOPPING
1	0	(13, 14)	460	140	1	30	1	100
2	0	(15, 16)	400	122	2	50	1	100

THE TYPE CODE IDENTIFIES THE APPLICABLE STATISTICAL DISTRIBUTION OF DWELL TIME

BUS ROUTE PATHS

SEQUENCE OF NODES DEFINING PATH

ROUTE										
1	8013	13	14	15	16	12	7042	42	8	9	8001
2	8001	1	41	7012	12	16	15	14	13	8013	

BUS STATIONS BY ROUTE

SEQUENCE OF STATIONS SERVICED BY ROUTE

ROUTE			
1	1	2	3
2	4	5	6

BUS VOLUMES

ROUTE	VOLUME (VEH/HR)	MEAN HEADWAY (SEC)
1	12	300
2	12	300

TRAFFIC ASSIGNMENT :SOURCE VOLUMES

ORIGIN NODE	VOLUME (VPH)
8001	3840
8006	3940

TRAFFIC ASSIGNMENT :SINK VOLUMES

DESTINATION NODE	VOLUME (VPH)
2026	850
2029	330

DESTINATION TRIP TABLE

FOR EACH DESTINATION NODE, TABLE PROVIDES LISTING OF DATA PAIRS: ORIGIN NODE/VOLUME

DESTINATION (2026) 8006/ 250 8013/ 100 2029/ 200 8028/ 100 8031/ 100 8034/ 100

TRAFFIC ASSIGNMENT RESULTS AT ITERATION : 3 CAPACITY ITERATION: 2

GEOMETRIC LINK	PATH-LINK	LENGTH FEET	FREE-FLOW TIME(SEC) ON-LINK	FREE-FLOW TIME(SEC) TOTAL	TRAVEL TIME(SEC)	CAPACITY VPH	VOLUME VPH	SPEED (MPH)	TURN TYPE	RECEIVER TYPE
(8011, 11)	(11, 12)	0	0	9.0	9.1	482	163	0.0	R	INT
	(11, 15)			14.0	14.3	903	392	0.0	T	INT
	(11, 10)			29.0	33.2	194	135	0.0	L	INT

TURN TYPE: R=RIGHT, T=THROUGH, D=DIAGONAL, L=LEFT; RECEIVER: INT = INTERNAL LINK

NETWORK HOURLY ESTIMATES: VEHICLE-MILES= 29258.71 VEHICLE-HOURS= 843.06 AVERAGE SPEED(MPH)= 34.71

TRAFFIC ASSIGNMENT EVALUATION

ITERATION	OBJ.FUNCTION VALUE	BOUND GAP(%)	LAMBDA	CONTRIBUTION(%)
1	0.2829140000E+07	100.000000	1.000000	19.065540
2	0.2792477000E+07	8.645954	0.308058	8.488111
3	0.2783125000E+07	0.669993	0.724463	72.446350

TRAFFIC ASSIGNMENT RESULTS

FREFLO SUBNETWORK

LINK	FIRST THROUGH MOVEMENT VOLUME VPH	FIRST THROUGH MOVEMENT PERCENT	SECOND THROUGH MOVEMENT VOLUME VPH	SECOND THROUGH MOVEMENT PERCENT	OFF RAMP MOVEMENT VOLUME VPH	OFF RAMP MOVEMENT PERCENT	TOTAL DISCHARGE VOLUME VPH	ESTIMATED AVERAGE SPEED MPH
(8001, 1)	3300	86	540	14	0	0	3840	43.5
(1, 2)	3300	100	0	0	0	0	3300	50.3
(2, 51)	3212	93	250	7	0	0	3462	47.6
(51, 52)	3212	100	0	0	0	0	3212	51.9
(52, 3)	3912	99	53	1	0	0	3965	42.3

LEVEL I SUBNETWORK

LINK	INTERNAL CENTROID	RIGHT TURN VOL. VPH	RIGHT TURN PCT.	THRU VOL. VPH	THRU PCT.	LEFT TURN VOL. VPH	LEFT TURN PCT.	DIAGONAL VOL. VPH	DIAGONAL PCT.	SOURCE FLOW VPH	SINK FLOW VPH	DISCHARGE VOLUME VPH	SPEED ESTIMATE MPH
(14, 10)	0	214	44	0	0	270	56	0	0	0	0	484	23.5
(11, 10)	0	44	12	316	88	0	0	0	0	0	0	360	19.4
(8010, 10)	0	0	0	140	27	370	73	0	0	0	0	510	
(8011, 11)	0	163	24	392	56	135	20	0	0	0	0	690	
(15, 11)	0	90	38	150	62	0	0	0	0	0	0	240	15.1

LEVEL II SUBNETWORK

LINK	INTERNAL CENTROID	RIGHT TURN VOL. VPH	RIGHT TURN PCT.	THRU VOL. VPH	THRU PCT.	LEFT TURN VOL. VPH	LEFT TURN PCT.	DIAGONAL VOL. VPH	DIAGONAL PCT.	SOURCE FLOW VPH	SINK FLOW VPH	DISCHARGE VOLUME VPH	SPEED ESTIMATE MPH
(7021, 21)	0	0	0	937	100	0	0	0	0	0	0	937	19.6
(25, 21)	0	200	19	703	65	170	16	0	0	0	0	1073	17.4
(22, 21)	0	402	55	330	44	10	1	0	0	0	0	742	20.0
(20, 21)	0	64	11	254	46	242	43	0	0	0	0	560	10.2
(7022, 22)	0	30	4	652	92	30	4	0	0	0	0	712	21.7

TRAFFIC ASSIGNMENT RESULTS

FREFLO SUBNETWORK

LINK	FIRST THROUGH MOVEMENT VOLUME VPH	FIRST THROUGH MOVEMENT PERCENT	SECOND THROUGH MOVEMENT VOLUME VPH	SECOND THROUGH MOVEMENT PERCENT	OFF RAMP MOVEMENT VOLUME VPH	OFF RAMP MOVEMENT PERCENT	TOTAL DISCHARGE VOLUME VPH	ESTIMATED AVERAGE SPEED MPH
(8001, 1)	3300	86	540	14	0	0	3840	43.5
(1, 2)	3300	100	0	0	0	0	3300	50.3
(2, 51)	3212	93	250	7	0	0	3462	47.6
(51, 52)	3212	100	0	0	0	0	3212	51.9
(52, 3)	3912	99	53	1	0	0	3965	42.3

LEVEL I SUBNETWORK

LINK	INTERNAL CENTROID	RIGHT TURN VOL. VPH	RIGHT TURN PCT.	THRU VOL. VPH	THRU PCT.	LEFT TURN VOL. VPH	LEFT TURN PCT.	DIAGONAL VOL. VPH	DIAGONAL PCT.	SOURCE FLOW VPH	SINK FLOW VPH	DISCHARGE VOLUME VPH	SPEED ESTIMATE MPH
(14, 10)	0	214	44	0	0	270	56	0	0	0	0	484	23.5
(11, 10)	0	44	12	316	88	0	0	0	0	0	0	360	19.4
(8010, 10)	0	0	0	140	27	370	73	0	0	0	0	510	
(8011, 11)	0	163	24	392	56	135	20	0	0	0	0	690	
(15, 11)	0	90	38	150	62	0	0	0	0	0	0	240	15.1

LEVEL II SUBNETWORK

LINK	INTERNAL CENTROID	RIGHT TURN VOL. VPH	RIGHT TURN PCT.	THRU VOL. VPH	THRU PCT.	LEFT TURN VOL. VPH	LEFT TURN PCT.	DIAGONAL VOL. VPH	DIAGONAL PCT.	SOURCE FLOW VPH	SINK FLOW VPH	DISCHARGE VOLUME VPH	SPEED ESTIMATE MPH
(7021, 21)	0	0	0	937	100	0	0	0	0	0	0	937	19.6
(25, 21)	0	200	19	703	65	170	16	0	0	0	0	1073	17.4
(22, 21)	0	402	55	330	44	10	1	0	0	0	0	742	20.0
(20, 21)	0	64	11	254	46	242	43	0	0	0	0	560	10.2
(7022, 22)	0	30	4	652	92	30	4	0	0	0	0	712	21.7

INITIALIZATION STATISTICS

TIME INTERVAL NUMBER	SUBNETWORK TYPE	PRIOR CONTENT (VEHICLES)	CURRENT CONTENT (VEHICLES)	PERCENT DIFFERENCE	
1	FREFLO	0	191	10000	
1	LEVEL I	0	66	10000	
1	LEVEL II	0	108	10000	
2	FREFLO	191	300	57	
2	LEVEL I	66	78	18	
2	LEVEL II	108	239	121	
3	FREFLO	300	368	22	
3	LEVEL I	82	87	6	
3	LEVEL II	237	280	18	
4	FREFLO	368	402	9	
4	LEVEL I	87	89	2	EQUILIBRIUM ATTAINED
4	LEVEL II	280	299	6	
5	FREFLO	402	416	3	EQUILIBRIUM ATTAINED
5	LEVEL II	299	307	2	EQUILIBRIUM ATTAINED

ALL EXISTING SUBNETWORKS REACHED EQUILIBRIUM

SPILLBACK ON LEVEL 1 LINK (115, 15) OCCURS 13 PERCENT OF THE TIME DURING TIME INTERVAL 4.

SPILLBACK ON LEVEL 2 LINK (21, 25) OCCURS 12 PERCENT OF THE TIME DURING TIME INTERVAL 10

FREFLO INTERMEDIATE STATISTICS AT TIME 8:50: 0

ELAPSED TIME IS 0:20: 0 (1200 SECONDS), TIME PERIOD 1 ELAPSED TIME IS 1200 SECONDS

LINK	VEHICLES DISCHARGED: AUTOS/ TRUCKS	VEHICLES DISCHARGED: BUSES	VEHICLES DISCHARGED: CAR POOLS	LINK VOLUMES (VEH/HR): REGULAR LANES	LINK VOLUMES (VEH/HR): SPECIAL LANES	SPEED (MPH): AUTOS/ TRUCKS	SPEED (MPH): BUSES	SPEED (MPH): CAR POOLS	SPEED (MPH): REGULAR LANES	SPEED (MPH): SPECIAL LANES	DENSITY (VEH/LANE-MI): AUTOS/ TRUCKS	DENSITY (VEH/LANE-MI): BUSES	DENSITY (VEH/LANE-MI): CAR POOLS	DENSITY (VEH/LANE-MI): REGULAR LANES	DENSITY (VEH/LANE-MI): SPECIAL LANES
(8001, 1)	1203	8	77	3839	0										
(1, 2)	1035	0	66	3301	0	54.8	0.0	54.8	54.8	0.0	18.9	0.0	1.2	20.1	0.0
(2, 51)	1102	0	69	3625	0	54.5	0.0	54.5	54.5	0.0	20.9	0.0	1.3	22.2	0.0
(51, 52)	1017	0	64	3275	0	54.3	0.0	54.3	54.3	0.0	18.9	0.0	1.2	20.1	0.0
(52, 3)	1227	0	64	3896	0	53.5	0.0	53.5	53.5	0.0	23.1	0.0	1.2	24.3	0.0

LEVEL I INTERMEDIATE LINK STATISTICS AT TIME 8:50: 0

ELAPSED TIME IS 0:20: 0 (1200 SECONDS), TIME PERIOD 1 ELAPSED TIME IS 1200 SECONDS

LINK	VEHICLE CONTENT: LEFT	THRU	RITE	DIAG	VEHICLE QUEUES BY LANE: 1	2	3	4	5	6	VEHICLES IN	VEHICLES OUT	NUMBER STOPS	PHASE	CONTROL DEVICE INDICATIONS: LEFT	THRU	RITE	DIAG	TIME ACTV
(7012, 12)	0	3	0	0	2	1	0	0	0	0	160	168	103	1	NOGO	GO	-	-	0
(16, 12)	0	4	0	0	2	1	0	0	0	0	143	142	105	1	-	GO	GO	-	0
(11, 12)	0	0	0	0	0	0	0	0	0	0	111	111	92	1	NOGO	-	NOGO	-	0

LEVEL II INTERMEDIATE LINK STATISTICS AT TIME 8:50: 0

ELAPSED TIME IS 0:20: 0 (1200 SECONDS), TIME PERIOD 1 ELAPSED TIME IS 1200 SECONDS

LINK	VEHICLE CONTENT	VEHICLE QUEUES: LEFT	THRU	RITE	DIAG	VEHICLES DISCHARGED	NUMBER STOPS	PHASE	CONTROL DEVICE INDICATIONS: LEFT	THRU	RITE	DIAG	TIME ACTV	SOURCE/ SINK
(21, 25)	80	74	1	0	0	409	350	2	NOGO	NOGO	NOGO	-	7	0
(27, 25)	4	0	1	0	0	437	350	2	NOGO	NOGO	NOGO	-	7	0
(26, 25)	10	0	3	2	0	187	113	2	PERM	GO	GO	-	7	0
(24, 25)	8	0	5	1	0	217	137	2	PERM	GO	GO	-	7	0
(22, 26)	0	0	0	0	0	258	199	1	PERM	GO	-	-	25	0
(29, 26)	15	0	0	0	0	545	134	1	-	GO	GO	-	25	80
(25, 26)	31	25	0	1	0	215	203	1	NOGO	-	NOGO	-	25	0

CUMULATIVE FREEWAY STATISTICS AT TIME 8:50: 0

ELAPSED TIME IS 0:20: 0 (1200 SECONDS), TIME PERIOD 1 ELAPSED TIME IS 1200 SECONDS

CUMULATIVE FREEWAY STATISTICS AT TIME 8:50: 0

ELAPSED TIME IS 0:20: 0 (1200 SECONDS), TIME PERIOD 1 ELAPSED TIME IS 1200 SECONDS

LINK	VEHICLE MILES	VEHICLE TRIPS	VEHICLE MINUTES MOVE TIME	VEHICLE MINUTES DELAY TIME	VEHICLE MINUTES TOTAL TIME	RATIO MOVE/ TOTAL	MIN./MILE TOTAL TIME	MIN./MILE DELAY TIME	SEC./VEH. TOT. TIME	SEC./VEH. DELAY TIME	AVERAGE VOLUME VPH	AVERAGE SPEED MPH	PERSON MILES	PERSON TRIPS	PERSON-MINUTES TOTAL TIME	PERSON-MINUTES DELAY TIME
(8001, 1)		1288									3864					
(1, 2)	333.57	1100	363.89	1.02	364.91	1.00	1.09	0.00	20	0	3302	54.8	476.5	1573	517.2	0.0
(2, 51)	488.06	1171	532.43	2.54	534.97	1.00	1.10	0.01	27	0	3514	54.7	698.9	1677	757.5	0.0
(51, 52)	1392.01	1080	1518.55	17.57	1536.12	0.99	1.10	0.01	85	1	3243	54.4	2041.2	1585	2175.4	0.0
(52, 3)	880.13	1290	960.14	26.79	986.93	0.97	1.12	0.03	46	1	3873	53.5	1250.6	1834	1376.5	12.2
SUBNETWORK=	7199.6	2922	135.49	2.20	137.69	0.98	1.15	0.02	3	0		52.3	10665.2	4265	201.42	0.89
			---- VEHICLE-HOURS ----						MINUTES/ VEHICLE-TRIP						PERSON-HOURS	

CUMULATIVE LEVEL I STATISTICS AT TIME 8:50: 0

ELAPSED TIME IS 0:20: 0 (1200 SECONDS), TIME PERIOD 1 ELAPSED TIME IS 1200 SECONDS

LINK STATISTICS

LINK	VEHICLE MILES	VEHICLE TRIPS	VEHICLE MINUTES MOVE TIME	VEHICLE MINUTES DELAY TIME	VEHICLE MINUTES TOTAL TIME	RATIO MOVE/ TOTAL	MINUTES/MILE TOTAL TIME	MINUTES/MILE DELAY TIME	SECONDS/VEHICLE TOTAL TIME	SECONDS/VEHICLE DELAY TIME	AVERAGE VALUES STOPS (PCT)	AVERAGE VALUES VOLUME VPH	AVERAGE VALUES SPEED MPH	AVERAGE VALUES OCCUP VEH.	STORAGE (PCT)
(7012, 12)	11.14	168	19.22	88.63	107.85	0.18	9.68	7.96	38.5	31.7	61	504	6.2	4.8	9.1
(16, 12)	21.51	142	37.11	32.45	69.57	0.53	3.23	1.51	29.4	13.7	73	426	18.6	3.5	4.0
(11, 12)	16.82	111	33.64	35.46	69.10	0.49	4.11	2.11	37.4	19.2	82	333	14.6	3.5	4.3
SUBNETWORK=	593.36	1942	19.16	16.38	35.55	0.54	3.59	1.66	1.10	0.51	1.1		16.7	106.4	5.6
			--- VEHICLE-HOURS ---						-- MINUTES/ -- VEHICLE-TRIP		PER TRIP				

LEVEL I BUS STATISTICS

LINK	BUS TRIPS	PERSON TRIPS	TRAVEL TIME (MINUTES)	MOVING TIME (MINUTES)	DELAY TIME (MINUTES)	M / T	NO.OF STOPS
(7012, 12)	5.0	125.0	2.1	0.6	1.6	0.27	5
(16, 12)	4.0	100.0	5.2	1.0	4.1	0.20	4

LEVEL I ENVIRONMENTAL MEASURES OF EFFECTIVENESS

LINK	AVG MPH	VEH-MI PER GALLON	PERSON-MI PER GALLON	GALLONS OF FUEL	GRAMS PER MILE CO	GRAMS PER MILE HC	KILOGRAMS CO	KILOGRAMS HC
(14, 10)	15.4	8.9	11.6	2.7	75.7	4.4	1.837	0.108
(11, 10)	15.9	9.0	11.8	0.9	73.9	4.4	0.610	0.036
SUBNETWORK =	16.7	9.2	12.0	64.4	71.7	4.3	42.536	2.527

MOVEMENT SPECIFIC LEVEL I STATISTICS

LINK	VEHICLE-MILE LEFT	VEHICLE-MILE THRU	VEHICLE-MILE RIGHT	VEHICLE-TRIPS LEFT	VEHICLE-TRIPS THRU	VEHICLE-TRIPS RIGHT	SPEED (MPH) LEFT	SPEED (MPH) THRU	SPEED (MPH) RIGHT	STOPS (PCT) LEFT	STOPS (PCT) THRU	STOPS (PCT) RIGHT
(7012, 12)	3.84	7.29	0.00	58	110	0	2.7	18.6	0.0	100.0	40.9	0.0
(16, 12)	0.00	19.53	1.97	0	129	13	0.0	18.3	21.9	0.0	74.4	69.2
(11, 12)	3.79	0.00	13.03	25	0	86	15.3	0.0	14.4	88.0	0.0	81.4

LEVEL I SECONDS PER VEHICLE STATISTICS BY TURN MOVEMENT

S E C O N D S P E R V E H I C L E

LINK	MOVE TIME LEFT	MOVE TIME THRU	MOVE TIME RIGHT	DELAY TIME LEFT	DELAY TIME THRU	DELAY TIME RIGHT	TOTAL TIME LEFT	TOTAL TIME THRU	TOTAL TIME RIGHT
(7012, 12)	6.9	6.9	0.0	80.4	6.0	0.0	87.2	12.8	0.0
(16, 12)	0.0	15.7	15.7	0.0	14.2	9.2	0.0	29.8	24.9
(11, 12)	18.2	0.0	18.2	17.5	0.0	19.7	35.7	0.0	37.8

LEVEL I VEHICLE-MINUTES STATISTICS BY TURN MOVEMENT

V E H I C L E - M I N U T E S

LINK	MOVE TIME LEFT	MOVE TIME THRU	MOVE TIME RIGHT	DELAY TIME LEFT	DELAY TIME THRU	DELAY TIME RIGHT	TOTAL TIME LEFT	TOTAL TIME THRU	TOTAL TIME RIGHT	RATIO MOVE/TOTAL LEFT	RATIO MOVE/TOTAL THRU	RATIO MOVE/TOTAL RIGHT
(7012, 12)	6.63	12.58	0.00	77.68	10.95	0.00	84.32	23.53	0.00	0.08	0.53	0.00
(16, 12)	0.00	33.70	3.40	0.00	30.46	2.00	0.00	64.17	5.40	0.00	0.53	0.63
(11, 12)	7.58	0.00	26.06	7.29	0.00	28.17	14.87	0.00	54.23	0.51	0.00	0.48

CUMULATIVE LEVEL II STATISTICS AT TIME 8:50: 0

ELAPSED TIME IS 0:20: 0 (1200 SECONDS), TIME PERIOD 1 ELAPSED TIME IS 1200 SECONDS

LINK STATISTICS

LINK	VEHICLE MILES	VEHICLE TRIPS	VEHICLE MINUTES MOVE TIME	VEHICLE MINUTES DELAY TIME	VEHICLE MINUTES TOTAL TIME	RATIO MOVE/ TOTAL	MINUTES/MILE TOTAL TIME	MINUTES/MILE DELAY TIME	SECONDS/VEHICLE TOTAL TIME	SECONDS/VEHICLE DELAY TIME	AVERAGE VALUES STOPS (PCT)	AVERAGE VALUES VOLUME VPH	AVERAGE VALUES SPEED MPH
(21, 25)	69.12	409	119.27	1318.50	1437.77	0.08	20.80	19.07	210.9	193.4	85	1227	2.9
(27, 25)	49.53	437	85.46	162.21	247.67	0.35	5.00	3.27	34.0	22.3	80	1309	12.0
(26, 25)	42.08	187	84.17	74.74	158.91	0.53	3.78	1.78	51.1	24.0	60	559	15.9
(24, 25)	24.68	217	49.36	73.36	122.72	0.40	4.97	2.97	33.9	20.3	62	651	12.1
(22, 26)	43.74	258	75.48	56.95	132.43	0.57	3.03	1.30	30.8	13.2	77	774	19.8
(29, 26)	171.67	505	296.22	96.51	392.72	0.75	2.29	0.56	46.7	11.5	24	1515	26.2
(25, 26)	48.68	215	97.36	440.50	537.86	0.18	11.05	9.05	150.5	123.2	94	643	5.4
SUBNETWORK=	1557.11	2374	47.71	82.36	130.07	0.37	5.01	3.17	3.29	2.08	2.1		12.0
			--- VEHICLE-HOURS ---						-- MINUTES/ -- VEHICLE-TRIP		PER TRIP		

LEVEL II BUS STATISTICS

LINK	BUS TRIPS	PERSON TRIPS	TRAVEL TIME (MINUTES)	MOVING TIME (MINUTES)	DELAY TIME (MINUTES)	M / T	NO.OF STOPS
(26, 22)	2.0	50.0	3.5	0.6	3.0	0.16	2
(23, 22)	2.0	50.0	1.9	0.4	1.5	0.20	2

LEVEL II ENVIRONMENTAL MEASURES OF EFFECTIVENESS

LINK	AVG MPH	VEH-MI PER GALLON	PERSON-MI PER GALLON	GALLONS OF FUEL	GRAMS PER MILE CO	GRAMS PER MILE HC	KILOGRAMS CO	KILOGRAMS HC
(21, 25)	2.9	3.5	4.6	19.7	291.5	14.2	20.153	0.979
(27, 25)	12.0	7.9	10.2	6.3	89.7	5.1	4.441	0.251
(26, 25)	15.8	9.0	11.7	4.7	74.2	4.4	3.123	0.184
(24, 25)	12.1	7.9	10.3	3.1	89.3	5.1	2.204	0.125
(22, 26)	19.8	9.6	14.3	4.5	65.3	4.0	2.858	0.174
(29, 26)	26.2	9.9	13.9	17.3	64.4	3.9	11.052	0.673
(25, 26)	5.4	5.0	6.4	9.8	166.9	8.5	8.125	0.416
SUBNETWORK =	12.1	7.9	10.3	199.7	89.3	5.1	140.856	7.968

SUBNETWORK RESULTS ASSUME 100 PERCENT AUTO TRAFFIC

DATA FOR LINKS WITH SPEED EXCEEDING 20 MPH ARE APPROXIMATIONS
BUSES ARE ASSUMED EQUIVALENT TO 2.5 AUTOS FOR THESE ESTIMATES.

MOVEMENT SPECIFIC LEVEL II STATISTICS

LINK	VEHICLE-MILE LEFT	VEHICLE-MILE THRU	VEHICLE-MILE RIGHT	VEHICLE-TRIPS LEFT	VEHICLE-TRIPS THRU	VEHICLE-TRIPS RIGHT	SPEED (MPH) LEFT	SPEED (MPH) THRU	SPEED (MPH) RIGHT	STOPS (PCT) LEFT	STOPS (PCT) THRU	STOPS (PCT) RIGHT
(21, 25)	26.14	38.63	4.06	154	229	24	1.3	11.6	9.9	77.6	87.2	87.9
(27, 25)	3.40	33.10	12.80	30	293	112	16.8	11.7	11.9	18.7	86.0	83.2
(26, 25)	2.82	19.21	19.64	12	86	87	14.9	15.1	16.7	68.0	71.8	49.5
(24, 25)	0.00	19.36	5.18	0	171	45	0.0	11.4	15.1	0.0	71.1	31.6
(22, 26)	12.47	30.72	0.00	73	182	0	15.3	22.9	0.0	93.6	71.2	0.0
(29, 26)	0.00	145.70	38.58	0	429	113	0.0	27.2	26.2	0.0	30.9	0.0
(25, 26)	34.43	0.00	13.98	152	0	62	4.3	0.0	15.4	97.3	0.0	89.3

LEVEL II SECONDS PER VEHICLE STATISTICS BY TURN MOVEMENT

S E C O N D S P E R V E H I C L E

LINK	MOVE TIME LEFT	MOVE TIME THRU	MOVE TIME RIGHT	DELAY TIME LEFT	DELAY TIME THRU	DELAY TIME RIGHT	TOTAL TIME LEFT	TOTAL TIME THRU	TOTAL TIME RIGHT
(21, 25)	17.5	17.5	17.5	452.9	35.0	44.0	470.4	52.5	61.5
(27, 25)	11.7	11.7	11.7	12.6	23.2	22.7	24.3	35.0	34.4
(26, 25)	27.1	27.1	27.1	27.6	26.5	21.4	54.6	53.6	48.5
(24, 25)	0.0	13.6	13.6	0.0	22.2	13.5	0.0	35.8	27.2
(22, 26)	17.5	17.5	0.0	22.3	9.1	0.0	39.8	26.6	0.0
(29, 26)	0.0	35.2	35.2	0.0	9.7	11.6	0.0	44.9	46.8
(25, 26)	27.2	0.0	27.2	163.6	0.0	25.9	190.9	0.0	53.2

LEVEL II VEHICLE-MINUTES STATISTICS BY TURN MOVEMENT

V E H I C L E - M I N U T E S

LINK	MOVE TIME LEFT	MOVE TIME THRU	MOVE TIME RIGHT	DELAY TIME LEFT	DELAY TIME THRU	DELAY TIME RIGHT	TOTAL TIME LEFT	TOTAL TIME THRU	TOTAL TIME RIGHT	RATIO MOVE/TOTAL LEFT	RATIO MOVE/TOTAL THRU	RATIO MOVE/TOTAL RIGHT
(21, 25)	45.10	66.65	7.00	1167.68	133.27	17.59	1212.78	199.92	24.59	0.04	0.33	0.28
(27, 25)	5.87	57.11	22.08	6.29	112.99	42.67	12.17	170.10	64.75	0.48	0.34	0.34
(26, 25)	5.64	38.43	39.29	5.75	37.69	31.10	11.38	76.12	70.38	0.50	0.50	0.56
(24, 25)	0.00	38.73	10.36	0.00	63.04	10.28	0.00	101.77	20.64	0.00	0.38	0.50
(22, 26)	21.52	53.02	0.00	27.36	27.36	0.00	48.88	80.37	0.00	0.44	0.66	0.00
(29, 26)	0.00	251.41	66.58	0.00	69.63	21.87	0.00	321.04	88.44	0.00	0.78	0.75
(25, 26)	68.86	0.00	27.96	413.76	0.00	26.61	482.62	0.00	54.57	0.14	0.00	0.51

CUMULATIVE NETWORK-WIDE BUS STATISTICS AT TIME 8:50: 0

ELAPSED TIME IS 0:20: 0 (1200 SECONDS), TIME PERIOD 1 ELAPSED TIME IS 1200 SECONDS

ROUTE STATISTICS

ROUTE	BUS TRIPS	TOTAL TRAVEL TIME (BUS-MIN.)	MEAN TRAVEL TIME (SEC/BUS)	PERSON TRIPS	PERSON TRAVEL TIME (MINUTES)
1	4	19.9	298.5	100	497.5
2	4	21.9	328.5	100	547.5

THESE ESTIMATES ASSUME AN AVERAGE BUS OCCUPANCY OF 25.0 PASSENGERS PER BUS THROUGHOUT THE NETWORK

NETWORK-WIDE AVERAGE STATISTICS

TOTAL VEHICLE- MILE = 9350.04 VEHICLE-HOURS OF: MOVE TIME = 202.36 , DELAY TIME = 100.94 , TOTAL TIME = 303.30

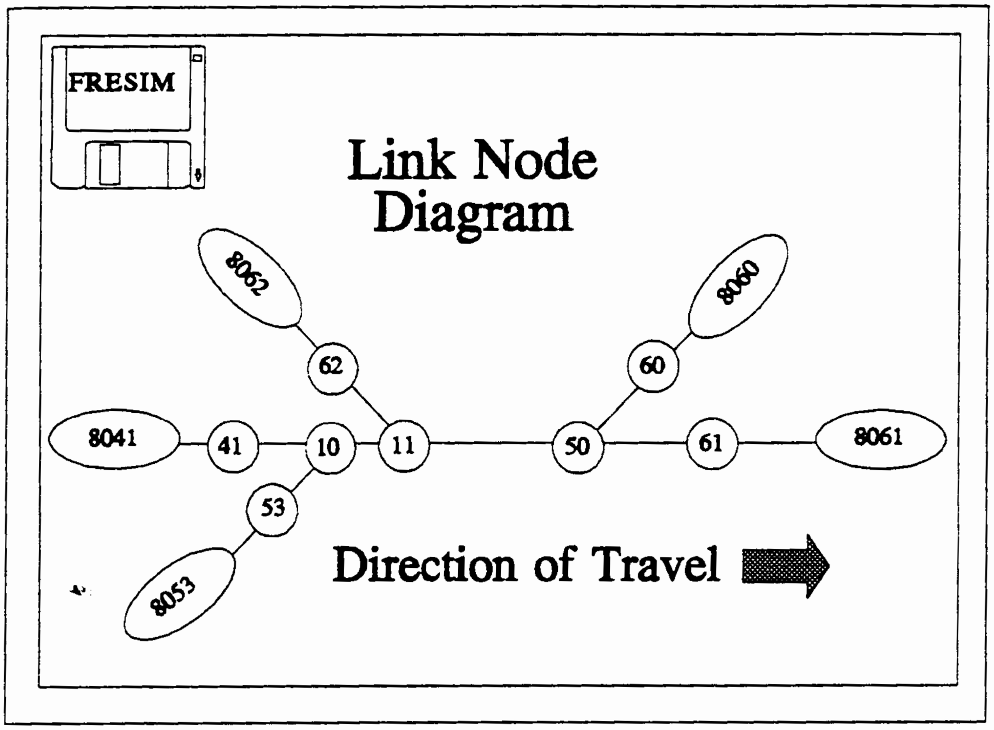
AVERAGE SPEED (MPH)= 30.83 MOVE/TOTAL = 0.67 MINUTES/MILE OF: DELAY TIME = 0.65 , TOTAL TIME = 1.95

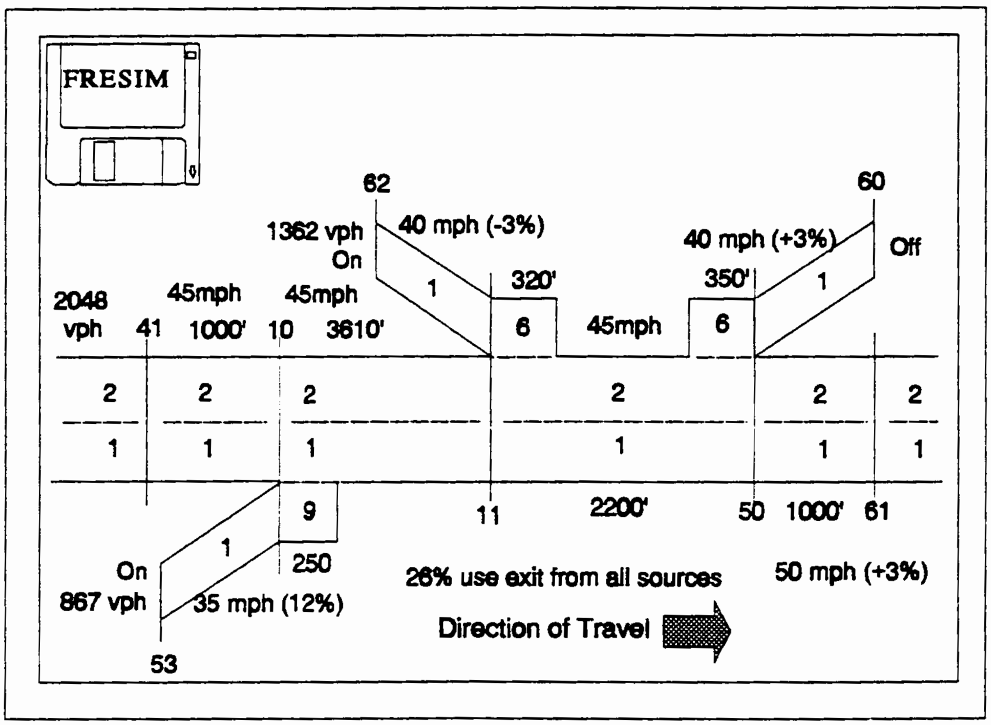
TOTAL CPU TIME FOR THIS RUN = 146.43 SECONDS

LAST CASE PROCESSED


FRESIM

FRESIM Ouput for Existing Conditions Sample Problem





Editor's Note: The FRESIM output was produced by a pre-release version of FRESIM and therefore results may not be reproducible using a later pre-release or release version. Portions of the output were deleted for the sake of brevity.

```
TTTTTTTTTTT  RRRRRRRRR      AAAAAAA     FFFFFFFFFFF
TTTTTTTTTTT  RRRRRRRRRR    AAAAAAAAA    FFFFFFFFFFF
TTTTTTTTTTT  RRRRRRRRRRR  AAAAAAAAAAA   FFFFFFFFFFF
    TTT      RRR     RRR  AAA     AAA   FFF
    TTT      RRR     RRR  AAA     AAA   FFF
    TTT      RRRRRRRRRRR  AAAAAAAAAAA   FFFFFFF
    TTT      RRRRRRRRRR   AAAAAAAAAAA   FFFFFFF
    TTT      RRR RRR      AAA     AAA   FFF
    TTT      RRR  RRR     AAA     AAA   FFF
    TTT      RRR   RRR    AAA     AAA   FFF
    TTT      RRR    RRR   AAA     AAA   FFF
    TTT      RRR     RRR  AAA     AAA   FFF

   MICRO-COMPUTER PROTECTED-MODE VERSION
    (REQUIRES 80386 AND 80387 OR ABOVE)


              VERSION 3.10
          RELEASE DATE  6/01/91


        TRAF-FRESIM SIMULATION MODEL

              DEVELOPED FOR

      U. S. DEPARTMENT OF TRANSPORTATION
        FEDERAL HIGHWAY ADMINISTRATION
          IVHS RESEARCH DIVISION
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**************************************************************************************************************************************

                                             START OF CASE  1

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         1    1    2    2    3    3    4    4    5    5    6    6    7    7    8
1---5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
FRESIM DATA FILE NAME: GW_X_CV.DAT                                             0
FRESIM SAMPLE PROBLEM, GW_PARKWAY, EXISTING GEOMETRICS AND VOLUMES             0
>: Last revised on 12-21-1991 at 21:24:48                                      0
SMART TRANSPORTATION ENGINEER         11   27 91SMART STATE DOT            1   1
   0   1   0       6             0           0     81600                7581   2
1800                                                                           3
              60  10                                                           4
   5     3001500 300   0   0   0   0   0   0                                   5
8041  41  10    00 2 00    0 00    0 00    0 1 0 0 0                          19
  41  10  11 10000 2 00    0 00    0 00    0 1 0 0 0                          19
  10  11  50 36100 2 91  250 00    0 00    0 1 0 0 0                          19
  11  50  61 22000 2 61  320 62  350 00    0 1 6 0 0                          19
  50  618061 10000 2 00    0 00    0 00    0 1 0 0 0                          19
8053  53  10    01 1 00    0 00    0 00    0 1 0 0 0                          19
  53  10  11 13001 1 00    0 00    0 00    0 9 0 0 0                          19
8062  62  11    01 1 00    0 00    0 00    0 1 0 0 0                          19
  62  11  50 10001 1 00    0 00    0 00    0 6 0 0 0                          19
  50  608060  5001 1 00    0 00    0 00    0 1 0 0 0                          19
8041  41 0 0   0 11840 0 0      0    0                                        20
  41  10 0 0   0 11845 0 0      0    0                                        20
  10  11 0 0   0 11845 0 0      0    0                                        20
  11  50 0 0   0 11845 0 0   6800    0                                        20
  50  61 3 0   0 11850 0 0      0    0                                        20
8053  53 0 0   0 11835 0 0      0    0                                        20
  53  10-2 0   0 11835 0 0      0    0                                        20
8062  62 0 0   0 11840 0 0      0    0                                        20
  62  11-3 0   0 11840 0 0      0    0                                        20
  50  60 3 0   0 11840 0 0      0    0                                        20
8041  41  10 100   0   0                                                      25
  41  10  11 100   0   0                                                      25
  10  11  50 100   0   0                                                      25
  11  50  61  74  60  26                                                      25
  50  618061 100   0   0                                                      25
8053  53  10 100   0   0                                                      25
  53  10  11 100   0   0                                                      25
8062  62  11 100   0   0                                                      25
  62  11  50 100   0   0                                                      25
  50  608060 100   0   0                                                      25
8041  412048   0                                                              50
8062  621362   0                                                              50
8053  53 867   0                                                              50
  62  61  74                                                                  74
  62  50  26                                                                  74
  41  61  74                                                                  74
  41  50  26                                                                  74
  53  61  74                                                                  74
  53  50  26                                                                  74
                                                                             170
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         1    1    2    2    3    3    4    4    5    5    6    6    7    7    8
1---5----0----5----0----5----0----5----0----5----0----5----0----5----0----5----0
```

TRAF SIMULATION MODEL

DEVELOPED FOR

U. S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
TRAFFIC SYSTEMS DIVISION

****

START OF CASE # 1

****

FRESIM DATA FILE NAME: GW_X_CV.DAT
FRESIM SAMPLE PROBLEM, GW PARKWAY, EXISTING GEOMETRICS AND VOLUMES
>: Last revised on 12-21-1991 at 21:24:48

DATE = 11/ 27/ 91
USER = SMART TRANSPORTATION ENGINEER
AGENCY = SMART STATE DOT
RUN CONTROL DATA

VALUE	RUN PARAMETERS AND OPTIONS
1	RUN IDENTIFICATION NUMBER
0	NEXT CASE CODE = (0,1) IF ANOTHER CASE (DOES NOT, DOES) FOLLOW
0	FRESIM OFFLINE INCIDENT DETECTION CODE = (0, 1) IF OFFLINE INCIDENT DETECTION (IS NOT, IS) BEING PERFORMED
1	RUN TYPE CODE = (1, 2, 3) IF (SIMULATION, TRAF. ASSIGNMT., BOTH) TO BE EXECUTED (-1, -2, -3) IF ONLY DIAGNOSTICS ARE BEING PERFORMED ON (SIMULATION, TRAF. ASSIGNMT., ALL) DATA
0	FRESIM ENVIRONMENTAL CODE OF FORM, XY X = (0,1) IF FUEL/EMISSION RATES (NOT,ARE) PRINTED Y = 0, 1, ..., 7, DENOTES CONDITIONS ON SIMULATION, OUTPUT, RATE TABLES, TRAJECTORY FILE
1600	CLOCK TIME AT START OF SIMULATION, HOURS AND MINUTES
7581	RANDOM NUMBER SEED
1800	DURATION (SEC) OF TIME PERIOD NO. 1
60	LENGTH OF A TIME INTERVAL, SECONDS
10	FRESIM TIME STEP DURATION IN TENTHS-OF-A-SECOND
6	MAXIMUM INITIALIZATION TIME, NUMBER OF TIME INTERVALS
5	NUMBER OF TIME INTERVALS BETWEEN SUCCESSIVE STANDARD OUTPUTS
300	TIME INTERMEDIATE OUTPUT WILL BEGIN AT INTERVALS OF, 300 SECS. FOR 1500 SECS. FOR MICROSCOPIC MODELS

TIME PERIOD 1 - FRESIM DATA

FRESIM LINK CHARACTERISTICS

LINK	TYPE	LNGTH (FT)	NO. THRU LANES	AUXILIARY LANE ONE TYPE	ONE ID	ONE LNGTH (FT)	TWO TYPE	TWO ID	TWO LNGTH (FT)	THREE TYPE	THREE ID	THREE LNGTH (FT)	THRU DEST NODE	CURV RADIUS (FT)	GRADE	SUPER ELEV	PAVE MENT CODE	TRUCK RESTRAINT CODE	TRUCK LANE	RIGHT LANE SEP 1	OF PAIR 2	FREE FLOW SPEED (MPH)	QUEUE HDWY (SEC)	LINK NAME
(8041, 41)	F	0	2										10	0	0	0	1*	0				40	1.8	
(41, 10)	F	1000	2										11	0	0	0	1*	0				45	1.8	
(10, 11)	F	3610	2	A	9	250							50	0	0	0	1*	0				45	1.8	
(11, 50)	F	2200	2	A	6	320	D	6	350				61	0	0	0	1*	0				45	1.8	
(50, 61)	F	1000	2										8061	0	3	0	1*	0				50	1.8	
(8053, 53)	R	0	1										10	0	0	0	1*	0				35	1.8	
(53, 10)	R	1300	1										11	0	-2	0	1*	0				35	1.8	
(8062, 62)	R	0	1										11	0	0	0	1*	0				40	1.8	
(62, 11)	R	1000	1										50	0	-3	0	1*	0				40	1.8	
(50, 60)	R	500	1										8060	0	3	0	1*	0				40	1.8	

* INDICATES THAT THE DEFAULT VALUE IS USED

LINK TYPE CODE

F FREEWAY LINK
R RAMP LINK

AUXILIARY LANE TYPE CODE

A ACCELERATION LANE
D DECELERATION LANE
F FULL AUXILIARY LANE

PAVEMENT CODE

1 DRY CONCRETE
2 WET CONCRETE
3 DRY ASPHALT
4 WET ASPHALT

TRUCK RESTRAINT CODE

0 TRUCKS ARE UNRESTRICTED
1 TRUCKS ARE BIASED TO CERTAIN LANE(S)
2 TRUCKS ARE RESTRICTED TO CERTAIN LANES(S)

FRESIM TURNING MOVEMENTS

LINK	MAIN-LINE TRAFFIC: DOWNSTREAM NODE NO. OF THE MAIN-LINE RECEIVING LINK	MAIN-LINE TRAFFIC: PERCENTAGE	EXITING TRAFFIC: DOWNSTREAM NODE NO. OF THE OFF-RAMP	EXITING TRAFFIC: PERCENTAGE
(8041, 41)	10	100		
(41, 10)	11	100		
(10, 11)	50	100		
(11, 50)	61	74	60	26
(50, 61)	8061	100		
(8053, 53)	10	100		
(53, 10)	11	100		
(8062, 62)	11	100		
(62, 11)	50	100		
(50, 60)	8060	100		

FRESIM LINK VOLUME

LINK	FLOW RATE (VEH/HOUR)	PERCENT TRUCKS
(8041, 41)	2048	
(8053, 53)	867	
(8062, 62)	1362	

***** WARNING - MESSAGE NUMBER 705, ROUTINE ANTWRN, PARAMETER(S) - P1 = 7809

FRESIM LANE ALIGNMENT TABLE

LINK	LINK TYPE	DISTANCE FROM UPST. NODE (FT)	UPSTREAM FEEDING LANE NUMBER 1	2	3	4	5	6	7	8	9	10	11	REASON CODE
(11, 50)	F	2200.0	1	2	-	-	-	-	-	-	-	-	-	4
(11, 50)	F	2200.0	-	-	-	-	-	1	-	-	-	-	-	2
(62, 11)	R	1000.0	6	-	-	-	-	-	-	-	-	-	-	1
(53, 10)	R	1300.0	9	-	-	-	-	-	-	-	-	-	-	1

LINK TYPE CODES
- R : RAMP
- F : FREEWAY

REASON CODES
1 : ALIGNMENT AT THE ON-RAMP GORE. ENTRIES IN THE TABLEAU INDICATE THE MAINLINE FREEWAY LANES WHICH RECEIVES THE TRAFFIC FROM THE UPSTREAM ON-RAMP LANES

2 : ALIGNMENT AT THE OFF-RAMP GORE. ENTRIES IN THE TABLEAU INDICATE THE OFF-RAMP LANES WHICH RECIEVE THE TRAFFIC FROM THE UPSTREAM MAINLINE FREEWAY LANES

3 : ALIGNMENT DUE TO A LANE ADD OR DROP. ENTRIES IN THE TABLEAU INDICATE THE LANES DOWNSTREAM OF THE LANE ADD OR DROP WHICH RECIEVE THE TRAFFIC FROM THE UPSTREAM LANE

4 : ALIGNMENT AT LINK BOUNDARY. ENTRIES IN THE TABLEAU INDICATE THE DOWNSTREAM LANES WHICH RECIEVE THE TRAFFIC FROM THE UPSTREAM LANES

TABLE OF FREEWAY WARNING SIGNS

TYPE OF WARNING SIGN	WARNING SIGN LINK	DISTANCE BETWEEN THE WARNING SIGN AND UPSTREAM NODE (FT)	WARNING SIGN OBJECTIVE: OFFRAMP NODE	WARNING SIGN OBJECTIVE: LINK CONTAINING INCIDENT	WARNING SIGN OBJECTIVE: LINK WITH LANE DROP	DISTANCE BETWEEN THE WARNING SIGN AND ITS OBJECTIVE (FT)	THRU TRAFFIC VACATES LANE(S)	EXITING TRAFFIC MOVES TO LANE(S)
OFFRAMP	(41, 10)	10.0	50			6800.0		2
OFFRAMP	(10, 11)	1.0	50			5809.0		2
OFFRAMP	(11, 50)	1.0	50			2199.0		2

FRESIM ORIGIN - DESTINATION TRIP TABLE

FOR EACH ORIGIN NODE, TABLE PROVIDES LISTING OF PAIRS OF DATA : DESTINATION/ FRACTION OF ENTRY VOLUME TRAVELING TO DESTINATION

ORIGIN NODE (8062)	50/ 0.260	61/ 0.740
ORIGIN NODE (8053)	50/ 0.260	61/ 0.740
ORIGIN NODE (8041)	50/ 0.260	61/ 0.740

****

TIME PERIOD 1 - FRESIM DATA

****

***** WARNING - MESSAGE NUMBER 705, ROUTINE ANTWRN, PARAMETER(S) - P1 = 7809

INITIALIZATION STATISTICS

TIME INTERVAL NUMBER	SUBNETWORK TYPE	PRIOR CONTENT (VEHICLES)	CURRENT CONTENT (VEHICLES)	PERCENT DIFFERENCE	
1	FRESIM	0	69	10000	
2	FRESIM	69	121	75	
3	FRESIM	121	135	11	
4	FRESIM	135	144	6	EQUILIBRIUM ATTAINED

ALL EXISTING SUBNETWORKS REACHED EQUILIBRIUM

FRESIM INTERMEDIATE LINK STATISTICS AT TIME 16 15 0

LINK	CON.	VEH DIS	TURN MOVEMENT LEFT	THRU	RT.	DELAY/ VEH.	AVG SPEED	METER CODE	LANE CHNG
(8041, 41)	0	512	0	512	0	N/A	N/A	0	0
(41, 10)	8	512	0	512	0	0.5	43.4	0	179
(10, 11)	133	658	0	658	0	76.0	19.4	0	664
(11, 50)	51	994	217	777	0	10.0	33.8	0	949
(50, 61)	14	773	0	773	0	1.1	46.7	0	147
(61, 8061)	N/A	N/A	0	0	0	N/A	N/A	0	0
(8053, 53)	0	217	0	217	0	N/A	N/A	0	0
(53, 10)	6	218	0	218	0	0.7	34.0	0	0
(8062, 62)	0	340	0	340	0	N/A	N/A	0	0
(62, 11)	8	339	0	339	0	4.8	31.3	0	0
(50, 60)	2	217	0	217	0	0.4	39.4	0	0
(60, 8060)	N/A	N/A	0	0	0	N/A	N/A	0	0

FRESIM INTERMEDIATE LINK STATISTICS AT TIME 16 15 0

TABLE OF VEHICLE CONTENT BY LANE

LINK	LINK LENGTH (FT)	DISTANCE TO UPSTR. NODE (FT)	LANE IDENTIFICATION NUMBER 1	2	3	4	5	6	7	8	9	10	11
(41, 10)	1000	1000	2	6	0	0	0	0	0	0	0	0	0
(10, 11)	3610	250	2	1	0	0	0	0	0	0	0	0	0
(10, 11)	3610	3610	41	89	0	0	0	0	0	0	0	0	0
(11, 50)	2200	320	3	7	0	0	0	0	0	0	0	0	0
(11, 50)	2200	1850	16	17	0	0	0	0	0	0	0	0	0
(11, 50)	2200	2200	4	3	0	0	0	0	0	0	0	0	0
(50, 61)	1000	1000	6	8	0	0	0	1	0	0	0	0	0
(53, 10)	1300	1300	6	0	0	0	0	0	0	0	0	0	0
(62, 11)	1000	1000	7	0	0	0	0	0	0	0	0	0	0
(50, 60)	500	500	2	0	0	0	0	0	0	0	0	0	0

FRESIM INTERMEDIATE LINK STATISTICS AT TIME 16 15 0

LINK	CON.	VEH DIS	TURN MOVEMENT LEFT	THRU	RT.	DELAY/ VEH.	AVG SPEED	METER CODE	LANE CHNG
(8041, 41)	0	512	0	512	0	N/A	N/A	0	0
(41, 10)	8	512	0	512	0	0.5	43.4	0	179
(10, 11)	133	658	0	658	0	76.0	19.4	0	664
(11, 50)	51	994	217	777	0	10.0	33.8	0	949
(50, 61)	14	773	0	773	0	1.1	46.7	0	147
(61, 8061)	N/A	N/A	0	0	0	N/A	N/A	0	0
(8053, 53)	0	217	0	217	0	N/A	N/A	0	0
(53, 10)	6	218	0	218	0	0.7	34.0	0	0
(8062, 62)	0	340	0	340	0	N/A	N/A	0	0
(62, 11)	8	339	0	339	0	4.8	31.3	0	0
(50, 60)	2	217	0	217	0	0.4	39.4	0	0
(60, 8060)	N/A	N/A	0	0	0	N/A	N/A	0	0

FRESIM INTERMEDIATE LINK STATISTICS AT TIME 16 15 0

TABLE OF VEHICLE CONTENT BY LANE

LINK	LINK LENGTH (FT)	DISTANCE TO UPSTR. NODE (FT)	LANE IDENTIFICATION NUMBER 1	2	3	4	5	6	7	8	9	10	11
(41, 10)	1000	1000	2	6	0	0	0	0	0	0	0	0	0
(10, 11)	3610	250	2	1	0	0	0	0	0	0	0	0	0
(10, 11)	3610	3610	41	89	0	0	0	0	0	0	0	0	0
(11, 50)	2200	320	3	7	0	0	0	0	0	0	0	0	0
(11, 50)	2200	1850	16	17	0	0	0	0	0	0	0	0	0
(11, 50)	2200	2200	4	3	0	0	0	1	0	0	0	0	0
(50, 61)	1000	1000	6	8	0	0	0	0	0	0	0	0	0
(53, 10)	1300	1300	6	0	0	0	0	0	0	0	0	0	0
(62, 11)	1000	1000	7	0	0	0	0	0	0	0	0	0	0
(50, 60)	500	500	2	0	0	0	0	0	0	0	0	0	0

CUMULATIVE FRESIM STATISTICS AT TIME 16 15 0

LINK STATISTICS

LINK	VEHICLES IN	VEHICLES OUT	LANE CHNG	CURR CONT	AVG CONT	VEH-MILES	VEH-MIN	SECONDS/VEHICLE TOTAL TIME	SECONDS/VEHICLE MOVE TIME	SECONDS/VEHICLE DELAY TIME	M/T	VEH-MIN/VEH-MILE TOTAL	VEH-MIN/VEH-MILE DELAY	VOLUME VEH/LN/HR	DENSITY VEH/LN-MILE	SPEED MILE/HR	LINK TYPE
(41, 10)	512	512	179	8	9.0	97.6	134.8	15.7	15.2	0.5	0.97	1.38	0.04	1032.	23.8	43.44	FRWY
(10, 11)	730	658	664	133	98.0	474.8	1515.4	130.9	58.9	72.0	0.45	3.19	1.76	1347.	71.7	18.80	FRWY
(11, 50)	997	994	949	51	49.1	414.6	738.0	44.5	34.5	10.0	0.78	1.78	0.40	1988.	59.0	33.71	FRWY
(50, 61)	777	773	147	14	12.6	146.8	188.7	14.6	13.5	1.1	0.93	1.29	0.09	1552.	33.3	46.67	FRWY
(53, 10)	217	218	0	6	6.3	53.9	95.1	26.1	25.4	0.7	0.97	1.77	0.05	876.	25.8	33.98	RAMP
(62, 11)	340	339	0	8	8.4	65.4	125.6	21.8	17.1	4.7	0.79	1.92	0.41	1382.	44.2	31.24	RAMP
(50, 60)	217	217	0	2	2.1	20.6	31.4	8.7	8.3	0.4	0.95	1.52	0.07	870.	22.1	39.37	RAMP

NETWORK STATISTICS

VEHICLE-MILES = 1273.7, VEHICLE-MINUTES = 2829.0, MOVING/TOTAL TRIP TIME = 0.630,

AVERAGE CONTENT = 185.6, CURRENT CONTENT = 222.0, SPEED(MPH) = 27.01,

TOTAL DELAY (VEH-MIN) = 1048.12, TRAVEL TIME (MIN)/VEH-MILE = 2.22, DELAY TIME (MIN)/ VEH-MILE = 0.82

FRESIM CUMULATIVE VALUES OF FUEL CONSUMPTION

LINK	LINK TYPE	GALLONS 1	GALLONS 2	GALLONS 3	GALLONS 4	GALLONS 5	GALLONS 6	GALLONS 7	M.P.G. 1	M.P.G. 2	M.P.G. 3	M.P.G. 4	M.P.G. 5	M.P.G. 6	M.P.G. 7
(41, 10)	FRWY	1.62	3.41	0.00	0.00	0.00	0.00	0.00	19.08	27.06	0.00	0.00	0.00	0.00	0.00
(10, 11)	FRWY	16.73	32.13	0.00	0.00	0.00	0.00	0.00	8.81	13.43	0.00	0.00	0.00	0.00	0.00
(11, 50)	FRWY	14.11	24.25	0.00	0.00	0.00	0.00	0.00	8.96	14.90	0.00	0.00	0.00	0.00	0.00
(50, 61)	FRWY	0.03	0.05	0.00	0.00	0.00	0.00	0.00	1553.96	2482.13	0.00	0.00	0.00	0.00	0.00
(53, 10)	RAMP	0.77	1.47	0.00	0.00	0.00	0.00	0.00	22.67	34.02	0.00	0.00	0.00	0.00	0.00
(62, 11)	RAMP	1.25	2.56	0.00	0.00	0.00	0.00	0.00	17.10	23.60	0.00	0.00	0.00	0.00	0.00
(50, 60)	RAMP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2611.27	5140.29	0.00	0.00	0.00	0.00	0.00
SUBNETWORK-		34.51	63.88	0.00	0.00	0.00	0.00	0.00	11.38	17.82	0.00	0.00	0.00	0.00	0.00

FRESIM CUMULATIVE VALUES OF EMISSION

VEHICLE EMISSIONS (GRAMS/ MILE) HC

LINK	LINK TYPE	1	2	3	4	5	6	7
(41, 10)	FRWY	0.11	0.11	0.00	0.00	0.00	0.00	0.00
(10, 11)	FRWY	0.30	0.34	0.00	0.00	0.00	0.00	0.00
(11, 50)	FRWY	0.36	0.40	0.00	0.00	0.00	0.00	0.00
(50, 61)	FRWY	0.27	0.31	0.00	0.00	0.00	0.00	0.00
(53, 10)	RAMP	0.04	0.05	0.00	0.00	0.00	0.00	0.00
(62, 11)	RAMP	0.10	0.15	0.00	0.00	0.00	0.00	0.00
(50, 60)	RAMP	0.13	0.14	0.00	0.00	0.00	0.00	0.00
SUBNETWORK-		0.28	0.31	0.00	0.00	0.00	0.00	0.00

VEHICLE EMISSIONS (GRAMS/ MILE) CO

LINK	LINK TYPE	1	2	3	4	5	6	7
(41, 10)	FRWY	8.68	9.25	0.00	0.00	0.00	0.00	0.00
(10, 11)	FRWY	21.79	25.22	0.00	0.00	0.00	0.00	0.00
(11, 50)	FRWY	29.43	32.24	0.00	0.00	0.00	0.00	0.00
(50, 61)	FRWY	21.99	25.09	0.00	0.00	0.00	0.00	0.00
(53, 10)	RAMP	2.90	3.84	0.00	0.00	0.00	0.00	0.00
(62, 11)	RAMP	6.67	11.04	0.00	0.00	0.00	0.00	0.00
(50, 60)	RAMP	7.69	8.32	0.00	0.00	0.00	0.00	0.00
SUBNETWORK-		21.33	24.20	0.00	0.00	0.00	0.00	0.00

VEHICLE EMISSIONS (GRAMS/ MILE) NO

LINK	LINK TYPE	1	2	3	4	5	6	7
(41, 10)	FRWY	0.50	0.49	0.00	0.00	0.00	0.00	0.00
(10, 11)	FRWY	1.27	1.22	0.00	0.00	0.00	0.00	0.00
(11, 50)	FRWY	1.41	1.34	0.00	0.00	0.00	0.00	0.00
(50, 61)	FRWY	1.06	1.08	0.00	0.00	0.00	0.00	0.00
(53, 10)	RAMP	0.19	0.20	0.00	0.00	0.00	0.00	0.00
(62, 11)	RAMP	0.52	0.57	0.00	0.00	0.00	0.00	0.00
(50, 60)	RAMP	0.52	0.53	0.00	0.00	0.00	0.00	0.00
SUBNETWORK-		1.13	1.10	0.00	0.00	0.00	0.00	0.00

VEHICLE TYPES 1, 2 = AUTO, VEHICLE TYPES 3, 4, 5, 6 = TRUCK, VEHICLE TYPE 7 = TRANSIT BUS

VEHICLE MISSED DESTINATION - VEHICLE NUMBER = 159 ORIGIN NODE = 8053 DESTINATION NODE = 50 LANE = 2 TIME = 952.0

VEHICLE MISSED DESTINATION - VEHICLE NUMBER = 159 ORIGIN NODE = 8053 DESTINATION NODE = 50 LANE = 2 TIME = 952.0

FRESIM INTERMEDIATE LINK STATISTICS AT TIME 16 30 0

LINK	CON.	VEH DIS	TURN MOVEMENT LEFT	THRU	RT.	DELAY/ VEH.	AVG SPEED	METER CODE	LANE CHNG
(8041, 41)	7	1017	0	1017	0	N/A	N/A	0	2
(41, 10)	55	970	0	970	0	14.7	23.2	0	390
(10, 11)	145	1320	0	1320	0	109.1	15.2	0	1138
(11, 50)	44	2003	454	1549	0	10.4	33.5	0	2045
(50, 61)	10	1549	0	1549	0	1.1	46.5	0	344
(61, 8061)	N/A	N/A	0	0	0	N/A	N/A	0	0
(8053, 53)	0	434	0	434	0	N/A	N/A	0	0
(53, 10)	7	434	0	434	0	0.8	33.7	0	0
(8062, 62)	0	681	0	681	0	N/A	N/A	0	0
(62, 11)	8	680	0	680	0	4.8	31.2	0	0
(50, 60)	3	453	0	453	0	0.4	39.3	0	0
(60, 8060)	N/A	N/A	0	0	0	N/A	N/A	0	0

FRESIM INTERMEDIATE LINK STATISTICS AT TIME 16 30 0

TABLE OF VEHICLE CONTENT BY LANE

LINK	LINK LENGTH (FT)	DISTANCE TO UPSTR. NODE (FT)	LANE IDENTIFICATION NUMBER 1	2	3	4	5	6	7	8	9	10	11
(41, 10)	1000	1000	25	29	0	0	0	0	0	0	0	0	0
(10, 11)	3610	250	7	5	0	0	0	0	0	0	1	0	0
(10, 11)	3610	3610	37	94	0	0	0	0	0	0	0	0	0
(11, 50)	2200	320	3	6	0	0	0	2	0	0	0	0	0
(11, 50)	2200	1850	9	15	0	0	0	0	0	0	0	0	0
(11, 50)	2200	2200	3	5	0	0	0	1	0	0	0	0	0
(50, 61)	1000	1000	6	4	0	0	0	0	0	0	0	0	0
(53, 10)	1300	1300	6	0	0	0	0	0	0	0	0	0	0
(62, 11)	1000	1000	8	0	0	0	0	0	0	0	0	0	0
(50, 60)	500	500	3	0	0	0	0	0	0	0	0	0	0

FRESIM CUMULATIVE VALUES OF FUEL CON[illegible]

LINK	LINK TYPE	GALLONS 1	2	3	4	5	6	7	M.P.G. 1	2	3	4	5	6	7
VEHICLE TYPE-															
(41, 10)	FRWY	3.99	9.57	0.00	0.00	0.00	0.00	0.00	12.94	17.13	0.00	0.00	0.00	0.00	0.00
(10, 11)	FRWY	34.10	69.81	0.00	0.00	0.00	0.00	0.00	7.45	11.13	0.00	0.00	0.00	0.00	0.00
(11, 50)	FRWY	26.27	47.78	0.00	0.00	0.00	0.00	0.00	8.53	14.29	0.00	0.00	0.00	0.00	0.00
(50, 61)	FRWY	0.05	0.10	0.00	0.00	0.00	0.00	0.00	1467.50	2428.87	0.00	0.00	0.00	0.00	0.00
(53, 10)	RAMP	1.44	2.64	0.00	0.00	0.00	0.00	0.00	22.40	33.67	0.00	0.00	0.00	0.00	0.00
(62, 11)	RAMP	2.22	4.79	0.00	0.00	0.00	0.00	0.00	16.28	23.19	0.00	0.00	0.00	0.00	0.00
(50, 60)	RAMP	0.00	0.01	0.00	0.00	0.00	0.00	0.00	2517.45	4712.63	0.00	0.00	0.00	0.00	0.00
SUBNETWORK-		68.07	134.71	0.00	0.00	0.00	0.00	0.00	10.09	15.56	0.00	0.00	0.00	0.00	0.00

FRESIM CUMULATIVE VALUES OF EMISSION

VEHICLE EMISSIONS (GRAMS/ MILE) HC

LINK	LINK TYPE	1	2	3	4	5	6	7
VEHICLE TYPE-								
(41, 10)	FRWY	0.16	0.20	0.00	0.00	0.00	0.00	0.00
(10, 11)	FRWY	0.33	0.38	0.00	0.00	0.00	0.00	0.00
(11, 50)	FRWY	0.39	0.43	0.00	0.00	0.00	0.00	0.00
(50, 61)	FRWY	0.29	0.32	0.00	0.00	0.00	0.00	0.00
(53, 10)	RAMP	0.04	0.05	0.00	0.00	0.00	0.00	0.00
(62, 11)	RAMP	0.12	0.16	0.00	0.00	0.00	0.00	0.00
(50, 60)	RAMP	0.13	0.16	0.00	0.00	0.00	0.00	0.00
SUBNETWORK-		0.30	0.35	0.00	0.00			

VEHICLE EMISSIONS (GRAMS/ MILE) CO

LINK	LINK TYPE	1	2	3	4	5	6	7
VEHICLE TYPE-								
(41, 10)	FRWY	10.95	13.68	0.00	0.00	0.00	0.00	0.00
(10, 11)	FRWY	23.37	27.73	0.00	0.00	0.00	0.00	0.00
(11, 50)	FRWY	31.45	34.79	0.00	0.00	0.00	0.00	0.00
(50, 61)	FRWY	23.77	26.15	0.00	0.00	0.00	0.00	0.00
(53, 10)	RAMP	3.17	3.87	0.00	0.00	0.00	0.00	0.00
(62, 11)	RAMP	7.51	11.46	0.00	0.00	0.00	0.00	0.00
(50, 60)	RAMP	8.44	10.16	0.00	0.00	0.00	0.00	0.00
SUBNETWORK-		23.07	26.59	0.00	0.00			

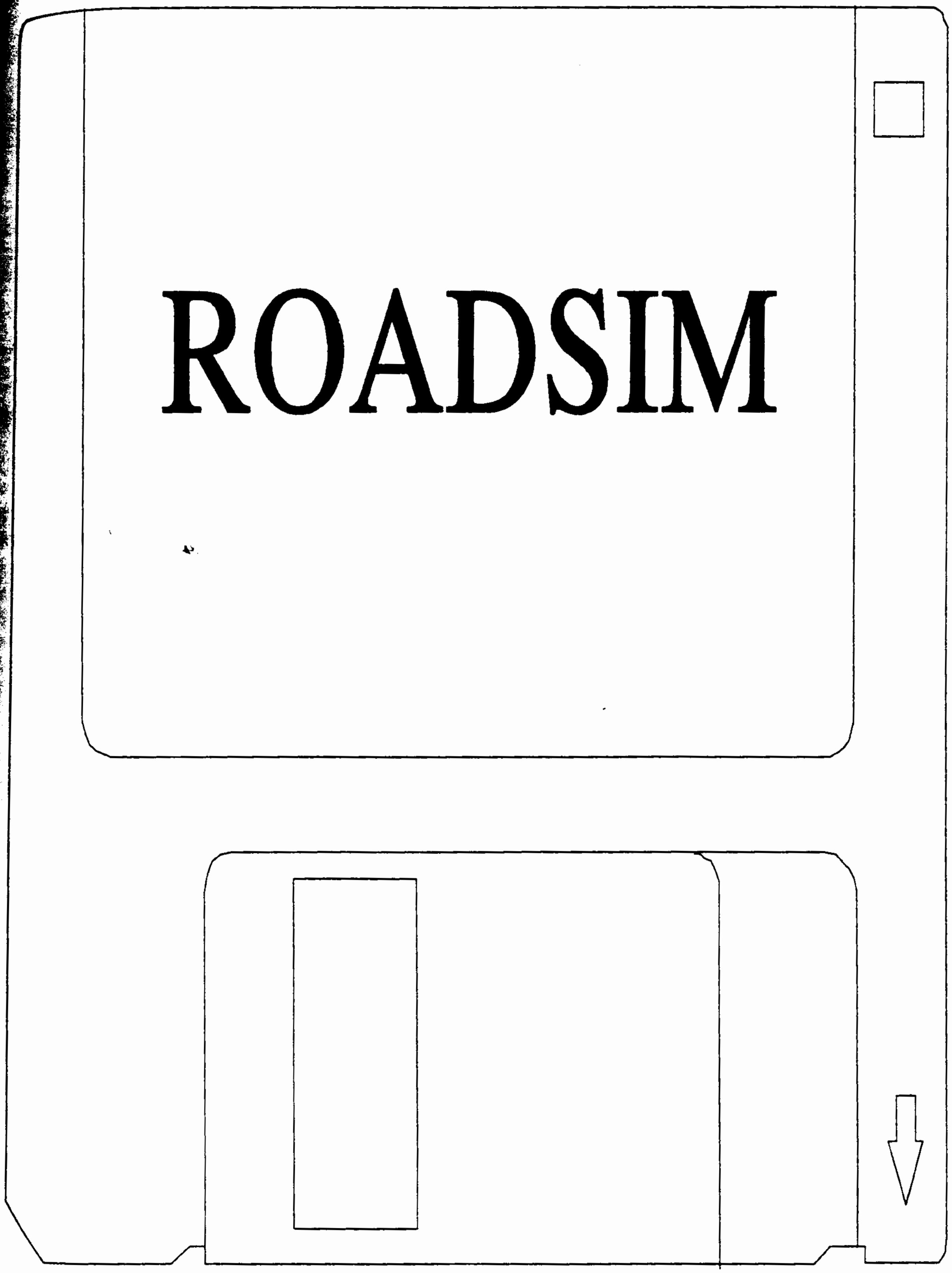
FRESIM CUMULATIVE VALUES OF EMISSION

VEHICLE EMISSIONS (GRAMS/ MILE) NO

LINK	LINK TYPE	1	2	3	4	5	6	7
VEHICLE TYPE-								
(41, 10)	FRWY	0.77	0.82	0.00	0.00	0.00	0.00	0.00
(10, 11)	FRWY	1.46	1.43	0.00	0.00	0.00	0.00	0.00
(11, 50)	FRWY	1.50	1.42	0.00	0.00	0.00	0.00	0.00
(50, 61)	FRWY	1.13	1.10	0.00	0.00	0.00	0.00	0.00
(53, 10)	RAMP	0.21	0.21	0.00	0.00	0.00	0.00	0.00
(62, 11)	RAMP	0.57	0.59	0.00	0.00	0.00	0.00	0.00
(50, 60)	RAMP	0.54	0.58	0.00	0.00	0.00	0.00	0.00
SUBNETWORK-		1.26	1.23	0.00	0.00	0.00	0.00	0.00

VEHICLE TYPES 1, 2 = AUTO, VEHICLE TYPES 3, 4, 5, 6 = TRUCK, VEHICLE TYPE 7 = TRANSIT BUS

LAST CASE PROCESSED.   COMPUTER TIME FOR THIS RUN IS   649.33 SECONDS (20 Mhz. 80386/80387)


ROADSIM

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**************************************************************************************************************************************

                     ROADSIM STAND-ALONE VERSION FOR MICRO-COMPUTERS

                                RELEASE DATE =  3/21/86

**************************************************************************************************************************************


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                TTTTTTTTTTT  RRRRRRRRRR    AAAAAAAAA   FFFFFFFFFFF
                TTTTTTTTTTT  RRRRRRRRRRR  AAAAAAAAAAA  FFFFFFFFFFF
                    TTT      RRR     RRR  AAA     AAA  FFF
                    TTT      RRR     RRR  AAA     AAA  FFF
                    TTT      RRRRRRRRRRR  AAAAAAAAAAA  FFFFFFF
                    TTT      RRRRRRRRRR   AAAAAAAAAAA  FFFFFFF
                    TTT      RRR RRR      AAA     AAA  FFF
                    TTT      RRR  RRR     AAA     AAA  FFF
                    TTT      RRR   RRR    AAA     AAA  FFF
                    TTT      RRR    RRR   AAA     AAA  FFF
                    TTT      RRR     RRR  AAA     AAA  FFF


                          TRAF SIMULATION MODEL

                              DEVELOPED FOR

                     U. S. DEPARTMENT OF TRANSPORTATION
                       FEDERAL HIGHWAY ADMINISTRATION
                          TRAFFIC SYSTEMS DIVISION
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*******************************************************************************************************************************

                                                                  START OF CASE    1

*******************************************************************************************************************************

                                               CARD FILE LIST

SEQ.#  :----+----1----+----2----+----3----+----4----+----5----+----6----+----7----+----8

     1 :ROADSIM SAMPLE FILE                                                              0
     2 :SMART ENGINEER                        02  21  92SMART DOT                        1
     3 :   0   1          10                                21200           75192871     2
     4 :1800                                                                             3
     5 :                 120                                                             4
     6 :                                                                                 5
     7 :       15                  1800                                                 12
     8 :8000   1 100   1  65   0 100                  1                                 16
     9 :   1   22559   1  65                          1                                 16
    10 :   2   34636   1  65   0 66716373549          1                                 16
    11 :   3   42071   1  60   01255                  1                                 16
    12 :   4   51463   1  60   01255                  1                                 16
    13 :   5   63508   1  65 508128227333508          1                                 16
    14 :   6   72264   1  65     304                  1                                 16
    15 :   7   82300   1  60 4422030                  1                                 16
    16 :   8   92300   1  60 5442300                  1                                 16
    17 :   9  102558   1  65    2558                  1                                 16
    18 :  108011 100   1  65   0 100                  0                                 16
    19 :8011  10 100   2  65   0 100                  1                                 16
    20 :  10   92558   2  65   02558                  1                                 16
    21 :   9   82300   2  65     95217562300          1                                 16
    22 :   8   72300   2  65    1054                  1                                 16
    23 :   7   62264   2  6511562264                  1                                 16
    24 :   6   53508   2  651471222530003508          1                                 16
    25 :   5   41463   2  60     668                  1                                 16
    26 :   4   32071   2  60 7161284                  1                                 16
    27 :   3   24636   2  60 3413841                  1                                 16
    28 :   2   12559   2  65                          1                                 16
    29 :    18000 100   2  65   0 100                 0                                 16
    30 :8000   1                                                                        17
    31 :   1   2   0405925591500                                                        17
    32 :   2   3 6672470163715003549258746361500                                        17
    33 :   3     41255231620711500                                                      17
    34 :   4     51255221614632008                                                      17
    35 :   5   6   02008 508150012822951273315OO                                        17
    36 :   6   7 304390222641942                                                        17
    37 :   7   8   01942 442150020302314230020 44                                       17
    38 :   8   9   02044 5441500                                                        17
    39 :   9  10                                                                        17
    40 :  10   9                                                                        17
    41 :  108011                                                                         17
    42 :8011  10                                                                        17
    43 :   9   8 952230417561500                                                        17
SEQ.#  :----+----1----+----2----+----3----+----4----+----5----+----6----+----7----+----8
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CARD FILE LIST (CONT.)

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SEQ.# :----+----1----+----2----+----3----+----4----+----5----+----6----+----7----+----8

   44 :   8   71054390223002656                                                      17
   45 :   7   6   0265611561500                                                      17
   46 :   6   5   02971147115002225227530081500                                      17
   47 :   5   4 668301114632216                                                      17
   48 :   4   3   02216 71615001284262820711841                                      17
   49 :   3   2   01841 34115003841485446364059                                      17
   50 :   2   1   0405925591500                                                      17
   51 :   18000                                                                      18
   52 :8000   1                                                                      18
   53 :   1   2                                                                      18
   54 :   2   3                   0   41541   12691  -63641  -63468 200   54235      18
   55 :   3   4                   5   51355   41356  -22071  -4 259 256   6 853      18
   56 :   4   5                   0  -11335   4                   254-131   71463      18
   57 :   5   6                1222  -62872  -32873   33508   2 722-200   31571      18
   58 :   6   7                   0  -5 364  -5                   14 247   6 512      18
   59 :   7   8                   0   51600   71601   52300   51143 103   81959      18
   60 :   8   9                 600   61100   31650  -12300  -4                      18
   61 :   9  10                 700   12558  -6                  269 246   6 817      18
   62 :  108011                                                                      18
   63 :   1                               0   0 450 550                              59
   64 :   2                               0   1  30  40                              59
   65 :   3  30          72 158 100  96   0   2 110  90  65  65                      59
   66 :   4  65         266 620 100  96   0   2  85 100  65  65                      59
   67 :   0                                                                         170
   68 :   1                                                                         210

SEQ.# :----+----1----+----2----+----3----+----4----+----5----+----6----+----7----+----8
```

... OF 24 SECONDS ASSUMED.

****

TIME PERIOD 1 - **RURAL ROAD DATA**

****

RURAL ROAD PARAMETERS

MEAN FREE FLOW SPEED = 55 MPH*

STD DEVIATION OF MEAN SPEED = 15 PCT OF MEAN SPEED

MAXIMUM ACCELERATION FACTOR TO ACCOUNT FOR HORSEPOWER RESTRAINT = 81 PCT*

MAXIMUM SPEED FACTOR TO ACCOUNT FOR HORSEPOWER RESTRAINT = 90 PCT*

MEASURE OF PASS SUPPRESSING INFLUENCE UPSTREAM OF A CURVE TO THE RIGHT = 10 SEC*

SPEED BIAS-
    FOR RECREATIONAL VEHICLES = -2.2 FT/SEC*
    FOR TRUCKS AND BUSES = -1.5 FT/SEC*

NOMINAL FORWARD SIGHT DISTANCE = 1800 FT

RANDOM NUMBER SEEDS TO SELECT INTERARRIVAL HEADWAYS AND VEHICLE TYPES FOR ENTERING VEHICLES-
    IN DIRECTION ONE = 7581*
    IN DIRECTION TWO = 7591*

RANDOM NUMBER SEEDS TO SELECT DESIRED SPEEDS FOR ENTERING VEHICLES-
    IN DIRECTION ONE = 7601*
    IN DIRECTION TWO = 7611*

RANDOM NUMBER SEED FOR PASSING MANEUVER DECISIONS = 7621*

*INDICATES A DEFAULT VALUE ASSIGNED INTERNALLY BY THE MODEL

RURAL ROAD LINK CHARACTERISTICS

LINK	LINK SPAN (FT)	MEAN SPEED (MPH)	DI-REC-TION	- - - NO PASSING REGIONS - - - -REG. 1- BEGIN (FT)	END (FT)	-REG. 2- BEGIN (FT)	END (FT)	-REG. 3- BEGIN (FT)	END (FT)	- - - - - - - - - SIGHT DISTANCE REGIONS*** - - - REG. 1 - - - BEG LOC (FT)	SGHT DIST (FT)	END LOC (FT)	SGHT DIST (FT)	- - - REG. 2 - - - BEG LOC (FT)	SGHT DIST (FT)	END LOC (FT)	SGHT DIST (FT)	- - REG. 3 - - - BEG LOC (FT)	SGHT DIST (FT)	END LOC (FT)	SGHT DIST (FT)
(8000, 1)*	100	65	1	0	100																
(1, 2)*	2559	65	1							0	4059	2559	1500								
(2, 3)*	4636	65	1	0	667	1637	3549			667	2470	1637	1500	3549	2587	4636	1500				
(3, 4)*	2071	60	1	0	1255					1255	2316	2071	1500								
(4, 5)*	1463	60	1	0	1255					1255	2216	1463	2008								
(5, 6)*	3508	65	1	508	1282	2733	3508			0	2008	508	1500	1282	2951	2733	1500				
(6, 7)*	2264	65	1	0	304					304	3902	2264	1942								
(7, 8)*	2300	60	1	442	2030					0	1942	442	1500	2030	2314	2300	2044				
(8, 9)*	2300	60	1	544	2300					0	2044	544	1500								
(9, 10)*	2558	65	1	0	2558																
(10,8011)	100	65	1	0	100																
(8011, 10)*	100	65	2	0	100																
(10, 9)*	2558	65	2	0	2558																
(9, 8)*	2300	65	2	0	952	1756	2300			952	2304	1756	1500								
(8, 7)*	2300	65	2	0	1054					1054	3902	2300	2656								
(7, 6)*	2264	65	2	1156	2264					0	2656	1156	1500								
(6, 5)*	3508	65	2	1471	2225	3000	3508			0	2971	1471	1500	2225	2275	3008	1500				
(5, 4)*	1463	60	2	0	668					668	3011	1463	2216								
(4, 3)*	2071	60	2	716	1284					0	2216	716	1500	1284	2628	2071	1841				
(3, 2)*	4636	60	2	341	3841					0	1841	341	1500	3841	4854	4636	4059				
(2, 1)*	2559	65	2							0	4059	2559	1500								
(1,8000)	100	65	2	0	100																

*DISTRIBUTIONS OF HEADWAYS, SPEEDS AND PLATOON SIZES WILL BE OUTPUT FOR THIS LINK.

***THESE REPRESENT SECTIONS OF THE ROADWAY WHERE THE PASSING SIGHT DISTANCE DIFFERS FROM THE DEFAULT NOMINAL VALUE OF 1800 FT.

RURAL ROAD LINK GEOMETRY

LINK	CRAWL REGION BEGIN (FT)	CRAWL REGION END (FT)	CRAWL REGION MEAN SPEED (MPH)	CRAWL REGION STD DEV (PCT)	GRADE REGIONS BEGIN/GRADE (FT) (PCT)	GRADE REGIONS END/GRADE (FT) (PCT)	GRADE REGIONS BEGIN/GRADE (FT) (PCT)	GRADE REGIONS END/GRADE (FT) (PCT)	CURVE REGION BEGIN (FT)	CURVE REGION END (FT)	RAD.OF CURVE (FT)	SUPER-ELEVATION (FT/FT)	CURVE DIR
(8000, 1)													
(1, 2)													
(2, 3)					0/ 4	1541/ 1	2691/ -6	3641/ -6	3468	4235	2000	.05	RT.
(3, 4)					5/ 5	1355/ 4	1356/ -2	2071/ -4	259	853	2560	.06	RT.
(4, 5)					0/ -1	1335/ 4			254	1463	1310	.07	LT.
(5, 6)					1222/ -6	2872/ -3	2873/ 3	3508/ 2	722	1571	2000	.03	LT.
(6, 7)					0/ -5	364/ -5			14	512	2470	.06	RT.
(7, 8)					0/ 5	1600/ 7	1601/ 5	2300/ 5	1143	1959	1030	.08	RT.
(8, 9)					600/ 6	1100/ 3	1650/ -1	2300/ -4					
(9, 10)					700/ 1	2558/ -6			269	817	2460	.06	RT.
(10,8011)													
(8011, 10)													
(10, 9)					0/ 6	1858/ -1			1741	2289	2460	.06	LT.
(9, 8)					0/ 4	650/ 1	1200/ -3	1700/ -6					
(8, 7)					0/ -5	699/ -5	700/ -7	2300/ -5	341	1157	1030	.08	LT.
(7, 6)					1900/ 5	2264/ 5			1752	2250	2470	.06	LT.
(6, 5)					0/ -2	635/ -3	636/ 3	2286/ 6	1937	2786	2000	.03	RT.
(5, 4)					128/ -4	1463/ 1			0	1209	1310	.07	RT.
(4, 3)					0/ 4	715/ 2	716/ -4	2066/ -5	1218	1812	2560	.06	LT.
(3, 2)					995/ 6	1945/ 6	3095/ -1	4636/ -4	401	1168	2000	.05	LT.
(2, 1)													
(1,8000)													

RURAL ROAD VEHICLE CHARACTERISTICS

VEH. TYPE	LENGTH (FT)	AFFECTED BY CRAWL ZONE	FLEET COMPO-NENT	MAXIMUM ENTRY SPD FOR DIR 1 (MPH)	MAXIMUM ENTRY SPD FOR DIR 2 (MPH)	LIGHT VEHICLE MAXIMUM ACCELERATION (MPH/SEC)	LIGHT VEHICLE MAXIMUM SPEED (MPH)	HEAVY VEHICLE WT PER HORSEPOWER (LBS/HP)	HEAVY VEHICLE WT PER FRONTAL AREA (LBS/SQ FT)	ELEVATION CORRECTIONS HORSEPOWER (PCT)	ELEVATION CORRECTIONS AERO. DRAG (PCT)
1*	17	NO	AUTO	75	75	5.5	75				
2*	25	NO	R.V.	65	65	5.9	65				
3	30	NO	TRK/BUS	65	65			72	158	100	96
4	65	NO	TRK/BUS	65	65			266	620	100	96

*INDICATES THAT ALL PARAMETERS FOR THIS VEHICLE TYPE AND FLEET COMPONENT ASSUME DEFAULT VALUES

ENTRY VOLUMES

DI- REC- TION	VEHICLE TYPE 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	TOTAL	
1	450	30	110	85	0	0	0	0	0	0	0	0	0	0	0	0	675	(VEH/HR)
2	550	40	90	100	0	0	0	0	0	0	0	0	0	0	0	0	780	(VEH/HR)

INITIALIZATION STATISTICS

TIME INTERVAL NUMBER	SUBNETWORK TYPE	PRIOR CONTENT (VEHICLES)	CURRENT CONTENT (VEHICLES)	PERCENT DIFFERENCE
1	ROADSIM	0	40	10000
2	ROADSIM	40	85	112
3	ROADSIM	85	123	44
4	ROADSIM	123	134	8
5	ROADSIM	134	151	12

INITIALIZATION TIME EXHAUSTED, SIMULATION WILL BE PERFORMED ANYWAY

SNAPSHOT OF ROADSIM

DIRECTION 1																			DIRECTION 2																		
VEH	TYPE	CAT	DRVR	LINK	LANE	DIST (FT)	LEADER	FOLLOW	LEAD TGT	FOL TGT	ONCOMER	SPD FPS	DES SPD FPS	ACC FPSS	STATE	STAGE	TIME MARG	ZONE	VEH	TYPE	CAT	DRVR	LINK	LANE	DIST (FT)	LEADER	FOLLOW	LEAD TGT	FOL TGT	ONCOMER	SPD FPS	DES SPD FPS	ACC FPSS	STATE	STAGE	TIME MARG	ZONE
38	3	2	1	10	1	23297	0	40	0	0	0	61	61	0	1	0	0	55	37	1	0	6	13	1	23104	34	0	124	0	45	85	110	0	3	0	0	58
40	1	0	3	10	1	23224	38	44	0	0	0	61	80	0	3	0	0	55	34	1	0	2	13	1	22818	130	37	124	0	60	80	80	0	1	0	0	58
44	1	0	5	10	1	23155	40	45	0	0	0	60	96	-1	3	0	0	55	130	1	0	4	13	1	21809	36	34	124	0	60	95	95	0	2	0	0	59
45	1	0	4	10	1	23091	44	50	0	0	37	61	88	0	3	0	0	55	36	1	0	3	13	1	21473	33	130	124	0	60	81	87	0	3	0	0	59
50	3	2	3	10	1	23031	45	52	0	0	37	61	79	2	3	0	0	55	33	1	0	2	13	1	21383	32	36	124	0	60	80	80	0	1	0	0	59
52	3	2	7	10	1	22941	50	56	0	0	37	60	112	-1	3	0	0	55	32	1	0	6	14	1	21035	28	33	124	0	60	81	110	0	3	0	0	60
56	1	0	3	10	1	22868	52	60	0	0	37	60	80	-2	3	0	0	55	28	1	0	2	14	1	20908	27	32	124	0	64	80	80	0	3	0	0	60
60	4	2	6	9	1	21020	56	47	0	0	32	62	101	1	1	0	0	52	27	1	0	2	14	1	20827	26	28	124	0	53	80	80	0	1	0	0	60
47	1	0	3	9	1	20912	60	64	0	0	32	62	80	2	3	0	0	52	26	1	0	4	14	1	20339	21	27	124	0	76	69	95	-3	3	0	0	61
64	3	2	2	9	1	20859	47	53	0	0	28	60	72	-1	3	0	0	52	21	1	0	7	14	1	20263	18	26	124	0	76	66	123	-2	3	0	0	61
53	1	0	2	9	1	20793	64	57	0	0	27	60	74	-1	3	0	0	52	18	1	0	3	14	1	20175	17	21	124	0	76	67	87	0	3	0	0	62
57	2	1	5	9	1	20725	53	65	0	0	27	60	94	1	3	0	0	52	17	1	0	3	14	1	20109	14	18	124	0	76	67	87	0	3	0	0	62
65	1	0	3	9	1	20659	57	70	0	0	27	60	80	2	3	0	0	52	14	1	0	4	14	1	20043	13	17	124	0	76	67	95	0	3	0	0	62
70	1	0	6	9	1	20584	65	72	0	0	27	59	102	2	3	0	0	52	13	1	0	1	14	1	19972	3	14	124	0	76	67	67	0	1	0	0	63
72	3	2	5	9	1	20519	70	71	0	0	27	57	94	2	3	0	0	50	3	2	1	6	15	1	18490	10	13	124	0	94	93	108	-1	2	0	0	68
71	1	0	4	9	1	20442	72	76	0	0	27	56	88	2	3	0	0	50	10	1	0	4	15	1	18263	12	3	124	0	97	80	95	1	3	0	0	68
76	4	2	7	9	1	19862	71	84	0	0	13	40	112	0	1	0	0	49	12	1	0	3	15	1	18170	127	10	124	0	97	77	87	0	1	0	0	70
84	1	0	4	9	1	19767	76	88	0	0	13	39	88	-1	3	0	0	49	127	2	1	6	15	1	17607	120	12	124	0	97	84	108	1	1	0	0	72
88	1	0	2	8	1	18777	84	92	0	0	13	75	80	1	1	0	0	46	124	1	0	4	15	P	17489	123	0	120	127	97	81	95	3	5	1	15	72
92	2	1	6	8	1	18516	88	94	0	0	13	71	108	1	1	0	0	44	123	1	0	4	15	P	17395	0	124	120	127	97	88	95	4	5	1	14	72
94	1	0	3	8	1	18428	92	97	0	0	3	68	87	0	3	0	0	44	120	1	0	2	15	1	17321	35	127	0	123	97	80	80	1	1	0	0	72
97	3	2	1	7	1	14966	94	77	0	0	119	66	66	0	1	0	0	38	35	3	2	7	16	1	16314	23	120	0	123	97	86	121	-1	3	0	0	73
77	1	0	1	7	1	14673	97	81	0	0	119	67	67	0	1	0	0	36	23	1	0	3	16	1	16167	115	35	0	123	97	87	87	0	3	0	0	73
81	3	2	5	7	1	14596	77	83	0	0	119	66	102	-1	3	0	0	35	115	1	0	4	16	1	15957	8	23	0	123	97	92	95	0	3	0	0	73
83	4	2	4	7	1	14509	81	100	0	0	119	66	94	2	3	0	0	35	8	1	0	5	16	1	15770	110	115	0	123	97	85	104	0	3	0	0	73
100	1	0	2	7	1	14403	83	104	0	0	119	63	80	2	3	0	0	35	110	1	0	7	16	1	15723	103	8	0	123	97	86	123	-12	3	0	0	73
104	3	2	3	7	1	14342	100	5	0	0	119	63	85	2	3	0	0	35	103	4	2	3	16	1	15600	151	110	0	123	97	85	85	0	2	0	0	73
5	3	2	2	6	1	14275	104	99	0	0	119	60	72	-3	3	0	0	34	151	3	2	5	16	1	15353	150	103	0	123	97	68	102	2	3	0	0	74
99	1	0	5	6	1	14191	5	140	0	0	119	61	96	-2	3	0	0	34	150	1	0	5	16	1	15275	149	151	0	123	97	68	104	2	3	0	0	74
140	1	0	5	6	1	14120	99	142	0	0	119	61	96	-3	3	0	0	34	149	1	0	5	16	1	15197	148	150	0	123	97	68	104	2	3	0	0	74
142	1	0	2	6	1	14065	140	144	0	0	119	63	74	0	3	0	0	34	148	1	0	3	16	1	15119	119	149	0	123	97	68	87	2	3	0	0	74
144	1	0	3	6	1	14004	142	9	0	0	119	64	80	1	3	0	0	34	119	1	0	1	16	1	15053	114	148	0	123	97	67	67	0	1	0	0	74
9	1	0	5	6	1	13929	144	96	0	0	119	66	96	1	3	0	0	34	114	1	0	2	17	1	13480	11	119	0	123	96	75	80	-2	3	0	0	78
96	3	2	3	6	1	13222	9	101	0	0	146	79	79	0	1	0	0	30	11	1	0	4	17	1	13409	146	114	0	123	96	76	95	0	3	0	0	78
101	1	0	4	6	1	13117	96	106	0	0	109	77	88	-3	3	0	0	30	146	1	0	6	17	1	13323	109	11	0	123	96	75	110	0	3	0	0	78
106	2	1	2	6	1	11342	101	111	0	0	109	72	72	0	1	0	0	26	109	4	2	2	17	1	13182	2	146	0	123	101	72	78	-1	1	0	0	78
111	1	0	5	6	1	11248	106	112	0	0	109	73	96	1	3	0	0	24	2	1	0	5	18	1	9753	102	109	0	123	4	74	104	2	3	0	0	89
112	3	2	3	6	1	11175	111	116	0	0	109	73	79	1	3	0	0	24	102	3	2	6	18	1	9652	6	2	0	123	4	74	109	1	3	0	0	89
116	1	0	6	6	1	11064	112	105	0	0	109	72	102	0	3	0	0	24	6	3	2	5	18	1	9539	145	102	0	123	4	74	102	1	3	0	0	90
105	1	0	5	6	1	10978	116	117	0	0	109	72	96	0	3	0	0	24	145	1	0	4	18	1	9450	143	6	0	123	4	73	95	-2	3	0	0	90
117	1	0	2	5	1	10554	105	147	0	0	109	74	74	0	1	0	0	21	143	1	0	4	18	1	9367	141	145	0	123	4	75	95	0	3	0	0	90
147	3	2	6	5	1	10452	117	4	0	0	109	74	101	0	3	0	0	21	141	1	0	7	19	1	9283	139	143	0	123	4	74	114	0	3	0	0	91
4	3	2	2	4	1	8269	147	107	0	0	87	78	78	0	1	0	0	15	139	1	0	3	19	1	9178	15	141	0	123	4	74	80	0	3	0	0	91

SNAPSHOT OF ROADSIM CONDITIONS AT TIME 600

DIRECTION 1																			DIRECTION 2																		
VEH	TYPE	CAR	DRVR	LINK	LANE	DIST (FT)	LEADER	FOLLOW	LEAD TGT	FOL TGT	ONCOMER	SPD FPS	DES SPD FPS	ACC FPSS	STATE	STAGE	TIME MARG	ZONE	VEH	TYPE	CAR	DRVR	LINK	LANE	DIST (FT)	LEADER	FOLLOW	LEAD TGT	FOL TGT	ONCOMER	SPD FPS	DES SPD FPS	ACC FPSS	STATE	STAGE	TIME MARG	ZONE
107	3	2	4	4	1	8144	4	108	0	0	137	76	94	0	3	0	0	14	15	3	2	3	19	1	9086	86	139	0	123	4	73	79	-2	3	0	0	91
108	1	0	4	4	1	8043	107	113	0	0	137	76	95	0	3	0	0	14	86	3	2	4	19	1	8997	138	15	0	123	4	71	87	-3	3	0	0	91
113	3	2	4	4	1	7955	108	25	0	0	137	76	94	0	3	0	0	14	138	4	2	5	19	1	8870	98	86	0	123	4	70	94	-1	3	0	0	91
25	1	0	2	3	1	7121	113	30	0	0	85	80	80	0	1	0	0	12	98	1	0	6	19	1	8717	95	138	0	123	4	69	102	0	3	0	0	91
30	1	0	5	3	1	7016	25	118	0	0	85	78	104	-3	3	0	0	12	95	1	0	4	19	1	8636	91	98	0	123	4	69	88	1	3	0	0	93
118	3	2	5	3	1	6910	30	121	0	0	85	81	102	1	3	0	0	12	91	1	0	6	19	1	8564	90	95	0	123	4	69	102	2	3	0	0	93
121	2	1	5	3	1	6790	118	122	0	0	85	80	101	0	3	0	0	11	90	2	1	3	19	1	8464	87	91	0	123	4	70	78	0	3	0	0	93
122	4	2	6	3	1	6304	121	125	0	0	85	97	109	2	2	0	0	11	87	3	2	4	19	1	8381	137	90	0	123	4	70	87	-2	3	0	0	93
125	1	0	4	3	1	6128	122	126	0	0	85	90	95	2	3	0	0	9	137	4	2	2	19	1	8255	75	87	0	123	107	72	72	0	1	0	0	93
126	3	2	5	3	1	6006	125	128	0	0	85	86	102	2	3	0	0	8	75	1	0	4	19	1	7883	136	137	0	123	25	62	88	0	3	0	0	94
128	3	2	2	3	1	5305	126	16	0	0	85	78	78	0	1	0	0	6	136	1	0	2	19	1	7818	85	75	0	123	25	62	74	0	3	0	0	94
16	1	0	2	3	1	4561	128	19	0	0	93	80	80	0	1	0	0	6	85	1	0	1	19	1	7764	89	136	0	123	25	62	62	0	1	0	0	94
19	1	0	6	3	1	4441	16	20	0	0	82	79	110	-2	3	0	0	6	89	1	0	4	20	1	4921	93	85	0	123	16	82	88	1	3	0	0	99
20	4	2	4	3	1	3854	19	22	0	0	7	74	94	0	1	0	0	4	93	2	1	4	20	1	4797	82	89	0	123	16	83	86	0	1	0	0	99
22	1	0	5	3	1	3716	20	24	0	0	7	75	104	1	3	0	0	4	82	1	0	3	20	1	4510	1	93	0	123	19	80	80	0	1	0	0	99
24	3	2	5	3	1	3618	22	129	0	0	78	78	102	1	3	0	0	4	1	1	0	6	20	1	4217	80	82	0	123	20	81	102	0	3	0	0	99
129	1	0	4	2	1	2376	24	131	0	0	73	95	95	0	1	0	0	2	80	1	0	4	20	1	4091	79	1	0	123	20	75	88	-1	3	0	0	100
131	1	0	6	2	1	2045	129	29	0	0	66	106	110	0	2	0	0	2	79	1	0	4	20	1	4007	7	80	0	123	20	74	88	1	3	0	0	100
29	1	0	3	2	1	1393	131	31	0	0	51	87	87	0	1	0	0	2	7	4	2	6	20	1	3878	78	79	0	123	20	75	101	1	1	0	0	100
31	1	0	1	2	1	939	29	39	0	0	43	67	67	0	1	0	0	2	78	1	0	5	20	1	3630	74	7	0	123	24	74	96	0	3	0	0	100
39	1	0	7	2	1	601	31	0	0	0	43	82	123	1	1	0	0	2	74	1	0	5	20	1	3540	73	78	0	123	129	74	96	0	3	0	0	100
																			73	1	0	2	20	1	3449	68	74	0	123	129	74	74	0	1	0	0	101
																			68	1	0	3	21	1	2376	69	73	0	123	131	74	80	2	3	0	0	102
																			69	3	2	5	21	1	2286	67	68	0	123	131	75	94	1	3	0	0	102
																			67	1	0	2	21	1	2196	66	69	0	123	131	74	74	0	3	0	0	102
																			66	1	0	2	21	1	2110	63	67	0	123	131	74	74	0	3	0	0	102
																			63	3	2	3	21	1	2019	61	66	0	123	29	69	79	-1	3	0	0	102
																			61	1	0	6	21	1	1950	54	63	0	123	29	66	102	-3	3	0	0	102
																			54	2	1	3	21	1	1854	59	61	0	123	29	63	78	-2	3	0	0	102
																			59	1	0	5	21	1	1791	62	54	0	123	29	62	96	-1	3	0	0	102
																			62	3	2	5	21	1	1707	58	59	0	123	29	62	94	0	3	0	0	102
																			58	1	0	4	21	1	1636	55	62	0	123	29	62	88	0	3	0	0	102
																			55	4	2	3	21	1	1523	51	58	0	123	29	62	79	0	3	0	0	102
																			51	3	2	6	21	1	1449	49	55	0	123	29	62	101	0	3	0	0	102
																			49	1	0	2	21	1	1370	43	51	0	123	31	62	74	0	3	0	0	102
																			43	1	0	1	21	1	1316	0	49	0	123	31	62	62	0	1	0	0	102

EXPLANA[illegible]N OF CODES

STATE CODES

EXPLANATION OF CODES

STAGE CODES

0. IN NORMAL LANE - NOT PASSING.
1. NOT COMMITTED TO COMPLETE.
2. COMMITTED TO COMPLETE PASS (I.E., WOULD PULL AHEAD OF OTHER VEHICLE EVEN IF LARGE DECELERATION WERE USED).
3. AHEAD OF IMPEDER (MEASURE NOSE TO NOSE).
4. CLEAR OF IMPEDER AND MAKING DECISION ABOUT PASSING ANOTHER VEHICLE, IF ANY.
5. ENDING PASS, AND HAS TWO REVIEW PERIODS BEFORE VACATING THE PASSING LANE.
6. ENDING PASS AND HAS ONE REVIEW BEFORE VACATING THE PASSING LANE.

STATE CODES

1. FREE, UNIMPEDED BY OTHER VEHICLES.
2. OVERTAKING LEADER BUT MORE THAN 8 FT/SEC FASTER.
3. FOLLOWING A LEADER.
5. PASSING ANOTHER (SAME DIRECTION) VEHICLE.
6. ENDING A PASS.

SNAPSHOT OF ROADSIM CONDITIONS AT TIME 1200

DIRECTION 1

VEH	TYPE	CAT	DRIVR	LINK	LANE	DIST (FT)	LEADER	FOLLOW	LEAD TGT	FOL TGT	ONCOMER	SPD FPS	DES SPD FPS	ACC FPSS	STATE	STAGE	TIME MARG	ZONE
139	4	2	6	10	1	22581	0	110	0	148	111	73	101	1	1	0	0	55
110	3	2	3	10	1	22461	139	23	0	148	111	71	79	-1	3	0	0	55
23	1	0	5	10	1	22363	110	35	0	148	106	72	96	2	3	0	0	55
35	2	1	3	10	1	22293	23	10	0	148	105	70	78	1	3	0	0	55
10	1	0	4	10	1	22211	35	12	0	148	105	67	88	-3	3	0	0	55
12	3	2	6	10	1	22120	10	16	0	148	105	68	101	-2	3	0	0	55
16	1	0	4	10	1	22034	12	115	0	148	102	69	88	1	3	0	0	55
115	1	0	3	10	1	21965	16	120	0	148	101	70	80	2	3	0	0	54
120	1	0	2	10	1	21897	115	122	0	148	101	70	74	1	3	0	0	53
122	1	0	3	10	1	21829	120	123	0	148	99	70	80	2	3	0	0	53
123	1	0	5	10	1	21748	122	125	0	148	97	68	96	2	3	0	0	53
125	1	0	4	10	1	21676	123	127	0	148	97	69	88	2	3	0	0	53
127	1	0	4	10	1	21603	125	22	0	148	97	69	88	2	3	0	0	53
22	1	0	6	10	1	21516	127	24	0	148	97	68	102	2	3	0	0	53
24	1	0	4	10	1	21446	22	128	0	148	97	67	88	1	3	0	0	53
128	1	0	1	9	1	20227	24	29	0	148	94	62	62	0	1	0	0	50
29	1	0	2	9	1	20173	128	129	0	148	77	62	74	0	3	0	0	50
129	3	2	2	9	1	20119	29	142	0	148	25	62	72	0	3	0	0	50
142	1	0	5	9	1	20035	129	144	0	148	11	62	96	0	3	0	0	50
144	4	2	3	9	1	18929	142	146	0	148	9	35	79	0	1	0	0	47
146	1	0	4	8	1	18837	144	13	0	148	9	35	95	1	3	0	0	46
148	1	0	5	8	P	18805	0	0	146	13	9	45	104	3	5	1	9	46
13	1	0	3	8	1	18754	146	14	148	0	9	38	87	1	3	0	0	46
14	1	0	6	8	1	18700	13	17	148	0	9	38	110	2	3	0	0	46
17	1	0	4	8	1	18654	14	21	148	0	9	36	95	0	3	0	0	46
21	1	0	4	8	1	18609	17	26	148	0	9	36	95	2	3	0	0	45
26	1	0	3	8	1	18567	21	27	148	0	9	35	87	0	3	0	0	45
27	1	0	6	8	1	18516	26	28	148	0	9	35	110	1	3	0	0	44
28	1	0	4	8	1	18472	27	34	148	0	9	35	95	1	3	0	0	44
34	1	0	5	8	1	18424	28	37	148	0	9	35	104	0	3	0	0	44
37	1	0	7	8	1	18373	34	41	148	0	9	35	123	1	3	0	0	44
41	2	1	5	8	1	18326	37	130	148	0	9	34	101	-1	3	0	0	44
130	3	2	7	8	1	18266	41	149	148	0	9	35	121	0	3	0	0	44
149	1	0	3	8	1	18211	130	31	148	0	9	35	87	0	3	0	0	44
31	1	0	3	8	1	18169	149	39	148	0	9	36	87	2	3	0	0	42
39	3	2	4	8	1	18124	31	151	148	0	9	35	94	0	3	0	0	42
151	2	1	7	8	1	18060	39	153	148	0	4	35	121	1	3	0	0	42
153	1	0	5	8	1	18005	151	156	148	0	4	34	104	-1	3	0	0	42
156	1	0	5	8	1	17958	153	158	148	0	4	35	104	1	3	0	0	42
158	1	0	1	6	1	14220	156	45	148	0	93	62	62	0	1	0	0	34
45	2	1	7	6	1	14141	158	7	148	0	93	62	112	0	3	0	0	34
7	1	0	3	6	1	14072	45	1	148	0	93	62	80	2	3	0	0	34
1	1	0	1	6	1	13166	7	53	148	0	69	62	62	0	1	0	0	30

DIRECTION 2

VEH	TYPE	CAT	DRIVR	LINK	LANE	DIST (FT)	LEADER	FOLLOW	LEAD TGT	FOL TGT	ONCOMER	SPD FPS	DES SPD FPS	ACC FPSS	STATE	STAGE	TIME MARG	ZONE
111	1	0	4	13	1	22735	106	0	5	0	139	88	95	0	3	0	0	58
106	3	2	4	13	1	22452	105	111	5	0	23	86	94	1	3	0	0	58
105	1	0	6	13	1	22318	102	106	5	0	35	86	110	1	2	0	0	58
102	1	0	4	13	1	22050	101	105	5	0	16	73	95	-3	3	0	0	58
101	1	0	6	13	1	21966	99	102	5	0	115	70	110	-1	3	0	0	58
99	1	0	7	13	1	21870	97	101	5	0	122	65	123	0	3	0	0	59
97	2	1	1	13	1	21778	94	99	5	0	123	65	65	0	1	0	0	59
94	4	2	7	14	1	20774	77	97	5	0	128	76	121	-1	1	0	0	60
77	1	0	2	14	1	20221	25	94	5	0	29	63	80	-1	3	0	0	62
25	1	0	6	14	1	20166	11	77	5	0	129	64	110	2	3	0	0	62
11	1	0	4	14	1	20083	9	25	5	0	142	64	95	0	3	0	0	62
9	4	2	2	14	1	19968	4	11	5	0	144	64	78	0	1	0	0	63
4	1	0	4	15	1	18066	2	9	5	0	151	83	95	0	1	0	0	70
5	1	0	5	15	P	17480	0	0	2	4	158	93	104	4	5	1	19	72
2	1	0	4	15	1	17362	15	4	0	5	158	89	95	1	3	0	0	72
15	4	2	4	15	1	17180	87	2	0	5	158	93	94	1	2	0	0	72
87	1	0	3	15	1	16840	85	15	0	5	158	72	87	-3	3	0	0	72
85	1	0	4	15	1	16763	74	87	0	5	158	77	95	2	3	0	0	72
74	1	0	1	15	1	16661	93	85	0	5	158	67	67	0	3	0	0	72
93	1	0	5	16	1	16527	72	74	0	5	158	104	104	0	1	0	0	73
72	2	1	6	17	1	13707	80	93	0	5	1	83	108	1	3	0	0	76
80	1	0	5	17	1	13577	75	72	0	5	1	80	104	0	3	0	0	78
75	2	1	4	17	1	13460	71	80	0	5	1	79	93	-1	3	0	0	78
71	3	2	4	17	1	13350	69	75	0	5	1	78	94	0	3	0	0	78
69	1	0	4	17	1	13259	68	71	0	5	1	78	95	0	3	0	0	78
68	1	0	2	17	1	13154	65	69	0	5	53	80	80	0	1	0	0	78
65	2	1	5	17	1	12698	66	68	0	5	165	73	101	0	3	0	0	79
66	1	0	6	17	1	12562	64	65	0	5	56	74	110	-3	3	0	0	80
64	1	0	3	17	1	12455	63	66	0	5	60	72	87	-2	3	0	0	80
63	1	0	5	17	1	12381	61	64	0	5	62	70	104	-2	3	0	0	81
61	1	0	6	17	1	12295	59	63	0	5	62	66	110	-4	3	0	0	81
59	1	0	6	17	1	12205	169	61	0	5	62	62	110	-4	2	0	0	81
169	2	1	4	17	1	12113	168	59	0	5	62	57	93	-4	3	0	0	81
168	1	0	2	17	1	12051	167	169	0	5	62	53	80	-1	3	0	0	82
167	4	2	6	17	1	11955	54	168	0	5	62	54	109	1	3	0	0	83
54	1	0	7	17	1	11876	166	167	0	5	62	59	123	2	3	0	0	83
166	4	2	2	17	1	11754	164	54	0	5	62	59	78	1	1	0	0	83
164	2	1	6	17	1	11116	163	166	0	5	79	77	108	0	2	0	0	85
163	1	0	4	17	1	10995	48	164	0	5	88	67	95	1	3	0	0	85
48	1	0	1	17	1	10925	162	163	0	5	88	67	67	0	1	0	0	85
162	3	2	4	18	1	10342	58	48	0	5	88	86	94	0	2	0	0	88
58	3	2	2	18	1	10034	50	162	0	5	88	76	78	0	1	0	0	89
50	1	0	5	19	1	8490	52	58	0	5	70	76	96	-1	3	0	0	93

DIRECTION 1

VEH	TYPE	CAT	DRIVR	LINK	LANE	DIST (FT)	LEADER	FOLLOW	LEAD TGT	FOL TGT	ONCOMER	SPD FPS	DES SPD FPS	ACC FPSS	STATE	STAGE	TIME MARG	ZONE
53	3	2	6	6	1	13087	1	46	148	0	68	62	101	0	3	0	0	30
46	3	2	4	6	1	13009	53	49	148	0	68	62	87	0	3	0	0	30
49	1	0	3	6	1	12935	46	55	148	0	68	62	80	2	3	0	0	30
55	1	0	4	6	1	12871	49	157	148	0	68	61	88	-1	3	0	0	30
157	1	0	5	6	1	12800	55	161	148	0	68	62	96	0	3	0	0	30
161	3	2	2	6	1	12746	157	165	148	0	68	63	72	1	3	0	0	30
165	1	0	6	6	1	12654	161	57	148	0	65	63	102	2	3	0	0	30
57	1	0	6	6	1	12575	165	56	148	0	65	62	102	0	3	0	0	30
56	1	0	6	6	1	12496	57	60	148	0	66	61	102	-2	3	0	0	30
60	1	0	4	6	1	12431	56	62	148	0	64	62	88	0	3	0	0	30
62	1	0	2	6	1	11738	60	73	148	0	166	74	74	0	1	0	0	27
73	1	0	4	6	1	11538	62	76	148	0	166	88	88	0	2	0	0	26
76	1	0	4	6	1	11186	73	79	148	0	166	88	88	0	1	0	0	24
79	1	0	5	6	1	11002	76	88	148	0	164	92	96	1	3	0	0	24
88	1	0	2	4	1	9121	79	67	148	0	58	80	80	0	1	0	0	18
67	4	2	5	4	1	8849	88	70	148	0	58	78	102	1	1	0	0	18
70	4	2	2	4	1	8131	67	78	148	0	51	67	78	-1	1	0	0	14
78	1	0	6	4	1	7989	70	89	148	0	51	70	110	0	3	0	0	14
89	1	0	6	4	1	7891	78	82	148	0	51	72	110	-1	3	0	0	14
82	1	0	3	4	1	7814	89	84	148	0	51	74	87	0	3	0	0	14
84	1	0	6	4	1	7716	82	86	148	0	51	75	110	0	3	0	0	14
86	4	2	5	4	1	7609	84	90	148	0	51	73	102	-1	3	0	0	14
90	1	0	2	3	1	7041	86	6	148	0	47	80	80	0	1	0	0	12
6	1	0	5	3	1	6773	90	81	148	0	47	96	104	0	2	0	0	11
81	4	2	4	3	1	4121	6	83	148	0	145	83	94	0	1	0	0	4
83	1	0	3	3	1	3655	81	91	148	0	145	87	87	0	1	0	0	4
91	1	0	5	3	1	3518	83	92	148	0	145	87	104	0	3	0	0	4
92	1	0	4	3	1	3384	91	95	148	0	145	89	95	0	3	0	0	4
95	1	0	3	3	1	3046	92	96	148	0	145	87	87	0	1	0	0	3
96	1	0	1	2	1	2145	95	98	148	0	19	67	67	0	1	0	0	2
98	1	0	4	2	1	2074	96	100	148	0	19	66	95	-2	3	0	0	2
100	1	0	5	2	1	1996	98	104	148	0	19	67	104	0	3	0	0	2
104	1	0	7	2	1	1890	100	109	148	0	19	73	123	-2	3	0	0	2
109	4	2	4	2	1	1223	104	112	148	0	19	94	94	0	1	0	0	2
112	1	0	1	2	1	604	109	113	148	0	108	67	67	0	1	0	0	2
113	1	0	5	2	1	511	112	30	148	0	133	74	104	0	3	0	0	2
30	1	0	4	1	1	76	113	0	148	0	117	76	95	2	1	0	0	1

VEH	TYPE	CAT	DRIVR	LINK	LANE	DIST (FT)	LEADER	FOLLOW	LEAD TGT	FOL TGT	ONCOMER	SPD FPS	DES SPD FPS	ACC FPSS	STATE	STAGE	TIME MARG	ZONE
52	1	0	5	19	1	8394	51	50	0	5	70	74	96	0	3	0	0	93
51	1	0	2	19	1	8303	47	52	0	5	70	74	74	0	1	0	0	93
47	4	2	4	19	1	7553	43	51	0	5	90	87	87	0	1	0	0	94
43	3	2	5	20	1	6394	160	47	0	5	81	80	94	1	3	0	0	97
160	3	2	3	20	1	6279	159	43	0	5	81	79	79	0	1	0	0	98
159	1	0	7	20	1	5830	155	160	0	5	81	51	114	0	3	0	0	98
155	1	0	6	20	1	5764	154	159	0	5	81	50	102	0	3	0	0	98
154	3	2	7	20	1	5686	152	155	0	5	81	49	112	0	3	0	0	98
152	1	0	6	20	1	5623	44	154	0	5	81	48	102	0	3	0	0	98
44	1	0	3	20	1	5560	150	152	0	5	81	46	80	-1	3	0	0	98
150	1	0	3	20	1	5512	42	44	0	5	81	47	80	1	3	0	0	98
42	3	2	4	20	1	5451	40	150	0	5	81	44	87	-3	3	0	0	98
40	4	2	3	20	1	5353	38	42	0	5	81	44	79	-1	1	0	0	98
38	1	0	5	20	1	5157	36	40	0	5	81	61	96	0	3	0	0	99
36	1	0	7	20	1	5087	33	38	0	5	81	61	114	0	3	0	0	99
33	1	0	4	20	1	5009	32	36	0	5	81	61	88	1	3	0	0	99
32	1	0	3	20	1	4946	18	33	0	5	81	61	80	0	3	0	0	99
18	1	0	4	20	1	4886	147	32	0	5	81	61	88	0	3	0	0	99
147	1	0	6	20	1	4822	145	18	0	5	81	61	102	0	3	0	0	99
145	3	2	1	20	1	4731	143	147	0	5	81	61	61	0	1	0	0	99
143	1	0	5	21	1	2555	141	145	0	5	96	62	96	0	3	0	0	102
141	1	0	4	21	1	2484	131	143	0	5	96	61	88	-2	3	0	0	102
131	1	0	3	21	1	2419	20	141	0	5	96	60	80	-3	3	0	0	102
20	1	0	3	21	1	2359	126	131	0	5	96	62	80	0	3	0	0	102
126	3	2	4	21	1	2286	124	20	0	5	96	62	87	0	3	0	0	102
124	1	0	5	21	1	2221	19	126	0	5	96	62	96	0	3	0	0	102
19	1	0	1	21	1	2150	3	124	0	5	96	62	62	0	1	0	0	102
3	4	2	6	21	1	1209	8	19	0	5	112	61	101	0	3	0	0	102
8	1	0	1	21	1	1129	103	3	0	5	112	60	62	-1	3	0	0	102
103	1	0	4	21	1	1076	119	8	0	5	112	60	88	-1	3	0	0	102
119	1	0	3	21	1	1013	138	103	0	5	112	61	80	2	3	0	0	102
138	1	0	5	21	1	953	136	119	0	5	112	61	96	0	3	0	0	102
136	1	0	3	21	1	883	121	138	0	5	112	59	80	-3	3	0	0	102
121	1	0	4	21	1	824	118	136	0	5	112	61	88	0	3	0	0	102
118	1	0	2	21	1	760	135	121	0	5	112	62	74	1	3	0	0	102
135	1	0	3	21	1	701	108	118	0	5	112	62	80	2	3	0	0	102
108	1	0	3	21	1	641	133	135	0	5	112	60	80	-2	3	0	0	102
133	3	2	4	21	1	568	107	108	0	5	113	60	87	-2	3	0	0	102
107	3	2	7	21	1	491	117	133	0	5	30	61	112	1	3	0	0	102
117	4	2	1	21	1	366	0	107	0	5	30	61	61	0	1	0	0	102

SNAPSHOT OF ROADSIM CONDITIONS AT TIME 1800

DIRECTION 1																			DIRECTION 2																		
VEH	TYPE	CAT	DRVR	LINK	LANE	DIST (FT)	LEADER	FOLLOW	LEAD TGT	FOL TGT	ONCOMER	SPD FPS	DES SPD FPS	ACC FPSS	STATE	STAGE	TIME MARG	ZONE	VEH	TYPE	CAT	DRVR	LINK	LANE	DIST (FT)	LEADER	FOLLOW	LEAD TGT	FOL TGT	ONCOMER	SPD FPS	DES SPD FPS	ACC FPSS	STATE	STAGE	TIME MARG	ZONE
133	3	2	1	10	1	23480	0	136	0	0	61	61	61	0	1	0	0	55	63	4	2	7	12	1	23785	61	0	0	0	133	73	121	0	1	0	0	57
136	3	2	6	10	1	23389	133	139	0	0	61	61	101	0	3	0	0	55	61	1	0	3	13	1	23497	60	63	0	0	133	73	87	0	3	0	0	58
139	1	0	3	10	1	23316	136	70	0	0	61	62	80	2	3	0	0	55	60	1	0	3	13	1	23309	59	61	0	0	70	70	87	1	2	0	0	58
70	4	2	3	10	1	21734	139	86	0	0	49	66	79	0	1	0	0	53	59	4	2	4	13	1	23166	55	60	0	0	70	57	94	-1	3	0	0	58
86	1	0	3	10	1	21621	70	74	0	0	54	66	80	0	3	0	0	53	55	1	0	1	13	1	22987	49	59	0	0	70	67	67	0	1	0	0	58
74	1	0	7	10	1	21537	86	85	0	0	54	66	114	1	3	0	0	53	49	1	0	5	13	1	21921	54	55	0	0	70	89	104	-1	2	0	0	58
85	1	0	4	10	1	21468	74	2	0	0	54	65	88	-1	3	0	0	53	54	1	0	1	13	1	21714	162	49	0	0	86	67	67	0	1	0	0	59
2	1	0	3	10	1	21404	85	83	0	0	54	66	80	1	3	0	0	53	162	1	0	6	14	1	20145	160	54	0	0	91	68	110	-2	3	0	0	62
83	1	0	4	10	1	21335	2	91	0	0	54	67	88	2	3	0	0	53	160	4	2	6	14	1	20005	157	162	0	0	91	69	109	0	1	0	0	62
91	4	2	1	8	1	18878	83	77	0	0	160	34	66	0	1	0	0	46	157	1	0	5	15	1	18764	155	160	0	0	25	81	104	2	3	0	0	67
77	1	0	3	8	1	18788	91	25	0	0	160	34	87	0	3	0	0	46	155	1	0	2	15	1	18658	131	157	0	0	141	80	80	0	1	0	0	67
25	1	0	1	8	1	18750	77	94	0	0	157	33	67	-1	3	0	0	46	131	2	1	5	15	1	17561	128	155	0	0	113	92	101	2	3	0	0	72
94	1	0	2	8	1	18709	25	140	0	0	157	33	80	-1	3	0	0	46	128	1	0	3	15	1	17384	52	131	0	0	12	85	87	2	3	0	0	72
140	1	0	7	8	1	18658	94	141	0	0	157	34	123	0	3	0	0	46	52	1	0	5	15	1	17232	46	128	0	0	18	82	104	2	3	0	0	72
141	1	0	4	8	1	18615	140	143	0	0	155	34	95	1	3	0	0	45	46	1	0	4	15	1	17117	51	52	0	0	14	86	95	2	3	0	0	72
143	4	2	7	8	1	18497	141	145	0	0	155	30	121	0	1	0	0	44	51	1	0	3	15	1	17008	7	46	0	0	14	87	87	0	3	0	0	72
145	1	0	2	8	1	18412	143	146	0	0	155	29	80	-2	3	0	0	44	7	1	0	4	15	1	16801	50	51	0	0	26	94	95	2	3	0	0	72
146	1	0	4	8	1	18370	145	148	0	0	155	30	95	0	3	0	0	44	50	4	2	4	15	1	16608	44	7	0	0	33	94	94	0	1	0	0	72
148	1	0	5	8	1	18326	146	149	0	0	155	30	104	1	3	0	0	44	44	3	2	2	16	1	16046	43	50	0	0	33	78	78	0	1	0	0	73
149	4	2	3	8	1	18268	148	151	0	0	155	26	85	0	3	0	0	44	43	1	0	4	17	1	13439	42	44	0	0	33	82	95	-1	3	0	0	78
151	1	0	4	8	1	18181	149	152	0	0	155	25	95	-1	3	0	0	42	42	1	0	5	17	1	13336	41	43	0	0	33	78	104	0	3	0	0	78
152	1	0	2	8	1	18146	151	98	0	0	155	25	80	-2	3	0	0	42	41	3	2	6	17	1	13216	34	42	0	0	33	79	109	0	3	0	0	78
98	1	0	7	8	1	18100	152	104	0	0	155	26	123	-1	3	0	0	42	34	1	0	4	17	1	13097	38	41	0	0	33	79	95	0	3	0	0	78
104	1	0	7	8	1	18054	98	99	0	0	155	27	123	1	3	0	0	42	38	1	0	2	17	1	12994	125	34	0	0	33	80	80	0	1	0	0	78
99	3	2	6	8	1	18008	104	101	0	0	155	26	109	-1	3	0	0	42	125	1	0	5	17	1	12038	123	38	0	0	40	69	104	0	3	0	0	83
101	4	2	3	8	1	17956	99	105	0	0	155	27	85	-1	3	0	0	42	123	2	1	2	17	1	11948	124	125	0	0	40	67	77	-1	2	0	0	83
105	1	0	2	8	1	17872	101	109	0	0	155	28	80	0	3	0	0	42	124	1	0	5	17	1	11872	122	123	0	0	40	54	104	0	3	0	0	83
109	4	2	5	8	1	17827	105	114	0	0	155	28	102	0	3	0	0	42	122	1	0	2	17	1	11810	121	124	0	0	40	54	80	0	3	0	0	83
114	3	2	5	8	1	17739	109	153	0	0	155	28	102	-3	3	0	0	41	121	1	0	5	17	1	11761	120	122	0	0	40	56	104	2	3	0	0	83
153	3	2	4	8	1	17684	114	154	0	0	155	30	94	0	3	0	0	41	120	1	0	5	17	1	11698	119	121	0	0	40	55	104	0	3	0	0	83
154	2	1	4	8	1	17629	153	30	0	0	155	30	93	0	3	0	0	41	119	3	2	6	17	1	11622	118	120	0	0	40	56	109	2	3	0	0	83
30	4	2	7	8	1	17573	154	113	0	0	155	30	121	0	3	0	0	40	118	1	0	6	17	1	11549	115	119	0	0	40	59	110	2	3	0	0	84
113	1	0	2	8	1	17488	30	3	0	0	131	29	80	-2	3	0	0	40	115	1	0	3	17	1	11474	107	118	0	0	40	59	87	0	3	0	0	84
3	1	0	6	8	1	17439	113	10	0	0	131	30	110	-2	3	0	0	40	107	1	0	6	17	1	11416	35	115	0	0	40	59	110	-1	3	0	0	84
10	1	0	4	8	1	17397	3	12	0	0	131	30	95	-3	3	0	0	40	35	4	2	2	17	1	11292	13	107	0	0	40	61	78	1	1	0	0	85
12	3	2	3	8	1	17357	10	16	0	0	128	32	85	-1	3	0	0	40	13	1	0	1	17	1	10925	27	35	0	0	39	67	67	0	1	0	0	85
16	1	0	5	8	1	17298	12	20	0	0	128	33	104	-2	3	0	0	40	27	1	0	4	19	1	8875	32	13	0	0	1	88	88	0	1	0	0	91
20	1	0	3	8	1	17257	16	18	0	0	128	34	87	-3	3	0	0	40	32	1	0	3	19	1	7735	21	27	0	0	1	73	80	-2	3	0	0	94
18	1	0	5	8	1	17206	20	29	0	0	52	38	104	-4	3	0	0	40	21	3	2	3	19	1	7639	24	32	0	0	1	74	79	0	3	0	0	94
29	1	0	6	8	1	17141	18	14	0	0	52	45	110	-6	2	0	0	40	24	1	0	7	19	1	7564	23	21	0	0	57	74	114	2	3	0	0	94
14	1	0	3	8	1	16910	29	26	0	0	51	83	87	-2	2	0	0	39	23	1	0	4	19	1	7461	22	24	0	0	57	73	88	-2	3	0	0	94
26	1	0	6	8	1	16765	14	33	0	0	7	85	110	-1	3	0	0	39	22	1	0	4	19	1	7379	19	23	0	0	58	74	88	0	3	0	0	94
33	1	0	1	6	1	12794	26	17	0	0	38	62	62	0	1	0	0	30	19	1	0	2	19	1	7297	8	22	0	0	58	74	74	0	1	[illegible]	0	95

SNAPSHOT OF ROADSIM CONDITIONS AT TIME

DIRECTION 1																			DIRECTION 2																		
VEH	TYPE	CAT	DRIV	LINK	LANE	DIST (FT)	LEADER	FOLLOW	LEAD TGT	FOL TGT	ONCOMER	SPD FPS	DES SPD FPS	ACC FPSS	STATE	STAGE	TIME MARG	ZONE	VEH	TYPE	CAT	DRIV	LINK	LANE	DIST (FT)	LEADER	FOLLOW	LEAD TGT	FOL TGT	ONCOMER	SPD FPS	DES SPD FPS	ACC FPSS	STATE	STAGE	TIME MARG	ZONE
17	1	0	1	6	1	12608	33	28	0	0	38	62	62	0	3	0	0	30	8	1	0	6	20	1	6150	108	19	0	0	129	72	102	0	3	0	0	98
28	1	0	3	6	1	12547	17	36	0	0	38	62	80	0	3	0	0	30	108	1	0	3	20	1	6049	116	8	0	0	129	73	80	0	3	0	0	98
36	1	0	7	6	1	12469	28	103	0	0	38	61	114	-1	3	0	0	30	116	1	0	2	20	1	5970	112	108	0	0	130	74	74	0	3	0	0	98
103	3	2	4	6	1	12404	36	110	0	0	38	61	87	-2	3	0	0	30	112	1	0	2	20	1	5817	111	116	0	0	130	74	74	0	1	0	0	98
110	3	2	2	6	1	12336	103	117	0	0	38	61	72	-2	3	0	0	29	111	1	0	4	20	1	4887	106	112	0	0	130	74	88	1	3	0	0	99
117	4	2	3	6	1	12263	110	37	0	0	38	60	79	-3	3	0	0	29	106	2	1	3	20	1	4798	102	111	0	0	132	75	78	1	3	0	0	99
37	3	2	6	6	1	12135	117	31	0	0	38	62	101	-1	3	0	0	29	102	1	0	6	20	1	4645	97	106	0	0	132	74	102	0	3	0	0	99
31	1	0	6	6	1	12042	37	40	0	0	38	62	102	-1	3	0	0	27	97	1	0	2	20	1	4543	100	102	0	0	132	74	74	0	1	0	0	99
40	1	0	5	6	1	11098	31	39	0	0	35	94	96	1	1	0	0	24	100	4	2	4	20	1	4086	96	97	0	0	156	62	87	1	1	0	0	100
39	1	0	6	5	1	10744	40	47	0	0	13	91	102	-1	1	0	0	23	96	1	0	2	20	1	3524	150	100	0	0	53	72	74	-2	3	0	0	100
47	1	0	7	5	1	10383	39	45	0	0	13	98	114	-1	3	0	0	21	150	1	0	3	20	1	3458	147	96	0	0	53	71	80	0	3	0	0	100
45	3	2	5	4	1	9153	47	1	0	0	13	97	102	2	1	0	0	18	147	1	0	3	20	1	3387	144	150	0	0	53	71	80	-2	3	0	0	101
1	4	2	3	4	1	7567	45	57	0	0	21	81	85	-1	1	0	0	14	144	4	2	7	20	1	3265	142	147	0	0	53	74	112	1	3	0	0	101
57	1	0	7	4	1	7386	1	58	0	0	23	83	123	-1	3	0	0	14	142	1	0	3	20	1	3063	95	144	0	0	53	74	80	2	3	0	0	101
58	3	2	6	3	1	7269	57	126	0	0	19	84	109	0	3	0	0	12	95	1	0	7	20	1	2988	11	142	0	0	53	74	114	2	3	0	0	101
126	3	2	3	3	1	6794	58	127	0	0	19	84	85	0	1	0	0	11	11	1	0	4	20	1	2886	9	95	0	0	53	74	88	0	3	0	0	101
127	4	2	4	3	1	6338	126	129	0	0	19	90	94	0	1	0	0	11	9	1	0	2	20	1	2804	92	11	0	0	53	74	74	0	3	0	0	101
129	4	2	5	3	1	5975	127	130	0	0	108	89	102	2	1	0	0	7	92	1	0	6	20	1	2718	87	9	0	0	53	78	102	-1	3	0	0	101
130	1	0	1	3	1	4825	129	132	0	0	111	67	67	0	1	0	0	6	87	3	2	5	21	1	2591	81	92	0	0	53	78	94	-2	3	0	0	102
132	1	0	1	3	1	4490	130	134	0	0	97	67	67	0	1	0	0	6	81	4	2	7	21	1	2439	5	87	0	0	53	76	112	-2	2	0	0	102
134	3	2	3	3	1	4424	132	156	0	0	97	67	85	0	3	0	0	6	5	1	0	1	21	1	2308	4	81	0	0	53	62	62	0	1	0	0	102
156	3	2	1	3	1	4027	134	158	0	0	100	66	66	0	1	0	0	4	4	1	0	7	21	1	314	15	5	0	0	62	62	114	2	3	0	0	102
158	4	2	5	3	1	3808	156	48	0	0	100	60	102	0	1	0	0	4	15	1	0	6	21	1	235	90	4	0	0	62	62	102	1	3	0	0	102
48	3	2	5	3	1	3691	158	159	0	0	100	60	102	0	3	0	0	4	90	3	2	6	21	1	144	6	15	0	0	62	62	101	1	3	0	0	102
159	1	0	6	3	1	3602	48	161	0	0	100	60	110	0	3	0	0	4	6	1	0	7	22	1	66	0	90	0	0	0	63	123	2	1	0	0	103
161	2	1	6	3	1	3525	159	53	0	0	100	60	108	0	3	0	0	4																			
53	1	0	3	2	1	1741	161	56	0	0	5	87	87	0	1	0	0	2																			
56	1	0	1	2	1	738	53	62	0	0	5	67	67	0	1	0	0	2																			
62	3	2	6	1	1	69	56	0	0	0	90	69	109	2	1	0	0	1																			

EXPLANATION OF CODES

STAGE CODES

0. IN NORMAL LANE - NOT PASSING.
1. NOT COMMITTED TO COMPLETE.
2. COMMITTED TO COMPLETE PASS (I.E., WOULD PULL AHEAD OF OTHER VEHICLE EVEN IF LARGE DECELERATION WERE USED).
3. AHEAD OF IMPEDER (MEASURE NOSE TO NOSE).
4. CLEAR OF IMPEDER AND MAKING DECISION ABOUT PASSING ANOTHER VEHICLE, IF ANY.
5. ENDING PASS, AND HAS TWO REVIEW PERIODS BEFORE VACATING THE PASSING LANE.
6. ENDING PASS AND HAS ONE REVIEW BEFORE VACATING THE PASSING LANE.

STATE CODES

1. FREE, UNIMPEDED BY OTHER VEHICLES.
2. OVERTAKING LEADER BUT MORE THAN 8 FT/SEC FASTER.
3. FOLLOWING A LEADER.
5. PASSING ANOTHER (SAME DIRECTION) VEHICLE.
6. ENDING A PASS.

CUMULATIVE ROADSIM STATISTICS SINCE BEGINNING OF SIMULATION

ELAPSED SIMULATION TIME IS 0 HOURS, 30 MINUTES, 0 SECONDS

LINK STATISTICS STRATIFIED BY VEHICLE CATEGORY (A = AUTOS, R = REC. VEH., T = TRUCKS/BUSES)

LINK	+ - VEHICLE-TRIPS - +				+ - - VEHICLE-MILES - - +				MEAN SPEED (MPH)				STD. DEV. OF SPEED				SPEED EXTREMES	
	A	R	T	TOTAL	A	R	T	TOTAL	A	R	T	ALL	A	R	T	ALL	MIN.	MAX.
(8000, 1)	226	15	96	337	4.3	.3	1.8	6.4	60.1	58.1	58.9	59.7	7.8	7.5	7.2	7.6	46	76
(1, 2)	224	15	96	335	108.6	7.3	46.5	162.4	58.4	56.8	56.5	57.8	7.2	6.1	6.7	7.0	44	75
(2, 3)	227	15	89	331	199.3	13.2	78.1	290.6	53.7	52.8	52.8	53.4	6.9	5.8	6.2	6.6	43	73
(3, 4)	236	18	87	341	92.6	7.1	34.1	133.8	49.6	47.7	49.2	49.4	7.7	6.1	7.3	7.5	37	70
(4, 5)	240	18	88	346	66.5	5.0	24.4	95.9	48.1	48.5	48.5	48.2	6.2	6.6	5.8	6.1	41	72
(5, 6)	234	18	85	337	155.5	12.0	56.5	223.9	46.5	46.7	46.5	46.5	5.2	4.4	4.8	5.0	41	69
(6, 7)	244	19	88	351	104.6	8.1	37.7	150.5	47.9	48.0	48.0	47.9	4.7	4.2	5.0	4.7	43	65
(7, 8)	224	19	80	323	97.6	8.3	34.8	140.7	37.6	38.9	35.5	37.2	8.0	7.8	7.7	8.0	25	56
(8, 9)	224	19	80	323	97.6	8.3	34.8	140.7	37.9	39.1	35.9	37.4	6.1	8.5	5.0	6.1	27	55
(9, 10)	227	20	79	326	110.0	9.7	38.3	157.9	46.1	46.7	46.9	46.3	4.3	5.4	3.8	4.3	41	61
(10,8011)	231	21	79	331	4.4	.4	1.5	6.3	48.5	47.9	51.3	49.1	5.3	6.0	7.5	6.1	40	68
DIRECTION 1	184	13	69	266	831.5	58.7	311.8	1202.0	47.2	46.9	46.5	47.0	3.5	3.8	3.0	3.4	42	58
(8011, 10)	269	23	96	388	5.1	.4	1.8	7.3	56.7	58.3	57.3	56.9	7.3	7.4	7.5	7.3	40	76
(10, 9)	264	23	95	382	127.9	11.1	46.0	185.1	54.1	52.9	51.1	53.2	6.3	6.3	7.2	6.6	40	71
(9, 8)	269	24	98	391	117.2	10.5	42.7	170.3	50.2	51.0	49.1	50.0	6.5	7.4	6.4	6.5	42	70
(8, 7)	266	23	100	389	115.9	10.0	43.6	169.5	50.3	51.7	53.2	51.1	4.8	5.8	6.8	5.6	44	69
(7, 6)	278	23	102	403	119.2	9.9	43.7	172.8	50.0	51.6	51.7	50.5	6.9	5.8	8.2	7.2	31	76
(6, 5)	266	22	102	390	176.7	14.6	67.8	259.1	44.3	44.7	41.6	43.6	6.6	6.3	6.8	6.7	32	66
(5, 4)	278	22	103	403	77.0	6.1	28.5	111.7	47.3	47.7	47.5	47.4	3.0	3.7	2.4	2.9	44	63
(4, 3)	275	22	104	401	107.9	8.6	40.8	157.3	45.7	46.7	47.5	46.2	4.5	4.8	4.6	4.6	41	65
(3, 2)	262	22	104	388	230.0	19.3	91.3	340.7	42.7	43.0	42.6	42.7	3.3	3.9	3.6	3.4	36	57
(2, 1)	276	22	109	407	133.8	10.7	52.8	197.3	43.1	43.4	43.4	43.2	3.1	3.2	2.9	3.0	33	57
(1,8000)	275	22	110	407	5.2	.4	2.1	7.7	44.3	43.7	43.2	43.9	4.0	3.1	2.9	3.7	23	68
DIRECTION 2	218	20	83	321	985.1	90.4	375.1	1450.5	46.7	47.2	46.7	46.7	3.0	3.8	3.5	3.2	40	55
OVERALL	402	33	152	587	1816.5	149.1	686.8	2652.5	46.9	47.1	46.6	46.8	3.3	3.8	3.2	3.3	40	58

STATISTICS PRESENTED FOR DIRECTION 1, DIRECTION 2 AND FOR OVERALL (I.E. BOTH DIRECTIONS), DESCRIBE THE OPERATIONAL PERFORMANCE OF ONLY THOSE VEHICLES WHICH TRAVELED THE ENTIRE LENGTH OF THE ROADWAY AFTER INITIALIZATION WAS COMPLETED.

LINK TRAVEL [illegible]

LINK	+ - - AUTOS - - +	+ - REC VEH - +	+ - - TRUCKS - - +	ALL VEHICLES	AUTO	R.V.	TRUCK	[illegible]
	MEAN TRAVEL TIMES BY CATEGORY (SEC.) - IDEAL/ZERO-TRAFFIC/ACTUAL							
(8000, 1)	1.1/ 1.1/ 1.1	1.2/ 1.2/ 1.2	1.2/ 1.2/ 1.2	1.1/ 1.1/ 1.1	.1	.2	.2	.1
(1, 2)	27.5/ 27.7/ 29.9	28.2/ 29.5/ 30.7	27.9/ 28.9/ 30.9	27.6/ 28.1/ 30.2	3.7	3.6	3.8	3.8
(2, 3)	49.9/ 50.9/ 58.8	51.4/ 54.1/ 59.9	50.7/ 54.5/ 59.8	50.2/ 52.0/ 59.2	7.3	6.5	6.8	7.1
(3, 4)	22.5/ 23.1/ 28.5	23.0/ 24.7/ 29.6	22.6/ 25.5/ 28.7	22.6/ 23.8/ 28.6	4.5	3.9	4.4	4.4
(4, 5)	15.6/ 17.4/ 20.7	16.2/ 17.8/ 20.6	16.0/ 18.1/ 20.6	15.7/ 17.6/ 20.7	2.5	2.7	2.4	2.5
(5, 6)	37.7/ 41.3/ 51.5	39.0/ 42.6/ 51.2	38.2/ 43.0/ 51.4	37.9/ 41.8/ 51.4	5.2	4.9	5.0	5.1
(6, 7)	24.6/ 24.8/ 32.2	25.1/ 25.9/ 32.1	24.9/ 25.4/ 32.2	24.7/ 25.0/ 32.2	2.9	2.8	3.0	2.9
(7, 8)	24.8/ 26.9/ 41.7	25.5/ 29.0/ 40.3	25.2/ 33.7/ 44.2	24.9/ 28.7/ 42.2	8.8	8.6	8.8	8.8
(8, 9)	24.8/ 27.3/ 41.4	25.5/ 29.0/ 40.1	25.2/ 36.0/ 43.6	24.9/ 29.6/ 41.9	6.2	8.5	5.7	6.3
(9, 10)	27.6/ 29.9/ 37.8	28.3/ 30.7/ 37.4	28.0/ 32.8/ 37.2	27.7/ 30.7/ 37.6	3.3	4.1	3.0	3.3
(10,8011)	1.2/ 1.2/ 1.4	1.2/ 1.2/ 1.4	1.2/ 1.2/ 1.3	1.2/ 1.2/ 1.4	.2	.2	.2	.2
DIRECTION 1	257.3/271.6/ 344.9	264.6/ 285.7/ 346.6	261.2/ 293.9/ 349.7	258.7/278.1/ 346.2	24.8	27.1	22.1	23.9
(8011, 10)	1.1/ 1.1/ 1.2	1.2/ 1.2/ 1.2	1.2/ 1.2/ 1.2	1.1/ 1.1/ 1.2	.1	.2	.2	.2
(10, 9)	27.6/ 28.1/ 32.2	28.3/ 30.4/ 32.9	27.9/ 31.3/ 34.1	27.7/ 29.0/ 32.8	3.8	4.2	4.9	4.2
(9, 8)	24.7/ 25.1/ 31.2	25.5/ 26.7/ 30.7	25.1/ 28.2/ 32.0	24.8/ 26.0/ 31.4	3.7	4.2	3.6	3.7
(8, 7)	24.8/ 26.6/ 31.2	25.5/ 26.9/ 30.4	25.2/ 26.9/ 29.5	24.9/ 26.7/ 30.7	2.9	3.4	3.7	3.2
(7, 6)	24.4/ 24.5/ 30.9	25.0/ 25.6/ 29.9	24.8/ 24.8/ 29.8	24.5/ 24.6/ 30.6	4.4	3.3	4.4	4.4
(6, 5)	37.7/ 39.4/ 54.0	39.0/ 42.0/ 53.5	38.2/ 43.2/ 57.5	37.9/ 40.5/ 54.9	8.0	7.9	9.1	8.4
(5, 4)	15.6/ 17.2/ 21.1	16.2/ 17.5/ 20.9	16.0/ 18.3/ 21.0	15.7/ 17.5/ 21.1	1.2	1.4	1.0	1.1
(4, 3)	22.5/ 24.2/ 30.9	23.1/ 25.1/ 30.2	22.7/ 25.6/ 29.7	22.6/ 24.6/ 30.6	2.8	3.0	2.9	2.9
(3, 2)	49.9/ 54.2/ 74.1	51.4/ 56.8/ 73.5	50.8/ 59.3/ 74.2	50.2/ 55.7/ 74.1	5.2	5.8	5.9	5.4
(2, 1)	27.6/ 29.9/ 40.5	28.3/ 30.6/ 40.2	28.0/ 30.5/ 40.2	27.7/ 30.1/ 40.4	2.6	2.5	2.5	2.6
(1,8000)	1.1/ 1.1/ 1.5	1.2/ 1.2/ 1.6	1.2/ 1.2/ 1.6	1.1/ 1.1/ 1.6	.1	.1	.1	.1
DIRECTION 2	257.0/271.4/ 348.4	264.7/ 284.0/ 344.4	261.1/ 289.0/ 348.5	258.5/276.7/ 348.2	22.2	27.7	25.9	23.6
OVERALL	257.1/271.5/ 346.8	264.7/ 284.7/ 345.2	261.1/ 291.2/ 349.0	258.6/277.3/ 347.3	23.5	27.0	24.4	23.7

WHEN THE NUMBER OF VEHICLE TRIPS IS SO SMALL THAT IT DOES NOT REPRESENT AN ADEQUATE SAMPLE, IT IS POSSIBLE FOR THE COMPUTED VALUE OF THE MEAN OF ACTUAL TRAVEL TIMES TO BE LESS THAN THE MEAN VALUE OF ZERO-TRAFFIC TRAVEL TIMES. THIS CONDITION, WHICH WILL PRODUCE NEGATIVE DELAYS ON THE NEXT PAGE, CAN ONLY BE RESOLVED BY EXTENDING THE SIMULATION TIME. PREFERABLY, VEHICLE TRIPS SHOULD EXCEED 30 FOR EACH VEHICLE CATEGORY.

LINK DELAY TIMES STRATIFIED BY VEHICLE CATEGORY

MEAN DELAY TIMES BY CATEGORY (SEC.) - GEOMETRIC/TRAFFIC/TOTAL

LINK	+ - - AUTOS - - +			+ - REC VEH - +			+ - - TRUCKS - - +			ALL VEHICLES			STANDARD DEVIATION BY CAT. AUTO	R.V.	TRUCK	ALL
(8000, 1)	.0/	.0/	.0	.0/	.0/	.0	.0/	.0/	.0	.0/	.0/	.0	.1	.2	.2	.1
(1, 2)	.2/	2.2/	2.4	1.3/	1.2/	2.5	1.0/	2.0/	3.0	.5/	2.1/	2.5	3.7	3.6	3.8	3.8
(2, 3)	1.0/	7.9/	8.9	2.7/	5.8/	8.5	3.8/	5.3/	9.1	1.8/	7.1/	9.0	7.3	6.5	6.8	7.1
(3, 4)	.6/	5.4/	6.0	1.7/	4.9/	6.6	2.9/	3.2/	6.1	1.2/	4.8/	6.0	4.5	3.9	4.4	4.4
(4, 5)	1.8/	3.3/	5.1	1.6/	2.8/	4.4	2.1/	2.5/	4.6	1.9/	3.1/	5.0	2.5	2.7	2.4	2.5
(5, 6)	3.6/	10.2/	13.8	3.6/	8.6/	12.2	4.8/	8.4/	13.2	3.9/	9.6/	13.5	5.2	4.9	5.0	5.1
(6, 7)	.2/	7.4/	7.6	.8/	6.2/	7.0	.5/	6.8/	7.3	.3/	7.2/	7.5	2.9	2.8	3.0	2.9
(7, 8)	2.1/	14.8/	16.9	3.5/	11.3/	14.8	8.5/	10.5/	19.0	3.8/	13.5/	17.3	8.8	8.6	8.8	8.8
(8, 9)	2.5/	14.1/	16.6	3.5/	11.1/	14.6	10.8/	7.6/	18.4	4.6/	12.3/	16.9	6.2	8.5	5.7	6.3
(9, 10)	2.3/	7.9/	10.2	2.4/	6.7/	9.1	4.8/	4.4/	9.2	2.9/	7.0/	9.9	3.3	4.1	3.0	3.3
(10,8011)	.0/	.2/	.2	.0/	.2/	.2	.0/	.1/	.1	.0/	.2/	.2	.2	.2	.2	.2
DIRECTION 1	14.3/	73.3/	87.6	21.1/	60.9/	82.0	32.7/	55.8/	88.5	19.4/	68.2/	87.6				
(8011, 10)	.0/	.1/	.1	.0/	.0/	.0	.0/	.0/	.0	.0/	.1/	.1	.1	.2	.2	.2
(10, 9)	.5/	4.1/	4.6	2.1/	2.5/	4.6	3.4/	2.8/	6.2	1.3/	3.7/	5.0	3.8	4.2	4.9	4.2
(9, 8)	.4/	6.1/	6.5	1.2/	4.0/	5.2	3.1/	3.8/	6.9	1.1/	5.4/	6.5	3.7	4.2	3.6	3.7
(8, 7)	1.8/	4.6/	6.4	1.4/	3.5/	4.9	1.7/	2.6/	4.3	1.8/	4.0/	5.8	2.9	3.4	3.7	3.2
(7, 6)	.1/	6.4/	6.5	.6/	4.3/	4.9	.0/	5.0/	5.0	.1/	5.9/	6.0	4.4	3.3	4.4	4.4
(6, 5)	1.7/	14.6/	16.3	3.0/	11.5/	14.5	5.0/	14.3/	19.3	2.6/	14.4/	17.0	8.0	7.9	9.1	8.4
(5, 4)	1.6/	3.9/	5.5	1.3/	3.4/	4.7	2.3/	2.7/	5.0	1.8/	3.6/	5.3	1.2	1.4	1.0	1.1
(4, 3)	1.7/	6.7/	8.4	2.0/	5.1/	7.1	2.9/	4.1/	7.0	2.0/	6.0/	8.0	2.8	3.0	2.9	2.9
(3, 2)	4.3/	19.9/	24.2	5.4/	16.7/	22.1	8.5/	14.9/	23.4	5.5/	18.4/	23.9	5.2	5.8	5.9	5.4
(2, 1)	2.3/	10.6/	12.9	2.3/	9.6/	11.9	2.5/	9.7/	12.2	2.4/	10.3/	12.6	2.6	2.5	2.5	2.6
(1,8000)	.0/	.4/	.4	.0/	.4/	.4	.0/	.4/	.4	.0/	.4/	.4	.1	.1	.1	.1
DIRECTION 2	14.4/	77.0/	91.4	19.3/	60.4/	79.6	27.9/	59.5/	87.4	18.2/	71.5/	89.7				
OVERALL	14.4/	75.3/	89.7	20.0/	60.6/	80.6	30.1/	57.8/	87.9	18.7/	70.0/	88.7				

PASSES ATTEMPTED/COMPLETED/ABORTED BY CATEGORY

LINK	NUMBER AUTOS	NUMBER REC VEH	NUMBER TRUCKS	NUMBER ALL	PER MILE PER HOUR AUTOS	PER MILE PER HOUR REC VEH	PER MILE PER HOUR TRUCKS	PER MILE PER HOUR ALL
(8000, 1)	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0
(1, 2)	5/ 5/ 0	0/ 0/ 0	0/ 0/ 0	5/ 5/ 0	21/ 21/ 0	0/ 0/ 0	0/ 0/ 0	21/ 21/ 0
(2, 3)	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0
(3, 4)	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0
(4, 5)	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0
(5, 6)	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0
(6, 7)	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0
(7, 8)	2/ 0/ 0	0/ 0/ 0	0/ 0/ 0	2/ 0/ 0	9/ 0/ 0	0/ 0/ 0	0/ 0/ 0	9/ 0/ 0
(8, 9)	0/ 1/ 1	0/ 0/ 0	0/ 0/ 0	0/ 1/ 1	0/ 5/ 5	0/ 0/ 0	0/ 0/ 0	0/ 5/ 5
(9, 10)	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0
(10,8011)	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0
DIRECTION 1	7/ 6/ 1	0/ 0/ 0	0/ 0/ 0	7/ 6/ 1	3/ 3/ 0	0/ 0/ 0	0/ 0/ 0	3/ 3/ 0
(8011, 10)	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0
(10, 9)	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0
(9, 8)	0/ 0/ 0	1/ 1/ 0	0/ 0/ 0	1/ 1/ 0	0/ 0/ 0	5/ 5/ 0	0/ 0/ 0	5/ 5/ 0
(8, 7)	19/ 8/ 1	2/ 1/ 0	3/ 0/ 0	24/ 9/ 1	87/ 37/ 5	9/ 5/ 0	14/ 0/ 0	110/ 41/ 5
(7, 6)	1/ 11/ 1	0/ 1/ 0	0/ 3/ 0	1/ 15/ 1	5/ 51/ 5	0/ 5/ 0	0/ 14/ 0	5/ 70/ 5
(6, 5)	5/ 3/ 2	0/ 0/ 0	1/ 1/ 0	6/ 4/ 2	15/ 9/ 6	0/ 0/ 0	3/ 3/ 0	18/ 12/ 6
(5, 4)	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0
(4, 3)	2/ 0/ 0	0/ 0/ 0	0/ 0/ 0	2/ 0/ 0	10/ 0/ 0	0/ 0/ 0	0/ 0/ 0	10/ 0/ 0
(3, 2)	1/ 2/ 0	0/ 0/ 0	0/ 0/ 0	1/ 2/ 0	2/ 5/ 0	0/ 0/ 0	0/ 0/ 0	2/ 5/ 0
(2, 1)	10/ 8/ 3	1/ 0/ 1	0/ 0/ 0	11/ 8/ 4	41/ 33/ 12	4/ 0/ 4	0/ 0/ 0	45/ 33/ 17
(1,8000)	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0
DIRECTION 2	38/ 32/ 7	4/ 3/ 1	4/ 4/ 0	46/ 39/ 8	17/ 14/ 3	2/ 1/ 0	2/ 2/ 0	20/ 17/ 4
OVERALL	45/ 38/ 8	4/ 3/ 1	4/ 4/ 0	53/ 45/ 9	10/ 8/ 2	1/ 1/ 0	1/ 1/ 0	12/ 10/ 2

DISTRIBUTIONS OF VEHICLE HEADWAYS, VEHICLE SPEEDS AND PLATOON SIZES IN DIRECTION 1

LINK	HEADWAYS, SEC	NO.	PCT	CUM	SPEEDS, FT/SEC	NO.	PCT	CUM	PLATOON SIZES	NO.	PCT	CUM
(8000, 1)	0 LT 1	0	.0	.0	0 TO 10	0	.0	.0	1	14	24.6	24.6
	1 LT 2	1	.3	.3	10 TO 20	0	.0	.0	2	9	15.8	40.4
	2 LT 3	59	17.5	17.8	20 TO 30	0	.0	.0	3	5	8.8	49.1
	3 LT 4	84	24.9	42.7	30 TO 40	0	.0	.0	4	6	10.5	59.6
	4 LT 5	70	20.8	63.5	40 TO 50	0	.0	.0	5	3	5.3	64.9
	5 LT 6	41	12.2	75.7	50 TO 60	0	.0	.0	6	2	3.5	68.4
	6 LT 10	47	13.9	89.6	60 TO 70	31	9.2	9.2	7 - 9	10	17.5	86.0
	10 LT 15	15	4.5	94.1	70 TO 80	44	13.1	22.3	10 - 14	5	8.8	94.7
	15 LT 20	10	3.0	97.0	80 TO 90	152	45.1	67.4	15 - 19	2	3.5	98.2
	20 LT 25	4	1.2	98.2	90 TO 100	87	25.8	93.2	20 - 24	0	.0	98.2
	25 LT999	6	1.8	100.0	100 TO 110	23	6.8	100.0	25 -199	1	1.8	100.0
(1, 2)	0 LT 1	0	.0	.0	0 TO 10	0	.0	.0	1	25	29.4	29.4
	1 LT 2	67	20.0	20.0	10 TO 20	0	.0	.0	2	13	15.3	44.7
	2 LT 3	73	21.8	41.8	20 TO 30	0	.0	.0	3	13	15.3	60.0
	3 LT 4	38	11.3	53.1	30 TO 40	0	.0	.0	4	6	7.1	67.1
	4 LT 5	28	8.4	61.5	40 TO 50	0	.0	.0	5	11	12.9	80.0
	5 LT 6	22	6.6	68.1	50 TO 60	0	.0	.0	6	3	3.5	83.5
	6 LT 10	53	15.8	83.9	60 TO 70	66	19.7	19.7	7 - 9	11	12.9	96.5
	10 LT 15	30	9.0	92.8	70 TO 80	41	12.2	31.9	10 - 14	2	2.4	98.8
	15 LT 20	15	4.5	97.3	80 TO 90	126	37.6	69.6	15 - 19	1	1.2	100.0
	20 LT 25	3	.9	98.2	90 TO 100	79	23.6	93.1	20 - 24	0	.0	100.0
	25 LT999	6	1.8	100.0	100 TO 110	23	6.9	100.0	25 -199	0	.0	100.0
(2, 3)	0 LT 1	0	.0	.0	0 TO 10	0	.0	.0	1	14	20.6	20.6
	1 LT 2	143	43.2	43.2	10 TO 20	0	.0	.0	2	9	13.2	33.8
	2 LT 3	69	20.8	64.0	20 TO 30	0	.0	.0	3	9	13.2	47.1
	3 LT 4	16	4.8	68.9	30 TO 40	0	.0	.0	4	6	8.8	55.9
	4 LT 5	13	3.9	72.8	40 TO 50	0	.0	.0	5	6	8.8	64.7
	5 LT 6	8	2.4	75.2	50 TO 60	0	.0	.0	6	4	5.9	70.6
	6 LT 10	30	9.1	84.3	60 TO 70	117	35.3	35.3	7 - 9	15	22.1	92.6
	10 LT 15	16	4.8	89.1	70 TO 80	38	11.5	46.8	10 - 14	4	5.9	98.5
	15 LT 20	14	4.2	93.4	80 TO 90	122	36.9	83.7	15 - 19	1	1.5	100.0
	20 LT 25	5	1.5	94.9	90 TO 100	43	13.0	96.7	20 - 24	0	.0	100.0
	25 LT999	17	5.1	100.0	100 TO 110	11	3.3	100.0	25 -199	0	.0	100.0

DISTRIBUTIONS OF VEHICLE HEADWAYS, VEHICLE SPEEDS AND PLATOON SIZES IN DIRECTION 1

LINK	HEADWAYS, SEC	NO.	PCT	CUM	SPEEDS, FT/SEC	NO.	PCT	CUM	PLATOON SIZES	NO.	PCT	CUM
(3, 4)	0 LT 1	0	.0	.0	0 TO 10	0	.0	.0	1	13	20.6	20.6
	1 LT 2	160	46.9	46.9	10 TO 20	0	.0	.0	2	7	11.1	31.7
	2 LT 3	66	19.4	66.3	20 TO 30	0	.0	.0	3	9	14.3	46.0
	3 LT 4	24	7.0	73.3	30 TO 40	0	.0	.0	4	8	12.7	58.7
	4 LT 5	13	3.8	77.1	40 TO 50	0	.0	.0	5	2	3.2	61.9
	5 LT 6	8	2.3	79.5	50 TO 60	0	.0	.0	6	3	4.8	66.7
	6 LT 10	24	7.0	86.5	60 TO 70	157	46.0	46.0	7 - 9	14	22.2	88.9
	10 LT 15	11	3.2	89.7	70 TO 80	39	11.4	57.5	10 - 14	6	9.5	98.4
	15 LT 20	10	2.9	92.7	80 TO 90	115	33.7	91.2	15 - 19	1	1.6	100.0
	20 LT 25	4	1.2	93.8	90 TO 100	21	6.2	97.4	20 - 24	0	.0	100.0
	25 LT999	21	6.2	100.0	100 TO 110	9	2.6	100.0	25 -199	0	.0	100.0
(4, 5)	0 LT 1	0	.0	.0	0 TO 10	0	.0	.0	1	11	19.6	19.6
	1 LT 2	208	60.1	60.1	10 TO 20	0	.0	.0	2	7	12.5	32.1
	2 LT 3	45	13.0	73.1	20 TO 30	0	.0	.0	3	4	7.1	39.3
	3 LT 4	9	2.6	75.7	30 TO 40	0	.0	.0	4	4	7.1	46.4
	4 LT 5	9	2.6	78.3	40 TO 50	0	.0	.0	5	4	7.1	53.6
	5 LT 6	13	3.8	82.1	50 TO 60	5	1.4	1.4	6	1	1.8	55.4
	6 LT 10	13	3.8	85.8	60 TO 70	184	53.2	54.6	7 - 9	17	30.4	85.7
	10 LT 15	12	3.5	89.3	70 TO 80	109	31.5	86.1	10 - 14	6	10.7	96.4
	15 LT 20	9	2.6	91.9	80 TO 90	41	11.8	98.0	15 - 19	1	1.8	98.2
	20 LT 25	4	1.2	93.1	90 TO 100	5	1.4	99.4	20 - 24	1	1.8	100.0
	25 LT999	24	6.9	100.0	100 TO 110	2	.6	100.0	25 -199	0	.0	100.0
(5, 6)	0 LT 1	0	.0	.0	0 TO 10	0	.0	.0	1	9	19.1	19.1
	1 LT 2	232	68.8	68.8	10 TO 20	0	.0	.0	2	4	8.5	27.7
	2 LT 3	43	12.8	81.6	20 TO 30	0	.0	.0	3	3	6.4	34.0
	3 LT 4	5	1.5	83.1	30 TO 40	0	.0	.0	4	2	4.3	38.3
	4 LT 5	3	.9	84.0	40 TO 50	0	.0	.0	5	4	8.5	46.8
	5 LT 6	3	.9	84.9	50 TO 60	0	.0	.0	6	0	.0	46.8
	6 LT 10	11	3.3	88.1	60 TO 70	210	62.3	62.3	7 - 9	17	36.2	83.0
	10 LT 15	3	.9	89.0	70 TO 80	98	29.1	91.4	10 - 14	4	8.5	91.5
	15 LT 20	6	1.8	90.8	80 TO 90	27	8.0	99.4	15 - 19	3	6.4	97.9
	20 LT 25	6	1.8	92.6	90 TO 100	1	.3	99.7	20 - 24	1	2.1	100.0
	25 LT999	25	7.4	100.0	100 TO 110	1	.3	100.0	25 -199	0	.0	100.0

DISTRIBUTIONS OF VEHICLE HEADWAYS, VEHICLE SPEEDS AND PLATOON SIZES IN DIRECTION 1

LINK	HEADWAYS, SEC	NO.	PCT	CUM	SPEEDS, FT/SEC	NO.	PCT	CUM	PLATOON SIZES	NO.	PCT	CUM
(6, 7)	0 LT 1	0	.0	.0	0 TO 10	0	.0	.0	1	6	14.6	14.6
	1 LT 2	238	67.8	67.8	10 TO 20	0	.0	.0	2	4	9.8	24.4
	2 LT 3	59	16.8	84.6	20 TO 30	0	.0	.0	3	3	7.3	31.7
	3 LT 4	4	1.1	85.8	30 TO 40	0	.0	.0	4	3	7.3	39.0
	4 LT 5	5	1.4	87.2	40 TO 50	0	.0	.0	5	2	4.9	43.9
	5 LT 6	4	1.1	88.3	50 TO 60	0	.0	.0	6	0	.0	43.9
	6 LT 10	2	.6	88.9	60 TO 70	237	67.5	67.5	7 - 9	14	34.1	78.0
	10 LT 15	9	2.6	91.5	70 TO 80	59	16.8	84.3	10 - 14	5	12.2	90.2
	15 LT 20	6	1.7	93.2	80 TO 90	52	14.8	99.1	15 - 19	3	7.3	97.6
	20 LT 25	5	1.4	94.6	90 TO 100	3	.9	100.0	20 - 24	1	2.4	100.0
	25 LT999	19	5.4	100.0	100 TO 110	0	.0	100.0	25 -199	0	.0	100.0
(7, 8)	0 LT 1	1	.3	.3	0 TO 10	0	.0	.0	1	7	13.7	13.7
	1 LT 2	188	58.2	58.5	10 TO 20	5	1.5	1.5	2	8	15.7	29.4
	2 LT 3	55	17.0	75.5	20 TO 30	7	2.2	3.7	3	9	17.6	47.1
	3 LT 4	18	5.6	81.1	30 TO 40	74	22.9	26.6	4	5	9.8	56.9
	4 LT 5	6	1.9	83.0	40 TO 50	83	25.7	52.3	5	3	5.9	62.7
	5 LT 6	4	1.2	84.2	50 TO 60	14	4.3	56.7	6	2	3.9	66.7
	6 LT 10	5	1.5	85.8	60 TO 70	106	32.8	89.5	7 - 9	7	13.7	80.4
	10 LT 15	7	2.2	87.9	70 TO 80	32	9.9	99.4	10 - 14	7	13.7	94.1
	15 LT 20	5	1.5	89.5	80 TO 90	2	.6	100.0	15 - 19	3	5.9	100.0
	20 LT 25	4	1.2	90.7	90 TO 100	0	.0	100.0	20 - 24	0	.0	100.0
	25 LT999	30	9.3	100.0	100 TO 110	0	.0	100.0	25 -199	0	.0	100.0
(8, 9)	0 LT 1	0	.0	.0	0 TO 10	0	.0	.0	1	6	13.0	13.0
	1 LT 2	217	67.2	67.2	10 TO 20	0	.0	.0	2	5	10.9	23.9
	2 LT 3	47	14.6	81.7	20 TO 30	0	.0	.0	3	8	17.4	41.3
	3 LT 4	6	1.9	83.6	30 TO 40	0	.0	.0	4	4	8.7	50.0
	4 LT 5	3	.9	84.5	40 TO 50	0	.0	.0	5	4	8.7	58.7
	5 LT 6	2	.6	85.1	50 TO 60	2	.6	.6	6	2	4.3	63.0
	6 LT 10	3	.9	86.1	60 TO 70	270	83.6	84.2	7 - 9	6	13.0	76.1
	10 LT 15	4	1.2	87.3	70 TO 80	23	7.1	91.3	10 - 14	8	17.4	93.5
	15 LT 20	8	2.5	89.8	80 TO 90	25	7.7	99.1	15 - 19	3	6.5	100.0
	20 LT 25	7	2.2	92.0	90 TO 100	3	.9	100.0	20 - 24	0	.0	100.0
	25 LT999	26	8.0	100.0	100 TO 110	0	.0	100.0	25 -199	0	.0	100.0

DISTRIBUTIONS OF VEHICLE HEADWAYS, VEHICLE SPEEDS AND PLATOON SIZES IN DIRECTION [illegible]

LINK	HEADWAYS, SEC	NO.	PCT	CUM	SPEEDS, FT/SEC	NO.	PCT	CUM	PLATOON SIZES	NO.	PCT	CUM
(9, 10)	0 LT 1	0	.0	.0	0 TO 10	0	.0	.0	1	249	90.9	90.9
	1 LT 2	52	16.0	16.0	10 TO 20	0	.0	.0	2	13	4.7	95.6
	2 LT 3	0	.0	16.0	20 TO 30	0	.0	.0	3	4	1.5	97.1
	3 LT 4	0	.0	16.0	30 TO 40	0	.0	.0	4	3	1.1	98.2
	4 LT 5	0	.0	16.0	40 TO 50	0	.0	.0	5	3	1.1	99.3
	5 LT 6	0	.0	16.0	50 TO 60	0	.0	.0	6	2	.7	100.0
	6 LT 10	0	.0	16.0	60 TO 70	125	38.3	38.3	7 - 9	0	.0	100.0
	10 LT 15	0	.0	16.0	70 TO 80	124	38.0	76.4	10 - 14	0	.0	100.0
	15 LT 20	0	.0	16.0	80 TO 90	63	19.3	95.7	15 - 19	0	.0	100.0
	20 LT 25	0	.0	16.0	90 TO 100	14	4.3	100.0	20 - 24	0	.0	100.0
	25 LT999	274	84.0	100.0	100 TO 110	0	.0	100.0	25 -199	0	.0	100.0

DISTRIBUTIONS OF VEHICLE HEADWAYS, VEHICLE SPEEDS AND PLATOON SIZES IN DIRECTION 2

LINK	HEADWAYS, SEC	NO.	PCT	CUM	SPEEDS, FT/SEC	NO.	PCT	CUM	PLATOON SIZES	NO.	PCT	CUM
(8011, 10)	0 LT 1	0	.0	.0	0 TO 10	0	.0	.0	1	19	25.0	25.0
	1 LT 2	11	2.8	2.8	10 TO 20	0	.0	.0	2	7	9.2	34.2
	2 LT 3	71	18.3	21.1	20 TO 30	0	.0	.0	3	11	14.5	48.7
	3 LT 4	95	24.5	45.6	30 TO 40	0	.0	.0	4	7	9.2	57.9
	4 LT 5	67	17.3	62.9	40 TO 50	0	.0	.0	5	9	11.8	69.7
	5 LT 6	41	10.6	73.5	50 TO 60	1	.3	.3	6	5	6.6	76.3
	6 LT 10	72	18.6	92.0	60 TO 70	56	14.4	14.7	7 - 9	12	15.8	92.1
	10 LT 15	28	7.2	99.2	70 TO 80	81	20.9	35.6	10 - 14	3	3.9	96.1
	15 LT 20	3	.8	100.0	80 TO 90	179	46.1	81.7	15 - 19	1	1.3	97.4
	20 LT 25	0	.0	100.0	90 TO 100	59	15.2	96.9	20 - 24	2	2.6	100.0
	25 LT999	0	.0	100.0	100 TO 110	12	3.1	100.0	25 -199	0	.0	100.0
(10, 9)	0 LT 1	0	.0	.0	0 TO 10	0	.0	.0	1	18	18.9	18.9
	1 LT 2	116	30.4	30.4	10 TO 20	0	.0	.0	2	14	14.7	33.7
	2 LT 3	88	23.0	53.4	20 TO 30	0	.0	.0	3	18	18.9	52.6
	3 LT 4	30	7.9	61.3	30 TO 40	0	.0	.0	4	11	11.6	64.2
	4 LT 5	19	5.0	66.2	40 TO 50	0	.0	.0	5	12	12.6	76.8
	5 LT 6	22	5.8	72.0	50 TO 60	7	1.8	1.8	6	8	8.4	85.3
	6 LT 10	42	11.0	83.0	60 TO 70	143	37.4	39.3	7 - 9	12	12.6	97.9
	10 LT 15	39	10.2	93.2	70 TO 80	54	14.1	53.4	10 - 14	2	2.1	100.0
	15 LT 20	19	5.0	98.2	80 TO 90	111	29.1	82.5	15 - 19	0	.0	100.0
	20 LT 25	5	1.3	99.5	90 TO 100	59	15.4	97.9	20 - 24	0	.0	100.0
	25 LT999	2	.5	100.0	100 TO 110	8	2.1	100.0	25 -199	0	.0	100.0
(9, 8)	0 LT 1	0	.0	.0	0 TO 10	0	.0	.0	1	16	17.8	17.8
	1 LT 2	194	49.6	49.6	10 TO 20	0	.0	.0	2	12	13.3	31.1
	2 LT 3	75	19.2	68.8	20 TO 30	0	.0	.0	3	15	16.7	47.8
	3 LT 4	8	2.0	70.8	30 TO 40	0	.0	.0	4	8	8.9	56.7
	4 LT 5	12	3.1	73.9	40 TO 50	4	1.0	1.0	5	13	14.4	71.1
	5 LT 6	6	1.5	75.4	50 TO 60	0	.0	1.0	6	10	11.1	82.2
	6 LT 10	31	7.9	83.4	60 TO 70	125	32.0	33.0	7 - 9	13	14.4	96.7
	10 LT 15	32	8.2	91.6	70 TO 80	121	30.9	63.9	10 - 14	3	3.3	100.0
	15 LT 20	16	4.1	95.7	80 TO 90	123	31.5	95.4	15 - 19	0	.0	100.0
	20 LT 25	5	1.3	96.9	90 TO 100	9	2.3	97.7	20 - 24	0	.0	100.0
	25 LT999	12	3.1	100.0	100 TO 110	9	2.3	100.0	25 -199	0	.0	100.0

DISTRIBUTIONS OF VEHICLE HEADWAYS, VEHICLE SPEEDS AND PLATOON SIZES IN DIRECTION 2

LINK	HEADWAYS, SEC	NO.	PCT	CUM	SPEEDS, FT/SEC	NO.	PCT	CUM	PLATOON SIZES	NO.	PCT	CUM
(8, 7)	0 LT 1	11	2.8	2.8	0 TO 10	0	.0	.0	1	7	9.9	9.9
	1 LT 2	190	48.8	51.7	10 TO 20	0	.0	.0	2	11	15.5	25.4
	2 LT 3	72	18.5	70.2	20 TO 30	0	.0	.0	3	8	11.3	36.6
	3 LT 4	9	2.3	72.5	30 TO 40	0	.0	.0	4	7	9.9	46.5
	4 LT 5	12	3.1	75.6	40 TO 50	0	.0	.0	5	8	11.3	57.7
	5 LT 6	14	3.6	79.2	50 TO 60	0	.0	.0	6	7	9.9	67.6
	6 LT 10	29	7.5	86.6	60 TO 70	112	28.8	28.8	7 - 9	16	22.5	90.1
	10 LT 15	22	5.7	92.3	70 TO 80	84	21.6	50.4	10 - 14	7	9.9	100.0
	15 LT 20	8	2.1	94.3	80 TO 90	138	35.5	85.9	15 - 19	0	.0	100.0
	20 LT 25	6	1.5	95.9	90 TO 100	30	7.7	93.6	20 - 24	0	.0	100.0
	25 LT999	16	4.1	100.0	100 TO 110	25	6.4	100.0	25 -199	0	.0	100.0
(7, 6)	0 LT 1	1	.2	.2	0 TO 10	0	.0	.0	1	14	18.4	18.4
	1 LT 2	212	52.6	52.9	10 TO 20	0	.0	.0	2	14	18.4	36.8
	2 LT 3	87	21.6	74.4	20 TO 30	0	.0	.0	3	6	7.9	44.7
	3 LT 4	11	2.7	77.2	30 TO 40	0	.0	.0	4	8	10.5	55.3
	4 LT 5	5	1.2	78.4	40 TO 50	0	.0	.0	5	6	7.9	63.2
	5 LT 6	2	.5	78.9	50 TO 60	3	.7	.7	6	4	5.3	68.4
	6 LT 10	27	6.7	85.6	60 TO 70	198	49.1	49.9	7 - 9	14	18.4	86.8
	10 LT 15	28	6.9	92.6	70 TO 80	89	22.1	72.0	10 - 14	10	13.2	100.0
	15 LT 20	7	1.7	94.3	80 TO 90	99	24.6	96.5	15 - 19	0	.0	100.0
	20 LT 25	13	3.2	97.5	90 TO 100	8	2.0	98.5	20 - 24	0	.0	100.0
	25 LT999	10	2.5	100.0	100 TO 110	6	1.5	100.0	25 -199	0	.0	100.0
(6, 5)	0 LT 1	0	.0	.0	0 TO 10	0	.0	.0	1	13	18.6	18.6
	1 LT 2	241	61.8	61.8	10 TO 20	0	.0	.0	2	8	11.4	30.0
	2 LT 3	52	13.3	75.1	20 TO 30	0	.0	.0	3	9	12.9	42.9
	3 LT 4	11	2.8	77.9	30 TO 40	0	.0	.0	4	10	14.3	57.1
	4 LT 5	7	1.8	79.7	40 TO 50	0	.0	.0	5	5	7.1	64.3
	5 LT 6	8	2.1	81.8	50 TO 60	18	4.6	4.6	6	3	4.3	68.6
	6 LT 10	11	2.8	84.6	60 TO 70	304	77.9	82.6	7 - 9	11	15.7	84.3
	10 LT 15	25	6.4	91.0	70 TO 80	43	11.0	93.6	10 - 14	11	15.7	100.0
	15 LT 20	13	3.3	94.4	80 TO 90	19	4.9	98.5	15 - 19	0	.0	100.0
	20 LT 25	6	1.5	95.9	90 TO 100	6	1.5	100.0	20 - 24	0	.0	100.0
	25 LT999	16	4.1	100.0	100 TO 110	0	.0	100.0	25 -199	0	.0	100.0

DISTRIBUTIONS OF VEHICLE HEADWAYS, VEHICLE SPEEDS AND PLATOON SIZES IN DIRECTION 2

LINK	HEADWAYS, SEC	NO.	PCT	CUM	SPEEDS, FT/SEC	NO.	PCT	CUM	PLATOON SIZES	NO.	PCT	CUM
(5, 4)	0 LT 1	0	.0	.0	0 TO 10	0	.0	.0	1	12	17.6	17.6
	1 LT 2	255	63.3	63.3	10 TO 20	0	.0	.0	2	7	10.3	27.9
	2 LT 3	60	14.9	78.2	20 TO 30	0	.0	.0	3	10	14.7	42.6
	3 LT 4	6	1.5	79.7	30 TO 40	0	.0	.0	4	10	14.7	57.4
	4 LT 5	7	1.7	81.4	40 TO 50	0	.0	.0	5	5	7.4	64.7
	5 LT 6	4	1.0	82.4	50 TO 60	0	.0	.0	6	3	4.4	69.1
	6 LT 10	25	6.2	88.6	60 TO 70	160	39.7	39.7	7 - 9	11	16.2	85.3
	10 LT 15	18	4.5	93.1	70 TO 80	221	54.8	94.5	10 - 14	8	11.8	97.1
	15 LT 20	6	1.5	94.5	80 TO 90	19	4.7	99.3	15 - 19	1	1.5	98.5
	20 LT 25	7	1.7	96.3	90 TO 100	3	.7	100.0	20 - 24	1	1.5	100.0
	25 LT999	15	3.7	100.0	100 TO 110	0	.0	100.0	25 -199	0	.0	100.0
(4, 3)	0 LT 1	2	.5	.5	0 TO 10	0	.0	.0	1	7	14.0	14.0
	1 LT 2	258	64.3	64.8	10 TO 20	0	.0	.0	2	6	12.0	26.0
	2 LT 3	62	15.5	80.3	20 TO 30	0	.0	.0	3	3	6.0	32.0
	3 LT 4	12	3.0	83.3	30 TO 40	0	.0	.0	4	6	12.0	44.0
	4 LT 5	5	1.2	84.5	40 TO 50	0	.0	.0	5	2	4.0	48.0
	5 LT 6	9	2.2	86.8	50 TO 60	2	.5	.5	6	1	2.0	50.0
	6 LT 10	11	2.7	89.5	60 TO 70	202	50.4	50.9	7 - 9	13	26.0	76.0
	10 LT 15	8	2.0	91.5	70 TO 80	151	37.7	88.5	10 - 14	5	10.0	86.0
	15 LT 20	5	1.2	92.8	80 TO 90	39	9.7	98.3	15 - 19	6	12.0	98.0
	20 LT 25	10	2.5	95.3	90 TO 100	4	1.0	99.3	20 - 24	1	2.0	100.0
	25 LT999	19	4.7	100.0	100 TO 110	3	.7	100.0	25 -199	0	.0	100.0
(3, 2)	0 LT 1	1	.3	.3	0 TO 10	0	.0	.0	1	5	11.9	11.9
	1 LT 2	269	69.3	69.6	10 TO 20	0	.0	.0	2	3	7.1	19.0
	2 LT 3	63	16.2	85.8	20 TO 30	0	.0	.0	3	3	7.1	26.2
	3 LT 4	5	1.3	87.1	30 TO 40	0	.0	.0	4	4	9.5	35.7
	4 LT 5	6	1.5	88.7	40 TO 50	0	.0	.0	5	2	4.8	40.5
	5 LT 6	2	.5	89.2	50 TO 60	4	1.0	1.0	6	1	2.4	42.9
	6 LT 10	2	.5	89.7	60 TO 70	233	60.1	61.1	7 - 9	11	26.2	69.0
	10 LT 15	7	1.8	91.5	70 TO 80	121	31.2	92.3	10 - 14	6	14.3	83.3
	15 LT 20	6	1.5	93.0	80 TO 90	29	7.5	99.7	15 - 19	6	14.3	97.6
	20 LT 25	7	1.8	94.8	90 TO 100	1	.3	100.0	20 - 24	1	2.4	100.0
	25 LT999	20	5.2	100.0	100 TO 110	0	.0	100.0	25 -199	0	.0	100.0

DISTRIBUTIONS OF VEHICLE HEADWAYS, VEHICLE SPEEDS AND PLATOON SIZES

LINK (2, 1)

HEADWAYS, SEC	NO.	PCT	CUM
0 LT 1	0	.0	.0
1 LT 2	148	36.4	36.4
2 LT 3	0	.0	36.4
3 LT 4	0	.0	36.4
4 LT 5	0	.0	36.4
5 LT 6	0	.0	36.4
6 LT 10	0	.0	36.4
10 LT 15	0	.0	36.4
15 LT 20	0	.0	36.4
20 LT 25	0	.0	36.4
25 LT999	259	63.6	100.0

SPEEDS, FT/SEC	NO.	PCT	CUM
0 TO 10	0	.0	.0
10 TO 20	0	.0	.0
20 TO 30	0	.0	.0
30 TO 40	2	.5	.5
40 TO 50	0	.0	.5
50 TO 60	3	.7	1.2
60 TO 70	354	87.0	88.2
70 TO 80	38	9.3	97.5
80 TO 90	8	2.0	99.5
90 TO 100	2	.5	100.0
100 TO 110	0	.0	100.0

PLATOON SIZES	NO.	PCT	CUM
1	198	76.4	76.4
2	28	10.8	87.3
3	14	5.4	92.7
4	7	2.7	95.4
5	4	1.5	96.9
6	4	1.5	98.5
7 - 9	3	1.2	99.6
10 - 14	1	.4	100.0
15 - 19	0	.0	100.0
20 - 24	0	.0	100.0
25 -199	0	.0	100.0

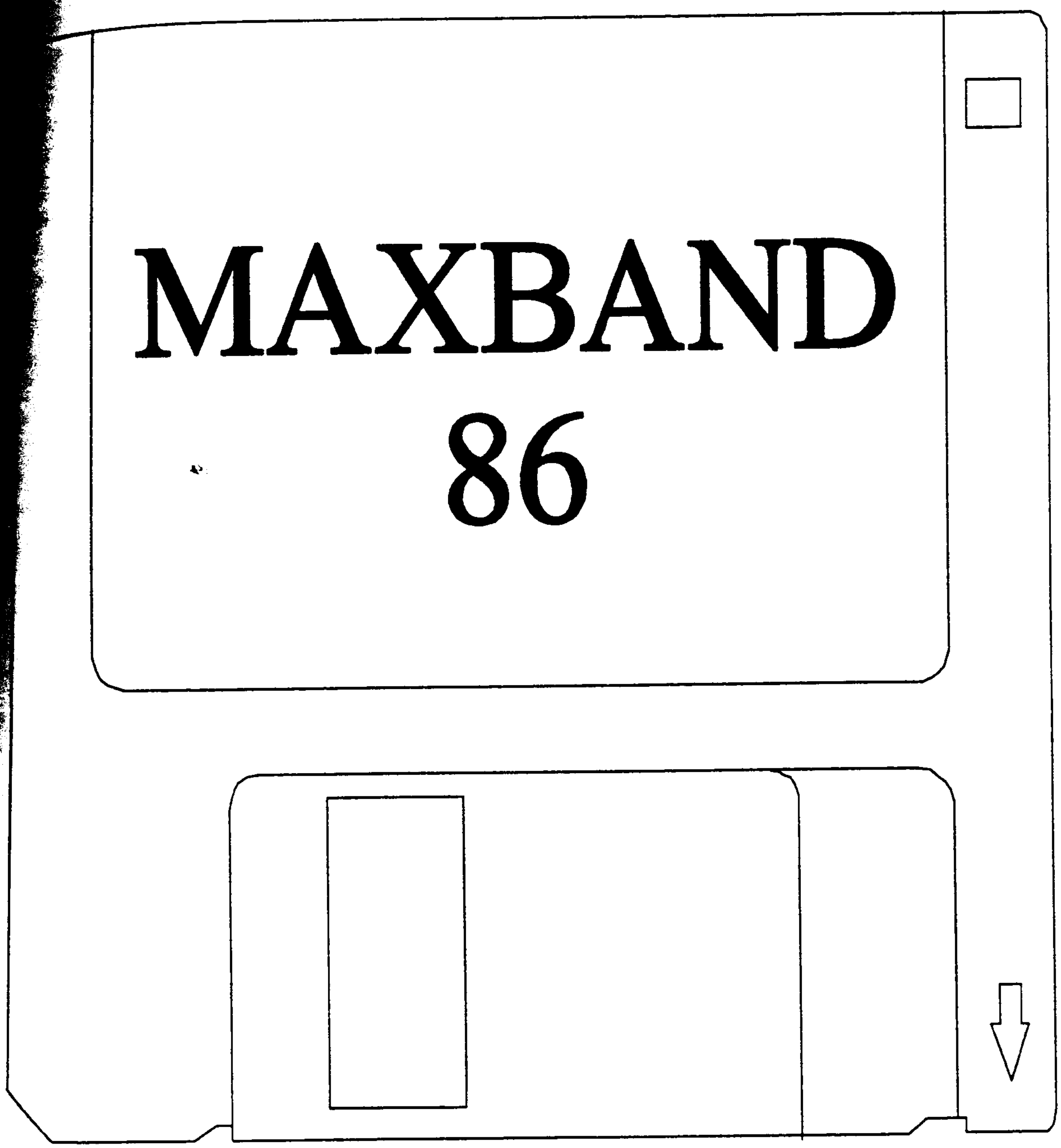
DISTRIBUTIONS OF MEAN SPEED AND TRAVEL TIMES, BY VEHICLE TYPE AND BY DIRECTION

	DIRECTION 1					DIRECTION 2				
			MEAN TRAVEL TIME (SEC.)					MEAN TRAVEL TIME (SEC.)		
VEHICLE TYPE	NUMBER	MEAN SPEED (MPH)	IDEAL	ZERO TRAFFIC	ACTUAL	NUMBER	MEAN SPEED (MPH)	IDEAL	ZERO TRAFFIC	ACTUAL
1	184	47.4	257	272	345	218	46.9	257	271	348
2	13	47.2	265	286	347	20	47.5	265	284	344
3	45	47.1	261	279	346	47	47.0	261	278	347
4	24	45.9	261	323	356	36	46.7	261	304	350

OVERALL SPEED HISTOGRAMS

	DIRECTION 1				DIRECTION 2			
SPEED FT/SEC	AUTOS NUM/ PCT/ CUM	REC VEHS NUM/ PCT/ CUM	TRUCKS NUM/ PCT/ CUM	ALL NUM/ PCT/ CUM	AUTOS NUM/ PCT/ CUM	REC VEHS NUM/ PCT/ CUM	TRUCKS NUM/ PCT/ CUM	ALL NUM/ PCT/ CUM
0 LT 10	0/ .0/ .0	0/ .0/ .0	0/ .0/ .0	0/ .0/ .0	0/ .0/ .0	0/ .0/ .0	0/ .0/ .0	0/ .0/ .0
10 LT 20	0/ .0/ .0	0/ .0/ .0	0/ .0/ .0	0/ .0/ .0	0/ .0/ .0	0/ .0/ .0	0/ .0/ .0	0/ .0/ .0
20 LT 30	0/ .0/ .0	0/ .0/ .0	0/ .0/ .0	0/ .0/ .0	0/ .0/ .0	0/ .0/ .0	0/ .0/ .0	0/ .0/ .0
30 LT 40	0/ .0/ .0	0/ .0/ .0	0/ .0/ .0	0/ .0/ .0	0/ .0/ .0	0/ .0/ .0	0/ .0/ .0	0/ .0/ .0
40 LT 50	0/ .0/ .0	0/ .0/ .0	0/ .0/ .0	0/ .0/ .0	0/ .0/ .0	0/ .0/ .0	0/ .0/ .0	0/ .0/ .0
50 LT 60	0/ .0/ .0	0/ .0/ .0	0/ .0/ .0	0/ .0/ .0	0/ .0/ .0	1/ 5.0/ 5.0	4/ 4.8/ 4.8	5/ 1.6/ 1.6
60 LT 70	110/59.8/ 59.8	9/69.2/ 69.2	42/60.9/ 60.9	161/60.5/ 60.5	127/58.3/ 58.3	10/50.0/ 55.0	43/51.8/ 56.6	180/56.1/ 57.6
70 LT 80	68/37.0/ 96.7	4/30.8/100.0	27/39.1/100.0	99/37.2/ 97.7	88/40.4/ 98.6	8/40.0/ 95.0	36/43.4/100.0	132/41.1/ 98.8
80 LT 90	6/ 3.3/100.0	0/ .0/100.0	0/ .0/100.0	6/ 2.3/100.0	3/ 1.4/100.0	1/ 5.0/100.0	0/ .0/100.0	4/ 1.2/100.0
90 LT100	0/ .0/100.0	0/ .0/100.0	0/ .0/100.0	0/ .0/100.0	0/ .0/100.0	0/ .0/100.0	0/ .0/100.0	0/ .0/100.0
100 LT110	0/ .0/100.0	0/ .0/100.0	0/ .0/100.0	0/ .0/100.0	0/ .0/100.0	0/ .0/100.0	0/ .0/100.0	0/ .0/100.0

LAST CASE PROCESSED


MAXBAND
86

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MAXBAND -- MAXIMAL BANDWIDTH TRAFFIC SIGNAL TIMING OPTIMIZATION PROGRAM
                                              **** MAXBAND INPUT CARDS ****
START
MPCODE        20000
TOLRN      .500E-04  .500E-03  .500E-04  .500E-03              .500E-03  .500E-03
SETUP           13          2  200                      N        NO HALSTED ST
ARTERY     60   80                          1   13
ART2        1    1     1   30     0     0  30    0     0
MAP              1     1                                        ROOSEVELT
VOLUME         268    56  562  212   722    0  708     0
CAPACITY      3000  1500 4500 1500  3000    0 3000     0
MINGREEN       .25   .10  .25  .10  .275    0 .275     0
LENGTH        1320        500
LEFTPAT                1
MAP              2     2                                        14ST ST
VOLUME         238     0  606    0   106    0  112     0
CAPACITY      3000     0 3000    0  1500    0 1500     0
MINGREEN       .25     0  .25    0  .275    0 .275     0
LENGTH         900       1320
MAP              3     3                                        16TH ST
VOLUME         280     0  724    0    98    0   60     0
CAPACITY      3000     0 3000    0  1500    0 1500     0
MINGREEN       .25     0  .25    0  .275    0 .275     0
LENGTH         850        900
MAP              4     4                                        CANALPORT
VOLUME         286     0  796    0   258    0  238     0
CAPACITY      3000     0 3000    0  1500    0 1500     0
MINGREEN       .25     0  .25    0  .275    0 .275     0
LENGTH        1000        650
MAP              5     5                                        18TH ST
VOLUME         318     0  846    0   314    0  592     0
CAPACITY      3000     0 3000    0  3000    0 3000     0
MINGREEN       .25     0  .25    0  .275    0 .275     0
LENGTH         800       1250
MAP              6     6                                        CERMAK
VOLUME         364     0  848    0   308    0  398     0
CAPACITY      3000     0 3000    0  3000    0 3000     0
MINGREEN       .25     0  .25    0  .275    0 .275     0
LENGTH        2050        750
MAP              7     7                                        ARCHER
VOLUME         390     0 1076    0   414    0 1166     0
CAPACITY      3000     0 3000    0  4500    0 4500     0
MINGREEN       .30     0  .30    0  .275    0 .275     0
LENGTH         700       1975
MAP              8     8                                        26TH ST
VOLUME         306     0  828    0   180    0    0     0
CAPACITY      3000     0 3000    0  1500    0    0     0
MINGREEN       .25     0  .25    0  .275    0    0     0
LENGTH        1325        950
MAP              9     9                                        29TH ST
VOLUME         398     0  732    0   130    0  134     0
CAPACITY      3000     0 3000    0  1500    0 1500     0
MINGREEN       .25     0  .25    0  .275    0 .275     0
LENGTH        1275       1100
```

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MAP               10   10                                          31ST ST
VOLUME           336   48  700   86  410    0  402    0
CAPACITY        3000 1500 3000 1500 1500    0 1500    0
MINGREEN         .25  .10  .25  .10 .275    0 .275    0
LENGTH          1349      1325
LEFTPAT                 1
MAP               12   11                                          33RD ST
VOLUME           472    0  608    0    0    0  130    0
CAPACITY        3000    0 3000    0    0    0 1500    0
MINGREEN         .25    0  .25    0    0    0 .275    0
LENGTH          2700      1200
MAP               14   12                                          37TH ST
VOLUME           366    0  610    0    0    0    4    0
CAPACITY        3000    0 3000    0    0    0 1500    0
MINGREEN         .25    0  .25    0    0    0 .275    0
LENGTH          1350      2625
MAP               15   13                                          39TH ST
VOLUME           314   56  504   46  498    0  808    0
CAPACITY        3000 1500 3000 1500 1500    0 1500    0
MINGREEN         .25  .10  .25  .10 .275    0 .275    0
LENGTH           500      1575
LEFTPAT                 1
END
DATA HAS BEEN SUCCESSFULLY ENTERED.
                                          **** MAXBAND INPUT DATA SUMMARY ****

                                               *** MPCODE VALUES ***

    MAXIMUM BRANCH AND BOUND ITERATIONS    (MAXRBB):      20000
    MAXIMUM BRANCH AND BOUND REINVERSIONS  (MAXIBB):        100
    MAXIMUM LINEAR PROGRAM ITERATIONS      (MAXITR):       1000
    MAXIMUM LINEAR PROGRAM REINVERSIONS    (MAXINV):        100

    RESTART: 0     (0 -- JOB IS NOT A RESTART;          1 -- JOB IS A RESTART)
    SWITCH : 1     (0 -- DO NOT PRINT PERFORMANCE PLOT; 1 -- PRINT PERFORMANCE PLOT)

    IMBEDDED VALUES OF TOLERANCES ARE:

    TOL 1 = 0.100E-05
    TOL 2 = 0.100E-04
    TOL 3 = 0.300E-05
    TOL 4 = 0.300E-04
    TOL 5 = 0.100E-04
    TOL 6 = 0.100E-04
    TOL 7 = 0.100E-04

    VALUES OF TOLERANCES AS REVISED ON TOLRN CARD ARE

    TOL 1 = 0.500E-04
    TOL 2 = 0.500E-03
    TOL 3 = 0.500E-04
    TOL 4 = 0.500E-03
    TOL 5 = 0.100E-04
    TOL 6 = 0.500E-03
    TOL 7 = 0.500E-03
```


THIS IS AN ARTERY PROBLEM.

*** ARTERY WIDE VALUES ***

THIS IS AN ARTERY PROBLEM.

*** ARTERY WIDE VALUES ***

NAME OF ARTERY: NO HALSTED ST
NUMBER OF INTERSECTIONS: 13
LOWER CYCLE LIMIT: 60.00 SECS
UPPER CYCLE LIMIT: 80.00 SECS

ARTERY IS ENTERED FROM: NORTH
UNITS: ENGLISH

		SOURCE *
WEIGHT OF SOUTHBOUND DIRECTION OF ARTERY (W(1)):	1.0000	0
WEIGHT OF NORTHBOUND DIRECTION OF ARTERY (W(2)):	1.0000	0

* (0 -- GIVEN; 1 -- COMPUTED FROM VOLUME INFORMATION)

NOTE : REGARDLESS OF THEIR SOURCES, THESE WEIGHTS WERE SCALED USING THE WITHIN ARTERY WEIGHTS FOR SINGLE ARTERY PROBLEM.
THESE WEIGHTS WERE SCALED USING BOTH WITHIN AND CROSS ARTERY WEIGHTS FOR NETWORK PROBLEM.

		SOUTHBOUND	NORTHBOUND
DESIGN SPEED	(MILES/HOUR):	30.00	30.00
TOLERANCES	(MILES/HOUR):	0.00	0.00
CHANGES BETWEEN LINKS	(MILES/HOUR):	0.00	0.00

*** INTERSECTION VALUES ***

						SOUTHBOUND				NORTHBOUND			
						---- SPLITS ----			QUEUE	---- SPLITS ----			QUEUE
SIGNAL NO.	NODE NO.	SEQ. NO.	LEFT CHOICES 1234 +	CROSS STREET NAME	SPLITS SOURCE *	GREEN	LEFT	RED	CLEARANCE	GREEN	LEFT	RED	CLEARANCE
						--- (FRACTIONS	OF CYCLE	) ---		--- (FRACTIONS	OF CYCLE	) ---	
1	1	1	0010	ROOSEVELT	1	0.4233	0.2775	0.5767	0.0000	0.2500	0.1042	0.7500	0.0000
2	2	2	0000	14ST ST	1	0.7250	0.0000	0.2750	0.0000	0.7250	0.0000	0.2750	0.0000
3	3	3	0000	16TH ST	1	0.7250	0.0000	0.2750	0.0000	0.7250	0.0000	0.2750	0.0000
4	4	4	0000	CANALPORT	1	0.6067	0.0000	0.3933	0.0000	0.6067	0.0000	0.3933	0.0000
5	5	5	0000	18TH ST	1	0.5883	0.0000	0.4117	0.0000	0.5883	0.0000	0.4117	0.0000
6	6	6	0000	CERMAK	1	0.6806	0.0000	0.3194	0.0000	0.6806	0.0000	0.3194	0.0000
7	7	7	0000	ARCHER	1	0.5806	0.0000	0.4194	0.0000	0.5806	0.0000	0.4194	0.0000
8	8	8	0000	26TH ST	1	0.6970	0.0000	0.3030	0.0000	0.6970	0.0000	0.3030	0.0000
9	9	9	0000	29TH ST	1	0.7250	0.0000	0.2750	0.0000	0.7250	0.0000	0.2750	0.0000
10	10	10	0010	31ST ST	1	0.4145	0.1596	0.5855	0.0000	0.3549	0.1000	0.6451	0.0000
11	12	11	0000	33RD ST	1	0.7005	0.0000	0.2995	0.0000	0.7005	0.0000	0.2995	0.0000
12	14	12	0000	37TH ST	1	0.7250	0.0000	0.2750	0.0000	0.7250	0.0000	0.2750	0.0000
13	15	13	0010	39TH ST	1	0.2500	0.1000	0.7500	0.0000	0.2500	0.1000	0.7500	0.0000

* (0 -- SPLITS GIVEN; 1 -- SPLITS COMPUTED FROM VOLUME AND CAPACITY INFORMATION)

NOTE: THE ABOVE SPLITS, REGARDLESS OF THEIR SOURCE, HAVE BEEN MODIFIED ACCORDING TO ANY MINIMUM GREEN TIMES GIVEN.

+ (0 -- PATTERN NOT ALLOWED; 1 -- PATTERN ALLOWED)

PATTERN 1 -- SOUTHBOUND LEFT LEADS GREEN; NORTHBOUND LEFT LAGS GREEN
PATTERN 2 -- SOUTHBOUND LEFT LAGS GREEN; NORTHBOUND LEFT LEADS GREEN
PATTERN 3 -- SOUTHBOUND LEFT LEADS GREEN; NORTHBOUND LEFT LEADS GREEN
PATTERN 4 -- SOUTHBOUND LEFT LAGS GREEN; NORTHBOUND LEFT LAGS GREEN

MINIMUM GREEN TIMES FOR APPROACHES -- FRACTIONS OF CYCLE

SIGNAL NO.	NORTHBOUND THROUGH	NORTHBOUND LEFT	SOUTHBOUND THROUGH	SOUTHBOUND LEFT	EASTBOUND THROUGH	EASTBOUND LEFT	WESTBOUND THROUGH	WESTBOUND LEFT
1	0.2500	0.1000	0.2500	0.1000	0.2750	0.0000	0.2750	0.0000
2	0.2500	0.0000	0.2500	0.0000	0.2750	0.0000	0.2750	0.0000
3	0.2500	0.0000	0.2500	0.0000	0.2750	0.0000	0.2750	0.0000
4	0.2500	0.0000	0.2500	0.0000	0.2750	0.0000	0.2750	0.0000
5	0.2500	0.0000	0.2500	0.0000	0.2750	0.0000	0.2750	0.0000
6	0.2500	0.0000	0.2500	0.0000	0.2750	0.0000	0.2750	0.0000
7	0.3000	0.0000	0.3000	0.0000	0.2750	0.0000	0.2750	0.0000
8	0.2500	0.0000	0.2500	0.0000	0.2750	0.0000	0.0000	0.0000
9	0.2500	0.0000	0.2500	0.0000	0.2750	0.0000	0.2750	0.0000
10	0.2500	0.1000	0.2500	0.1000	0.2750	0.0000	0.2750	0.0000
11	0.2500	0.0000	0.2500	0.0000	0.0000	0.0000	0.2750	0.0000
12	0.2500	0.0000	0.2500	0.0000	0.0000	0.0000	0.2750	0.0000
13	0.2500	0.1000	0.2500	0.1000	0.2750	0.0000	0.2750	0.0000

*** LINK VALUES ***

SIGNAL NO.		SOUTHBOUND LENGTH (FEET)	SOUTHBOUND SPEED (MILES/HOUR)	SOUTHBOUND TOLERANCE (MILES/HOUR)	NORTHBOUND LENGTH (FEET)	NORTHBOUND SPEED (MILES/HOUR)	NORTHBOUND TOLERANCE (MILES/HOUR)
1							
	---------	1320.00	30.00	0.00	1320.00	30.00	0.00
2							
	---------	900.00	30.00	0.00	900.00	30.00	0.00
3							
	---------	650.00	30.00	0.00	850.00	30.00	0.00
4							
	---------	1250.00	30.00	0.00	1000.00	30.00	0.00
5							
	---------	750.00	30.00	0.00	800.00	30.00	0.00
6							
	---------	1975.00	30.00	0.00	2050.00	30.00	0.00
7							
	---------	950.00	30.00	0.00	700.00	30.00	0.00
8							
	---------	1100.00	30.00	0.00	1325.00	30.00	0.00
9							
	---------	1325.00	30.00	0.00	1275.00	30.00	0.00
10							
	---------	1200.00	30.00	0.00	1349.00	30.00	0.00
11							
	---------	2625.00	30.00	0.00	2700.00	30.00	0.00
12							
	---------	1575.00	30.00	0.00	1350.00	30.00	0.00
13							

VOLUMES ON AP[illegible]

SIGNAL NO.	NORTHBOUND THROUGH	NORTHBOUND LEFT	SOUTHBOUND THROUGH	SOUTHBOUND LEFT	EASTBOUND THROUGH	EASTBOUND LEFT	[illegible] THROUGH	[illegible]
1	268.00	56.00	562.00	212.00	722.00	0.00	708.00	0.00
2	238.00	0.00	606.00	0.00	106.00	0.00	112.00	0.00
3	280.00	0.00	724.00	0.00	98.00	0.00	60.00	0.00
4	286.00	0.00	796.00	0.00	258.00	0.00	238.00	0.00
5	318.00	0.00	846.00	0.00	314.00	0.00	592.00	0.00
6	364.00	0.00	848.00	0.00	308.00	0.00	398.00	0.00
7	390.00	0.00	1076.00	0.00	414.00	0.00	1166.00	0.00
8	306.00	0.00	828.00	0.00	180.00	0.00	0.00	0.00
9	398.00	0.00	732.00	0.00	130.00	0.00	134.00	0.00
10	336.00	48.00	700.00	86.00	410.00	0.00	402.00	0.00
11	472.00	0.00	608.00	0.00	0.00	0.00	130.00	0.00
12	366.00	0.00	610.00	0.00	0.00	0.00	4.00	0.00
13	314.00	56.00	504.00	46.00	498.00	0.00	808.00	0.00

CAPACITIES ON APPROACHES -- VEHICLES PER HOUR

SIGNAL NO.	NORTHBOUND THROUGH	NORTHBOUND LEFT	SOUTHBOUND THROUGH	SOUTHBOUND LEFT	EASTBOUND THROUGH	EASTBOUND LEFT	WESTBOUND THROUGH	WESTBOUND LEFT
1	3000.00	1500.00	4500.00	1500.00	3000.00	0.00	3000.00	0.00
2	3000.00	0.00	3000.00	0.00	1500.00	0.00	1500.00	0.00
3	3000.00	0.00	3000.00	0.00	1500.00	0.00	1500.00	0.00
4	3000.00	0.00	3000.00	0.00	1500.00	0.00	1500.00	0.00
5	3000.00	0.00	3000.00	0.00	3000.00	0.00	3000.00	0.00
6	3000.00	0.00	3000.00	0.00	3000.00	0.00	3000.00	0.00
7	3000.00	0.00	3000.00	0.00	4500.00	0.00	4500.00	0.00
8	3000.00	0.00	3000.00	0.00	1500.00	0.00	0.00	0.00
9	3000.00	0.00	3000.00	0.00	1500.00	0.00	1500.00	0.00
10	3000.00	1500.00	3000.00	1500.00	1500.00	0.00	1500.00	0.00
11	3000.00	0.00	3000.00	0.00	0.00	0.00	1500.00	0.00
12	3000.00	0.00	3000.00	0.00	0.00	0.00	1500.00	0.00
13	3000.00	1500.00	3000.00	1500.00	1500.00	0.00	1500.00	0.00

**** MPCODE PERFORMANCE PLOT ****

BEST OBJECTIVE FUNCTION VALUE =	0.0439204	NUMBER OF BRANCH AND BOUND ITERATIONS =	150
BEST OBJECTIVE FUNCTION VALUE =	0.0955509	NUMBER OF BRANCH AND BOUND ITERATIONS =	459
BEST OBJECTIVE FUNCTION VALUE =	0.2405473	NUMBER OF BRANCH AND BOUND ITERATIONS =	1325
BEST OBJECTIVE FUNCTION VALUE =	0.2731403	NUMBER OF BRANCH AND BOUND ITERATIONS =	1573
BEST OBJECTIVE FUNCTION VALUE =	0.4673791	NUMBER OF BRANCH AND BOUND ITERATIONS =	3093

MPCODE HAS BEEN SUCCESSFULLY COMPLETED.

A REPORT BASED ON THE OPTIMAL SOLUTION WILL BE WRITTEN.

**** MPCODE STATISTICS ****

NUMBER OF BRANCH AND BOUND ITERATIONS PERFORMED: 3355   NUMBER OF BRANCH AND BOUND REINVERSIONS PERFORMED: 24

MAXIMUM NUMBER OF ITERATIONS PERFORMED BY A LINEAR PROGRAM: 85
MAXIMUM NUMBER OF REINVERSIONS PERFORMED BY A LINEAR PROGRAM: 2

NUMBER OF SOLUTIONS FOUND: 5   VALUE OF OBJECTIVE FUNCTION AT LAST SOLUTION: 0.467379

**** MAXBAND SOLUTION REPORT ****

THIS IS AN ARTERY PROBLEM.

NAME OF ARTERY: NO HALSTED ST   NUMBER OF INTERSECTIONS: 13
ARTERY IS ENTERED FROM: NORTH   UNITS: ENGLISH

*** ARTERY WIDE INFORMATION ***

CYCLE TIME: 63.54 SECS   SOUTHBOUND BANDWIDTH (B(1)): 0.2337 (FRACTION OF CYCLE)   NORTHBOUND BANDWIDTH (B(2)): 0.2337 (FRACTION OF CYCLE)

EFFICIENCY(%): 23.37   ATTAINABILITY(%): 93.48

(EFFICIENCY - AVERAGE FRACTION OF CYCLE LENGTH FOR PROGRESSION)
(ATTAINABILITY - AVERAGE FRACTION OF ARTERIAL MINIMUM THROUGH GREENS FOR PROGRESSION)

OBJECTIVE FUNCTION (C(1)B(1) + C(2)B(2)): 0.467379

ALL PHASE STARTING TIMES ARE RELATIVE TO THE START OF GREEN IN THE SOUTHBOUND DIRECTION AT SIGNAL 1.

*** INTERSECTION INFORMATION ***

SIGNAL NO.	NODE NO.	SEQUENCE NO.	CROSS STREET NAME	LEFT TURN PATTERN SELECTED	SIGNAL NO.
1	1	1	ROOSEVELT	3	1
2	2	2	14ST ST		
3	3	3	16TH ST		
4	4	4	CANALPORT		
5	5	5	18TH ST		
6	6	6	CERMAK		
7	7	7	ARCHER		
8	8	8	26TH ST		
9	9	9	29TH ST		
10	10	10	31ST ST	3	10
11	12	11	33RD ST		
12	14	12	37TH ST		
13	15	13	39TH ST	3	13

** PHASE SETTINGS -- FRACTIONS OF CYCLE **

		- - - - GREEN - - - -			- - - - LEFT - - - -			- - - - RED - - - -			- - - - - - - - BAND - - - - - - - -			
SIGNAL NO.	DIRECTION	BEGIN	END	DURATION	BEGIN	END	DURATION	BEGIN	END	DURATION	BEGIN	END	DURATION	ADVANCED BY QUEUE CLEAR TIME
1	SOUTHBOUND	.0000	.4233	0.4233	.8958	.1733	0.2775	.4233	.0000	0.5767	.0000	.2337	0.2337	0.0000
	NORTHBOUND	.1733	.4233	0.2500	.8958	.0000	0.1042	.4233	.1733	0.7500	.1896	.4233	0.2337	0.0000
2	SOUTHBOUND	.3491	.0741	0.7250			0.0000	.0741	.3491	0.2750	.4721	.7058	0.2337	0.0000
	NORTHBOUND	.3491	.0741	0.7250			0.0000	.0741	.3491	0.2750	.7174	.9511	0.2337	0.0000
3	SOUTHBOUND	.3491	.0741	0.7250			0.0000	.0741	.3491	0.2750	.7940	.0277	0.2337	0.0000
	NORTHBOUND	.3491	.0741	0.7250			0.0000	.0741	.3491	0.2750	.3955	.6292	0.2337	0.0000
4	SOUTHBOUND	.8725	.4792	0.6067			0.0000	.4792	.8725	0.3933	.0265	.2602	0.2337	0.0000
	NORTHBOUND	.8725	.4792	0.6067			0.0000	.4792	.8725	0.3933	.0915	.3252	0.2337	0.0000
5	SOUTHBOUND	.4264	.0147	0.5883			0.0000	.0147	.4264	0.4117	.4736	.7073	0.2337	0.0000
	NORTHBOUND	.4264	.0147	0.5883			0.0000	.0147	.4264	0.4117	.7338	.9675	0.2337	0.0000
6	SOUTHBOUND	.3713	.0519	0.6806			0.0000	.0519	.3713	0.3194	.7419	.9755	0.2337	0.0000
	NORTHBOUND	.3713	.0519	0.6806			0.0000	.0519	.3713	0.3194	.4477	.6814	0.2337	0.0000

** PHASE SETTINGS -- FRACTIONS OF CYCLE **

SIGNAL NO.	DIRECTION	GREEN BEGIN	GREEN END	GREEN DURATION	LEFT BEGIN	LEFT END	LEFT DURATION	RED BEGIN	RED END	RED DURATION	BAND BEGIN	BAND END	BAND DURATION	ADVANCED BY QUEUE CLEAR TIME
7	SOUTHBOUND	.4079	.9885	0.5806			0.0000	.9885	.4079	0.4194	.4483	.6819	0.2337	0.0000
	NORTHBOUND	.4079	.9885	0.5806			0.0000	.9885	.4079	0.4194	.7145	.9482	0.2337	0.0000
8	SOUTHBOUND	.3944	.0914	0.6970			0.0000	.0914	.3944	0.3030	.7880	.0217	0.2337	0.0000
	NORTHBOUND	.3944	.0914	0.6970			0.0000	.0914	.3944	0.3030	.4641	.6978	0.2337	0.0000
9	SOUTHBOUND	.8402	.5652	0.7250			0.0000	.5652	.8402	0.2750	.1815	.4152	0.2337	0.0000
	NORTHBOUND	.8402	.5652	0.7250			0.0000	.5652	.8402	0.2750	.9902	.2239	0.2337	0.0000
10	SOUTHBOUND	.4746	.8891	0.4145	.3746	.5342	0.1596	.8891	.4746	0.5855	.6554	.8891	0.2337	0.0000
	NORTHBOUND	.5342	.8891	0.3549	.3746	.4746	0.1000	.8891	.5342	0.6451	.5342	.7679	0.2337	0.0000
11	SOUTHBOUND	.8348	.5352	0.7005			0.0000	.5352	.8348	0.2995	.0846	.3183	0.2337	0.0000
	NORTHBOUND	.8348	.5352	0.7005			0.0000	.5352	.8348	0.2995	.0517	.2854	0.2337	0.0000
12	SOUTHBOUND	.8091	.5341	0.7250			0.0000	.5341	.8091	0.2750	.0235	.2572	0.2337	0.0000
	NORTHBOUND	.8091	.5341	0.7250			0.0000	.5341	.8091	0.2750	.0860	.3197	0.2337	0.0000
13	SOUTHBOUND	.5868	.8368	0.2500	.4868	.5868	0.1000	.8368	.5868	0.7500	.5868	.8205	0.2337	0.0000
	NORTHBOUND	.5868	.8368	0.2500	.4868	.5868	0.1000	.8368	.5868	0.7500	.6031	.8368	0.2337	0.0000

** PHASE SETTINGS -- SECONDS **

SIGNAL NO.	DIRECTION	GREEN BEGIN	GREEN END	GREEN DURATION	LEFT BEGIN	LEFT END	LEFT DURATION	RED BEGIN	RED END	RED DURATION	BAND BEGIN	BAND END	BAND DURATION	ADVANCED BY QUEUE CLEAR TIME
1	SOUTHBOUND	0.0	26.9	26.9	56.9	11.0	17.6	26.9	0.0	36.6	0.0	14.8	14.8	0.0
	NORTHBOUND	11.0	26.9	15.9	56.9	0.0	6.6	26.9	11.0	47.7	12.0	26.9	14.8	0.0
2	SOUTHBOUND	22.2	4.7	46.1			0.0	4.7	22.2	17.5	30.0	44.8	14.8	0.0
	NORTHBOUND	22.2	4.7	46.1			0.0	4.7	22.2	17.5	45.6	60.4	14.8	0.0
3	SOUTHBOUND	22.2	4.7	46.1			0.0	4.7	22.2	17.5	50.5	1.8	14.8	0.0
	NORTHBOUND	22.2	4.7	46.1			0.0	4.7	22.2	17.5	25.1	40.0	14.8	0.0
4	SOUTHBOUND	55.4	30.5	38.6			0.0	30.5	55.4	25.0	1.7	16.5	14.8	0.0
	NORTHBOUND	55.4	30.5	38.6			0.0	30.5	55.4	25.0	5.8	20.7	14.8	0.0
5	SOUTHBOUND	27.1	0.9	37.4			0.0	0.9	27.1	26.2	30.1	44.9	14.8	0.0
	NORTHBOUND	27.1	0.9	37.4			0.0	0.9	27.1	26.2	46.6	61.5	14.8	0.0
6	SOUTHBOUND	23.6	3.3	43.2			0.0	3.3	23.6	20.3	47.1	62.0	14.8	0.0
	NORTHBOUND	23.6	3.3	43.2			0.0	3.3	23.6	20.3	28.4	43.3	14.8	0.0
7	SOUTHBOUND	25.9	62.8	36.9			0.0	62.8	25.9	26.7	28.5	43.3	14.8	0.0
	NORTHBOUND	25.9	62.8	36.9			0.0	62.8	25.9	26.7	45.4	60.2	14.8	0.0

0.0 62.8 25.9 26.7 45.4 60.2 14.8 0.0

I - MA[illegible]AND [illegible]

** PHASE SETTINGS — SECONDS **

SIGNAL NO.	DIRECTION	GREEN BEGIN	GREEN END	GREEN DURATION	LEFT BEGIN	LEFT END	LEFT DURATION	RED BEGIN	RED END	RED DURATION	[illegible] BEGIN	[illegible] END	[illegible] DURATION	ADVANCED BY QUEUE CLEAR TIME
8	SOUTHBOUND	25.1	5.8	44.3			0.0	5.8	25.1	19.3	50.1	1.4	14.8	0.0
	NORTHBOUND	25.1	5.8	44.3			0.0	5.8	25.1	19.3	29.5	44.3	14.8	0.0
9	SOUTHBOUND	53.4	35.9	46.1			0.0	35.9	53.4	17.5	11.5	26.4	14.8	0.0
	NORTHBOUND	53.4	35.9	46.1			0.0	35.9	53.4	17.5	62.9	14.2	14.8	0.0
10	SOUTHBOUND	30.2	56.5	26.3	23.8	33.9	10.1	56.5	30.2	37.2	41.6	56.5	14.8	0.0
	NORTHBOUND	33.9	56.5	22.6	23.8	30.2	6.4	56.5	33.9	41.0	33.9	48.8	14.8	0.0
11	SOUTHBOUND	53.0	34.0	44.5			0.0	34.0	53.0	19.0	5.4	20.2	14.8	0.0
	NORTHBOUND	53.0	34.0	44.5			0.0	34.0	53.0	19.0	3.3	18.1	14.8	0.0
12	SOUTHBOUND	51.4	33.9	46.1			0.0	33.9	51.4	17.5	1.5	16.3	14.8	0.0
	NORTHBOUND	51.4	33.9	46.1			0.0	33.9	51.4	17.5	5.5	20.3	14.8	0.0
13	SOUTHBOUND	37.3	53.2	15.9	30.9	37.3	6.4	53.2	37.3	47.7	37.3	52.1	14.8	0.0
	NORTHBOUND	37.3	53.2	15.9	30.9	37.3	6.4	53.2	37.3	47.7	38.3	53.2	14.8	0.0

** PROGRESSION TIMES AND SPEEDS **

SIGNAL NO.		SOUTHBOUND LENGTH (FEET)	SOUTHBOUND PROGRESSION TRAVERSAL TIME (SECS)	SOUTHBOUND PROGRESSION SPEED (MILES/HOUR)	NORTHBOUND LENGTH (FEET)	NORTHBOUND PROGRESSION TRAVERSAL TIME (SECS)	NORTHBOUND PROGRESSION SPEED (MILES/HOUR)
1	---------	1320.00	30.00	30.00	1320.00	30.00	30.00
2	---------	900.00	20.45	30.00	900.00	20.45	30.00
3	---------	650.00	14.77	30.00	850.00	19.32	30.00
4	---------	1250.00	28.41	30.00	1000.00	22.73	30.00
5	---------	750.00	17.05	30.00	800.00	18.18	30.00
6	---------	1975.00	44.89	30.00	2050.00	46.59	30.00
7	---------	950.00	21.59	30.00	700.00	15.91	30.00
8	---------	1100.00	25.00	30.00	1325.00	30.11	30.00
9	---------	1325.00	30.11	30.00	1275.00	28.98	30.00
10	---------	1200.00	27.27	30.00	1349.00	30.66	30.00
11	---------	2625.00	59.66	30.00	2700.00	61.36	30.00
12	---------	1575.00	35.80	30.00	1350.00	30.68	30.00
13							
ENTIRE ARTERY		15620.00	355.00	30.00	15619.00	354.98	30.00

*** MAXBAND TIME-SPACE DIAGRAM ***

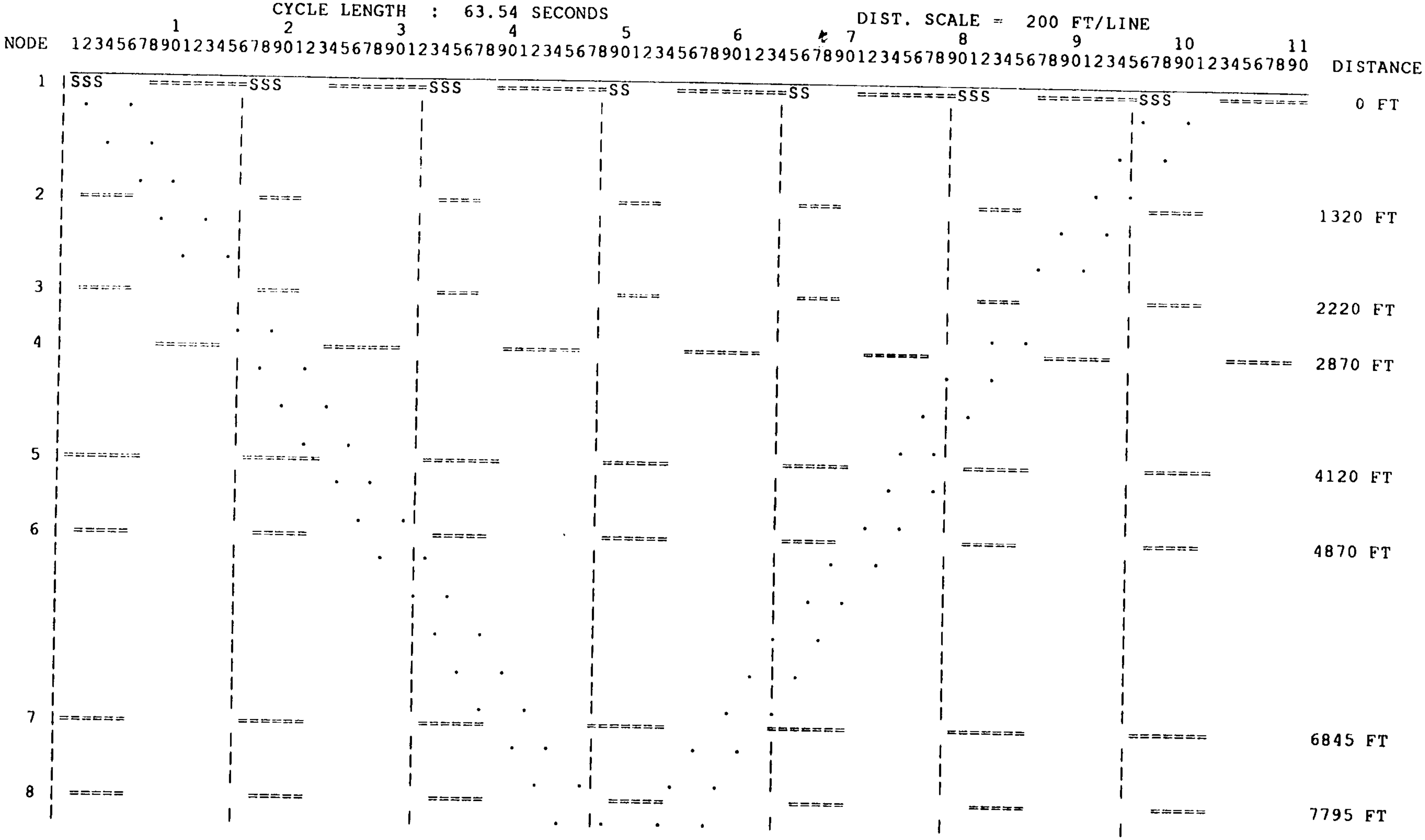
**** WARNING **** THE TIME SCALE HAS BEEN CHANGED TO 4 SEC/CHAR.
THE ORIGINAL INPUT SCALE OF 2 SEC/CHAR CANNOT ACCOMMODATE A T-S PLOT WITH
PROGRESSION BANDS OF BOTH DIRECTIONS FULLY SHOWN.

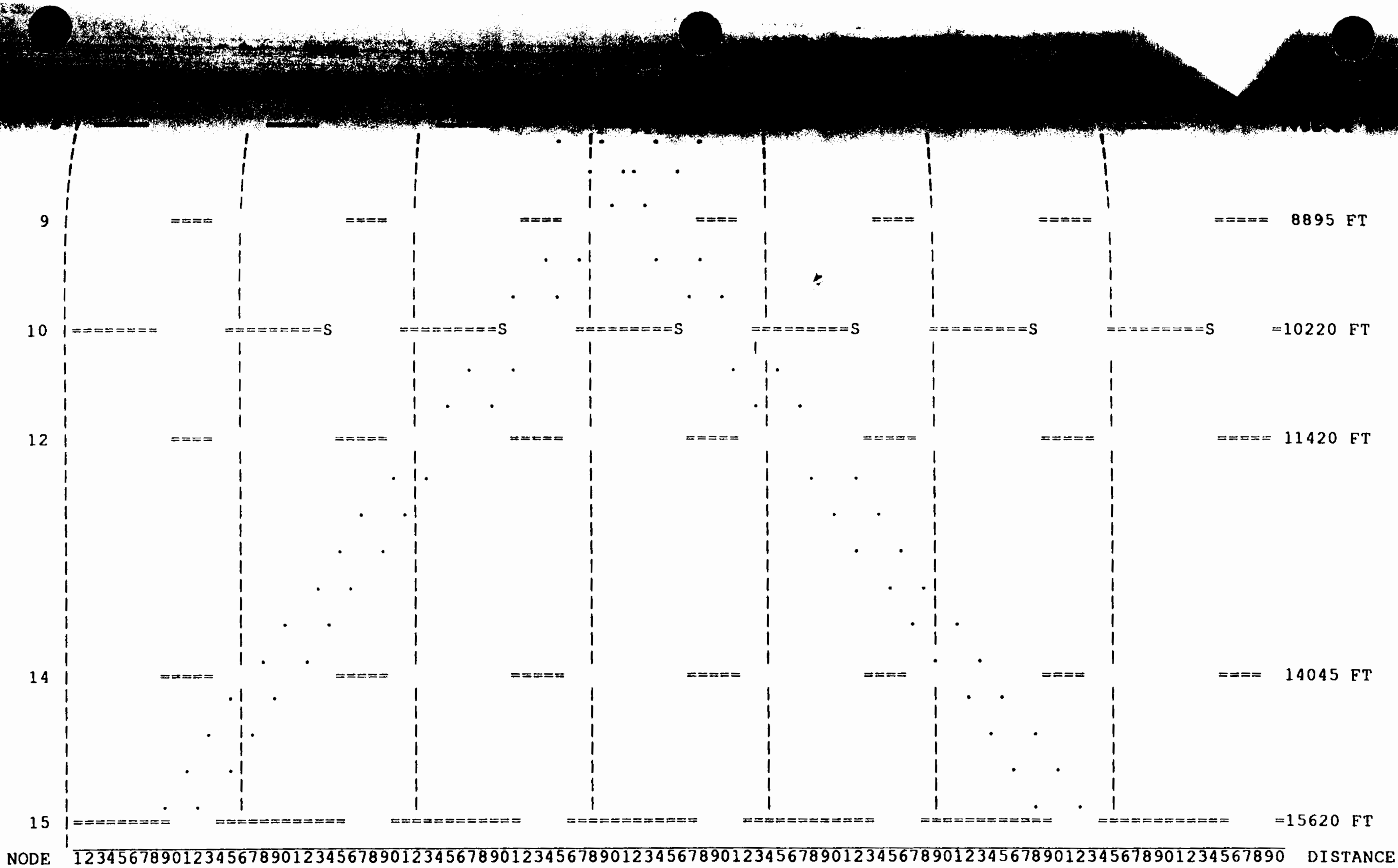
NAME OF ARTERY: NO HALSTED ST

TIME SCALE = 4 SEC/CHAR

CYCLE LENGTH : 63.54 SECONDS

DIST. SCALE = 200 FT/LINE





NODE 1 ---> NODE 15: SOUTHBOUND DIRECTION (DOWN)
NODE 15 ---> NODE 1: NORTHBOUND DIRECTION (UP)
SOUTHBOUND BAND = 14.8 SECONDS AT 30.0 MILES/HOUR
NORTHBOUND BAND = 14.8 SECONDS AT 30.0 MILES/HOUR

SSS SOUTHBOUND GREEN (DOWN)
NNN NORTHBOUND GREEN (UP)
GREEN IN BOTH DIRECTIONS
=== RED IN BOTH DIRECTIONS

**** SUMMARY OF MAXBAND BEST SIGNAL TIMING SOLUTION ****

*-[MASTER INTERSECTION] = INTERSECTION NO. 1 CYCLE LENGTH = 63.54 SEC

INTERSECTION NO. 1

ROOSEVELT (E-W) AT NO HALSTED ST (N-S)

	- MAIN STREET -			- CROSS STREET -			-- BAND COORDINATES --				-- QUEUE CLEARANCE --	
PHASE NUMBER	1	2	3			4	OUTBOUND		INBOUND		OUTBOUND	INBOUND
NEMA MOVEMENTS	1+5	2+5	2+6	-	-	4+8	BEGIN	END	BEGIN	END		
PHASE (SEC)	6.6	11.0	15.9	-	-	30.0	0.0	14.8	12.0	26.9	0.0	0.0
PHASE (%)	10.4	17.3	25.0	-	-	47.3	0.0	23.4	19.0	42.3	0.0	0.0
PIN SET (%) 100 /	0.0	10.4	27.7	-	-	52.7	0.0	23.4	19.0	42.3		

OFFSET POINT = 56.9 SEC (89.6%). REFERENCED TO START OF PHASE NUMBER 1.

INTERSECTION NO. 2

14ST ST (E-W) AT NO HALSTED ST (N-S)

	- MAIN STREET -			- CROSS STREET -			-- BAND COORDINATES --				-- QUEUE CLEARANCE --	
PHASE NUMBER		1				2	OUTBOUND		INBOUND		OUTBOUND	INBOUND
NEMA MOVEMENTS	-	2+6	-	-	-	4+8	BEGIN	END	BEGIN	END		
PHASE (SEC)	-	46.1	-	-	-	17.5	30.0	44.8	45.6	60.4	0.0	0.0
PHASE (%)	-	72.5	-	-	-	27.5	47.2	70.6	71.7	95.1	0.0	0.0
PIN SET (%) 100 /	0.0	0.0	-	-	-	72.5	47.2	70.6	71.7	95.1		

OFFSET POINT = 22.2 SEC (34.9%). REFERENCED TO START OF PHASE NUMBER 1.

INTERSECTION NO. 3

16TH ST (E-W) AT NO HALSTED ST (N-S)

	- MAIN STREET -			- CROSS STREET -			-- BAND COORDINATES --				-- QUEUE CLEARANCE --	
PHASE NUMBER		1				2	OUTBOUND		INBOUND		OUTBOUND	INBOUND
NEMA MOVEMENTS	-	2+6	-	-	-	4+8	BEGIN	END	BEGIN	END		
PHASE (SEC)	-	46.1	-	-	-	17.5	50.5	1.8	25.1	40.0	0.0	0.0
PHASE (%)	-	72.5	-	-	-	27.5	79.4	2.8	39.6	62.9	0.0	0.0
PIN SET (%) 100 /	0.0	0.0	-	-	-	72.5	79.4	2.8	39.6	62.9		

OFFSET POINT = 22.2 SEC (34.9%). REFERENCED TO START OF PHASE NUMBER 1.

INTERSECTION NO. 4

CANALPORT (E-W) AT NO HALSTED ST (N-S)

		- MAIN STREET -			- CROSS STREET -			-- BAND COORDINATES --				-- QUEUE CLEARANCE --	
PHASE NUMBER			1				2	OUTBOUND		INBOUND		OUTBOUND	INBOUND
NEMA MOVEMENTS		-	2+6	-	-	-	4+8	BEGIN	END	BEGIN	END		
PHASE (SEC)		-	38.6	-	-	-	25.0	1.7	16.5	5.8	20.7	0.0	0.0
PHASE (%)		-	60.7	-	-	-	39.3	2.7	26.0	9.2	32.5	0.0	0.0
PIN SET (%)	100 /	0.0	0.0	-	-	-	60.7	2.7	26.0	9.2	32.5		

OFFSET POINT = 55.4 SEC (87.3%). REFERENCED TO START OF PHASE NUMBER 1.

INTERSECTION NO. 5

18TH ST (E-W) AT NO HALSTED ST (N-S)

		- MAIN STREET -			- CROSS STREET -			-- BAND COORDINATES --				-- QUEUE CLEARANCE --	
PHASE NUMBER			1				2	OUTBOUND		INBOUND		OUTBOUND	INBOUND
NEMA MOVEMENTS		-	2+6	-	-	-	4+8	BEGIN	END	BEGIN	END		
PHASE (SEC)		-	37.4	-	-	-	26.2	30.1	44.9	46.6	61.5	0.0	0.0
PHASE (%)		-	58.8	-	-	-	41.2	47.4	70.7	73.4	96.8	0.0	0.0
PIN SET (%)	100 /	0.0	0.0	-	-	-	58.8	47.4	70.7	73.4	96.8		

OFFSET POINT = 27.1 SEC (42.6%). REFERENCED TO START OF PHASE NUMBER 1.

INTERSECTION NO. 6

CERMAK (E-W) AT NO HALSTED ST (N-S)

		- MAIN STREET -			- CROSS STREET -			-- BAND COORDINATES --				-- QUEUE CLEARANCE --	
PHASE NUMBER			1				2	OUTBOUND		INBOUND		OUTBOUND	INBOUND
NEMA MOVEMENTS		-	2+6	-	-	-	4+8	BEGIN	END	BEGIN	END		
PHASE (SEC)		-	43.2	-	-	-	20.3	47.1	62.0	28.4	43.3	0.0	0.0
PHASE (%)		-	68.1	-	-	-	31.9	74.2	97.6	44.8	68.1	0.0	0.0
PIN SET (%)	100 /	0.0	0.0	-	-	-	68.1	74.2	97.6	44.8	68.1		

OFFSET POINT = 23.6 SEC (37.1%). REFERENCED TO START OF PHASE NUMBER 1.

**** SUMMARY OF MAXBAND BEST SIGNAL TIMING SOLUTION (CONTINUED) ****

INTERSECTION NO. 7

ARCHER (E-W) AT NO HALSTED ST (N-S)

		- MAIN STREET -			- CROSS STREET -			-- BAND COORDINATES --				-- QUEUE CLEARANCE --	
PHASE NUMBER			1				2	OUTBOUND		INBOUND		OUTBOUND	INBOUND
NEMA MOVEMENTS		-	2+6	-	-	-	4+8	BEGIN	END	BEGIN	END		
PHASE (SEC)		-	36.9	-	-	-	26.7	28.5	43.3	45.4	60.2		
PHASE (%)		-	58.1	-	-	-	41.9	44.8	68.2	71.4	94.8	0.0	0.0
PIN SET (%)	100 / 0.0		0.0	-	-	-	58.1	44.8	68.2	71.4	94.8	0.0	0.0

OFFSET POINT = 25.9 SEC (40.8%). REFERENCED TO START OF PHASE NUMBER 1.

INTERSECTION NO. 8

26TH ST (E-W) AT NO HALSTED ST (N-S)

		- MAIN STREET -			- CROSS STREET -			-- BAND COORDINATES --				-- QUEUE CLEARANCE --	
PHASE NUMBER			1				2	OUTBOUND		INBOUND		OUTBOUND	INBOUND
NEMA MOVEMENTS		-	2+6	-	-	-	4+8	BEGIN	END	BEGIN	END		
PHASE (SEC)		-	44.3	-	-	-	19.3	50.1	1.4	29.5	44.3		
PHASE (%)		-	69.7	-	-	-	30.3	78.8	2.2	46.4	69.8	0.0	0.0
PIN SET (%)	100 / 0.0		0.0	-	-	-	69.7	78.8	2.2	46.4	69.8	0.0	0.0

OFFSET POINT = 25.1 SEC (39.4%). REFERENCED TO START OF PHASE NUMBER 1.

INTERSECTION NO. 9

29TH ST (E-W) AT NO HALSTED ST (N-S)

		- MAIN STREET -			- CROSS STREET -			-- BAND COORDINATES --				-- QUEUE CLEARANCE --	
PHASE NUMBER			1				2	OUTBOUND		INBOUND		OUTBOUND	INBOUND
NEMA MOVEMENTS		-	2+6	-	-	-	4+8	BEGIN	END	BEGIN	END		
PHASE (SEC)		-	46.1	-	-	-	17.5	11.5	26.4	62.9	14.2		
PHASE (%)		-	72.5	-	-	-	27.5	18.1	41.5	99.0	22.4	0.0	0.0
PIN SET (%)	100 / 0.0		0.0	-	-	-	72.5	18.1	41.5	99.0	22.4	0.0	0.0

OFFSET POINT = 53.4 SEC (84.0%). REFERENCED TO START OF PHASE NUMBER 1.

**** SUMMARY OF MAXBAND [illegible]

INTERSECTION NO. 10

31ST ST (E-W) AT NO HALSTED ST (N-S)

		- MAIN STREET -			- CROSS STREET -			-- BAND COORDINATES --				-- QUEUE CLEARANCE --	
								OUTBOUND		INBOUND		OUTBOUND	INBOUND
PHASE NUMBER		1	2	3			4						
NEMA MOVEMENTS		1+5	2+5	2+6	-	-	4+8	BEGIN	END	BEGIN	END		
PHASE (SEC)		6.4	3.8	22.6	-	-	30.9	41.6	56.5	33.9	48.8	0.0	0.0
PHASE (%)		10.0	6.0	35.5	-	-	48.6	65.5	88.9	53.4	76.8	0.0	0.0
PIN SET (%)	100 /	0.0	10.0	16.0	-	-	51.4	65.5	88.9	53.4	76.8		

OFFSET POINT = 23.8 SEC (37.5%). REFERENCED TO START OF PHASE NUMBER 1.

INTERSECTION NO. 12

33RD ST (E-W) AT NO HALSTED ST (N-S)

		- MAIN STREET -			- CROSS STREET -			-- BAND COORDINATES --				-- QUEUE CLEARANCE --	
								OUTBOUND		INBOUND		OUTBOUND	INBOUND
PHASE NUMBER			1				2						
NEMA MOVEMENTS		-	2+6	-	-	-	4+8	BEGIN	END	BEGIN	END		
PHASE (SEC)		-	44.5	-	-	-	19.0	5.4	20.2	3.3	18.1	0.0	0.0
PHASE (%)		-	70.0	-	-	-	30.0	8.5	31.8	5.2	28.5	0.0	0.0
PIN SET (%)	100 /	0.0	0.0	-	-	-	70.0	8.5	31.8	5.2	28.5		

OFFSET POINT = 53.0 SEC (83.5%). REFERENCED TO START OF PHASE NUMBER 1.

INTERSECTION NO. 14

37TH ST (E-W) AT NO HALSTED ST (N-S)

		- MAIN STREET -			- CROSS STREET -			-- BAND COORDINATES --				-- QUEUE CLEARANCE --	
								OUTBOUND		INBOUND		OUTBOUND	INBOUND
PHASE NUMBER			1				2						
NEMA MOVEMENTS		-	2+6	-	-	-	4+8	BEGIN	END	BEGIN	END		
PHASE (SEC)		-	46.1	-	-	-	17.5	1.5	16.3	5.5	20.3	0.0	0.0
PHASE (%)		-	72.5	-	-	-	27.5	2.3	25.7	8.6	32.0	0.0	0.0
PIN SET (%)	100 /	0.0	0.0	-	-	-	72.5	2.3	25.7	8.6	32.0		

OFFSET POINT = 51.4 SEC (80.9%). REFERENCED TO START OF PHASE NUMBER 1.

**** SUMMARY OF MAXBAND BEST SIGNAL TIMING SOLUTION (CONTINUED) ****

INTERSECTION NO. 15

39TH ST (E-W) AT NO HALSTED ST (N-S)

	- MAIN STREET -			- CROSS STREET -			-- BAND COORDINATES --				-- QUEUE CLEARANCE --	
PHASE NUMBER	1		2			3	OUTBOUND		INBOUND		OUTBOUND	INBOUND
NEMA MOVEMENTS	1+5	-	2+6	-	-	4+8	BEGIN	END	BEGIN	END		
PHASE (SEC)	6.4	-	15.9	-	-	41.3	37.3	52.1	38.3	53.2	0.0	0.0
PHASE (%)	10.0	-	25.0	-	-	65.0	58.7	82.0	60.3	83.7	0.0	0.0
PIN SET (%) 100 /	0.0	-	10.0	-	-	35.0	58.7	82.0	60.3	83.7		

OFFSET POINT = 30.9 SEC (48.7%). REFERENCED TO START OF PHASE NUMBER 1.

*** MAXBAND BEST SOLUTION ***

NEMA MOVEMENT NUMBERS

=============================

CROSS STREET

```
                                     4 | | 7          |
             INBOUND                   | |            |   T------ 6           INBOUND
             <-------                  | L            |      L--- 1           <-------
                                      T  L            |    L
                                                      |
 MAIN STREET                        ------- INTERSECTION -------
                                                      |
                                          L           |    L   T
             OUTBOUND               5 ---L            |     L  |              OUTBOUND
             ------->               2 ------T         |      | |              ------->
                                                      |    3 | | 8
```

**** MAXBAND END ****

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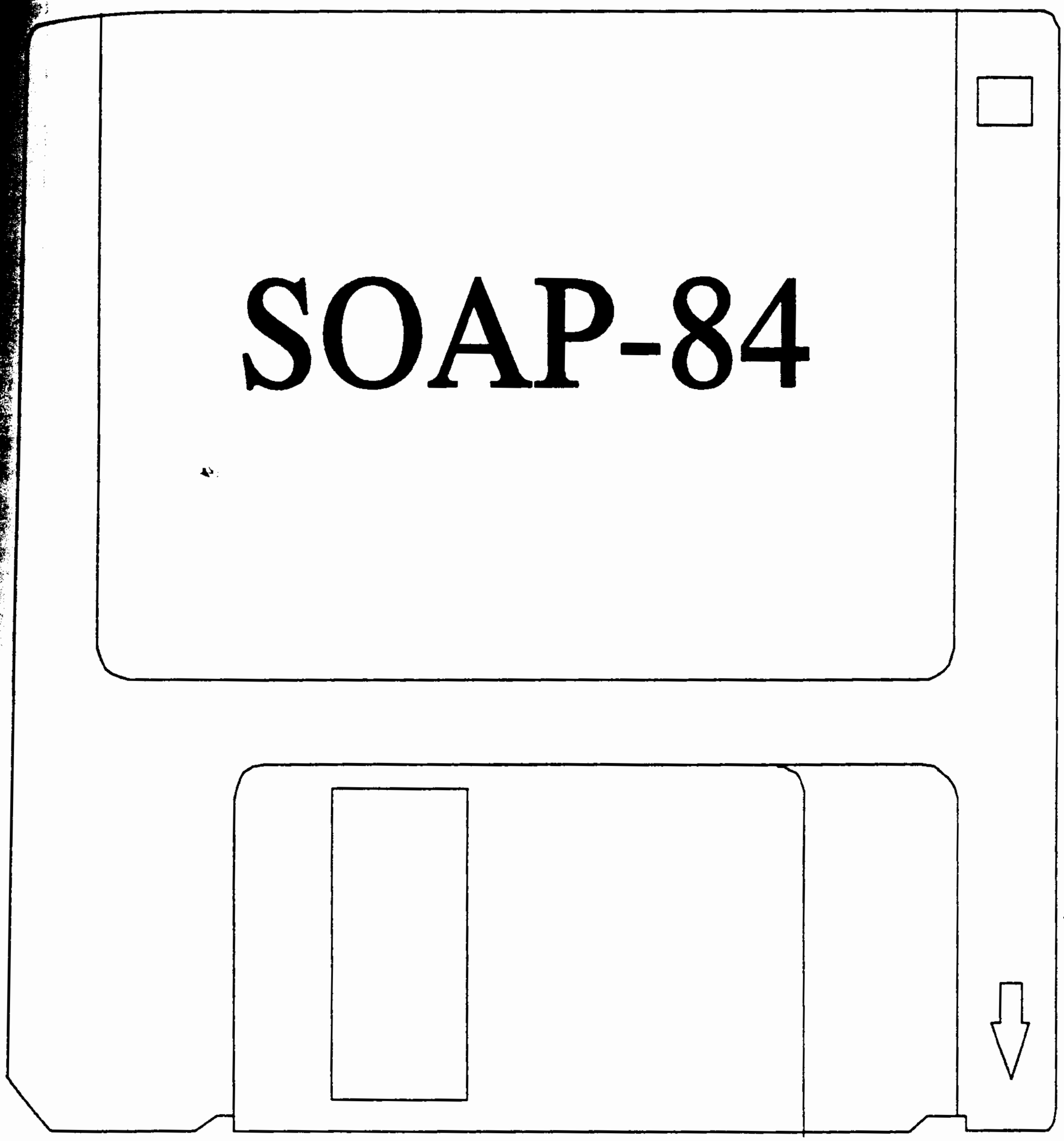
SOAP-84

Editor's Note: The newer SOAP-84 Release 84.04 uses the NEMA phase numbering scheme.

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*****************************************************************************************************************

VERSION: 84.02                                                                            RELEASE:  APRIL, 1985
                              S I G N A L   O P E R A T I O N S   A N A L Y S I S   P A C K A G E

                                   OFFICE OF IMPLEMENTATION ...FEDERAL HIGHWAY ADMINISTRATION

                                       TECHNICAL SUPPORT MESSAGE CENTER:  (904) 392-0378

*****************************************************************************************************************


    -----------------------------
    S O A P   I N P U T   E C H O
    -----------------------------

     NO.  CARD ID A    B    NBT  NBL  SBT  SBL  EBT  EBL  WBT  WBL             COMMENT
    ----:-------- - ---- ---- ---- ---- ---- ---- ---- ---- ----++++-++++---------------:
       2 :BEGIN             700 1800   15                                    FLORIDA & GATOR:
       3 :     ***********************************************************               :
       4 :    THIS IS USERS MANUAL EXAMPLE NO. 3                                         :
       5 :     ***********************************************************               :
       6 :CONTROL 45  800    1              0    0    0    0    0                        :
        *** NOTE ... DEFAULT VALUE USED FOR CYCLE MIN.
        *** NOTE ... DEFAULT VALUE USED FOR CYCLE MAX.
       7 :CONTROL 60 1000    2              0    0    0    0    0                        :
        *** NOTE ... DEFAULT VALUE USED FOR CYCLE MIN.
        *** NOTE ... DEFAULT VALUE USED FOR CYCLE MAX.
       8 :CONTROL 30 1645    3              0    0    0    0    0                        :
        *** NOTE ... DEFAULT VALUE USED FOR CYCLE MIN.
        *** NOTE ... DEFAULT VALUE USED FOR CYCLE MAX.
       9 :VOLUME  15  700  200   30  225   40  120   25  190   45                        :
      10 :VOLUME  15  715  225   35  210   35  100   20  175   30                        :
      11 :VOLUME  15  730  230   45  230   40  120   25  195   50                        :
      12 :VOLUME  15  745  225   40  225   40  125   25  200   50                        :
      13 :VOLUME  15  800  250   35  250   35  100   30  175   55                        :
      14 :VOLUME  15  815  240   35  240   35  110   30  185   30                        :
      15 :VOLUME  15  830  225   35  225   40  120   25  190   45                        :
      16 :VOLUME  15  845  200   30  210   35  100   20  175   50                        :
      17 :VOLUME  60  900  600  100  600  100  400   50  700  100                        :
      18 :VOLUME  60 1000  525  115  675   95  300   50  650   90                        :
      19 :VOLUME  60 1400  585   80  555   90  375   75  525  105                        :
      20 :VOLUME  60 1500  560  115  600  120  400  100  600  110                        :
      21 :VOLUME  15 1600  180   30  205   40  140   25  210   45                        :
    ----:-------- - ---- ---- ---- ---- ---- ---- ---- ---- ----++++-++++---------------:
     NO.  CARD ID A    B    NBT  NBL  SBT  SBL  EBT  EBL  WBT  WBL             COMMENT
```

```
 NO.  CARD ID A    B    NBT  NBL  SBT  SBL  EBT  EBL  WBT  WBL              COMMENT
----:--------- - ---- ---- ---- ---- ---- ---- ---- ---- ----++++-++++----------------:
 22 :VOLUME   15 1615  205   35  190   35  120   20  185   30                          :
 23 :VOLUME   15 1630  210   45  210   40  140   25  205   50                          :
 24 :VOLUME   15 1645  205   40  205   40  145   25  220   50                          :
 25 :VOLUME   15 1700  230   35  230   35  120   30  195   55                          :
 26 :VOLUME   15 1715  220   35  220   35  130   30  205   30                          :
 27 :VOLUME   15 1730  205   35  205   40  140   25  210   45                          :
 28 :VOLUME   15 1745  180   30  190   35  120   20  195   50                          :
 29 :CAPACITY11  700    2    1    2    1    2    1    2    1                          :
 30 :MINGREEN         15   10   15   10   15   10   15   10                          :
 31 :HEADWAY  0                                                                      :
                          2.4       2.3       2.6       2.6                          :
    *** NOTE ... DEFAULT VALUE USED FOR LOST TIME.                                   :
    *** NOTE ... DEFAULT VALUE USED FOR NORTHBOUND THRU. HEADWAY.
    *** NOTE ... DEFAULT VALUE USED FOR SOUTHBOUND THRU. HEADWAY.
    *** NOTE ... DEFAULT VALUE USED FOR EASTBOUND  THRU. HEADWAY.
    *** NOTE ... DEFAULT VALUE USED FOR WESTBOUND  THRU. HEADWAY.
 32 :GROWTH   11  700 1.03 1.03 1.03 1.03 1.03 1.03 1.03 1.03
 33 :TRUCKS   11  700    5    0    5    0    5    0    5    0                          :
    *** NOTE ... NORTHBOUND LEFT. TRUCK FACTOR ASSUMED NOT TO EXIST.                 :
    *** NOTE ... SOUTHBOUND LEFT. TRUCK FACTOR ASSUMED NOT TO EXIST.
    *** NOTE ... EASTBOUND  LEFT. TRUCK FACTOR ASSUMED NOT TO EXIST.
    *** NOTE ... WESTBOUND  LEFT  TRUCK FACTOR ASSUMED NOT TO EXIST.
 34 :LEFTURN  0    0    0    1    0    1    0    0    0
 35 :SEQUENCE 0    0    0    0    0    0    0    0    0   ONS  EW                     :
 36 :DIAGRAM                                            OLT  ETW                     :
 37 :TABLE                                                                           :
 38 :RUN      1                                         ALL                          :
----:--------- - ---- ---- ---- ---- ---- ---- ---- ---- ----++++-++++----------------:
                                                                   EXAMPLE NO. 3    :
 NO.  CARD ID A    B    NBT  NBL  SBT  SBL  EBT  EBL  WBT  WBL              COMMENT

  *** WARNING: THE PERIODS BEGINNING AT THE FOLLOWING TIMES ARE
               EXCLUDED FROM THE COMPUTATIONS:

               1100. 1115. 1130. 1145. 1200. 1215. 1230. 1245.
               1300. 1315. 1330. 1345.
```

TABLE NO. 1
SPECIFIED VOLUMES (VEHICLES PER 15 MINUTE PERIOD)

VOLUME	TIME	1 - NBT	2 - NBL	3 - SBT	4 - SBL	5 - EBT	6 - EBL	7 - WBT	8 - WBL
1	700	200.000	30.000	225.000	40.000	120.000	25.000	190.000	45.000
2	715	225.000	35.000	210.000	35.000	100.000	20.000	175.000	30.000
3	730	230.000	45.000	230.000	40.000	120.000	25.000	195.000	50.000
4	745	225.000	40.000	225.000	40.000	125.000	25.000	200.000	50.000
5	800	250.000	35.000	250.000	35.000	100.000	30.000	175.000	55.000
6	815	240.000	35.000	240.000	35.000	110.000	30.000	185.000	30.000
7	830	225.000	35.000	225.000	40.000	120.000	25.000	190.000	45.000
8	845	200.000	30.000	210.000	35.000	100.000	20.000	175.000	50.000
9	900	150.000	25.000	150.000	25.000	100.000	12.500	175.000	25.000
10	915	150.000	25.000	150.000	25.000	100.000	12.500	175.000	25.000
11	930	150.000	25.000	150.000	25.000	100.000	12.500	175.000	25.000
12	945	150.000	25.000	150.000	25.000	100.000	12.500	175.000	25.000
13	1000	131.250	28.750	168.750	23.750	75.000	12.500	162.500	22.500
14	1015	131.250	28.750	168.750	23.750	75.000	12.500	162.500	22.500
15	1030	131.250	28.750	168.750	23.750	75.000	12.500	162.500	22.500

--- Remaining periods deleted from output.

TABLE NO. 2
SPECIFIED GROWTH FACTORS FOR VOLUME ADJUSTMENT

GROWTH	TIME	1 - NBT	2 - NBL	3 - SBT	4 - SBL	5 - EBT	6 - EBL	7 - WBT	8 - WBL
1	700	1.030	1.030	1.030	1.030	1.030	1.030	1.030	1.030
2	715	1.030	1.030	1.030	1.030	1.030	1.030	1.030	1.030
3	730	1.030	1.030	1.030	1.030	1.030	1.030	1.030	1.030
4	745	1.030	1.030	1.030	1.030	1.030	1.030	1.030	1.030
5	800	1.030	1.030	1.030	1.030	1.030	1.030	1.030	1.030
6	815	1.030	1.030	1.030	1.030	1.030	1.030	1.030	1.030
7	830	1.030	1.030	1.030	1.030	1.030	1.030	1.030	1.030
8	845	1.030	1.030	1.030	1.030	1.030	1.030	1.030	1.030
9	900	1.030	1.030	1.030	1.030	1.030	1.030	1.030	1.030
10	915	1.030	1.030	1.030	1.030	1.030	1.030	1.030	1.030
11	930	1.030	1.030	1.030	1.030	1.030	1.030	1.030	1.030
12	945	1.030	1.030	1.030	1.030	1.030	1.030	1.030	1.030
13	1000	1.030	1.030	1.030	1.030	1.030	1.030	1.030	1.030
14	1015	1.030	1.030	1.030	1.030	1.030	1.030	1.030	1.030
15	1030	1.030	1.030	1.030	1.030	1.030	1.030	1.030	1.030

--- Remaining periods deleted from output.

TABLE NO. 3
SPECIFIED PERCENTAGE OF TRUCKS FOR VOLUME ADJUSTMENT

TRUCKS	TIME	1 - NBT	2 - NBL	3 - SBT	4 - SBL	5 - EBT	6 - EBL	7 - WBT	8 - WBL
1	700	5.000	.000	5.000	.000	5.000	.000	5.000	.000
2	715	5.000	.000	5.000	.000	5.000	.000	5.000	.000
3	730	5.000	.000	5.000	.000	5.000	.000	5.000	.000
4	745	5.000	.000	5.000	.000	5.000	.000	5.000	.000
5	800	5.000	.000	5.000	.000	5.000	.000	5.000	.000
6	815	5.000	.000	5.000	.000	5.000	.000	5.000	.000
7	830	5.000	.000	5.000	.000	5.000	.000	5.000	.000
8	845	5.000	.000	5.000	.000	5.000	.000	5.000	.000
9	900	5.000	.000	5.000	.000	5.000	.000	5.000	.000
10	915	5.000	.000	5.000	.000	5.000	.000	5.000	.000
11	930	5.000	.000	5.000	.000	5.000	.000	5.000	.000
12	945	5.000	.000	5.000	.000	5.000	.000	5.000	.000
13	1000	5.000	.000	5.000	.000	5.000	.000	5.000	.000
14	1015	5.000	.000	5.000	.000	5.000	.000	5.000	.000
15	1030	5.000	.000	5.000	.000	5.000	.000	5.000	.000

--- Remaining periods deleted from output.

TABLE NO. 4
CALCULATED TRAFFIC VOLUMES (VEHICLES PER 15 MINUTE PERIOD)

XVOL	TIME	1 - NBT	2 - NBL	3 - SBT	4 - SBL	5 - EBT	6 - EBL	7 - WBT	8 - WBL
1	700	212.180	30.900	238.702	41.200	127.308	25.750	201.571	46.350
2	715	238.702	36.050	222.789	36.050	106.090	20.600	185.658	30.900
3	730	244.007	46.350	244.007	41.200	127.308	25.750	206.876	51.500
4	745	238.702	41.200	238.702	41.200	132.613	25.750	212.180	51.500
5	800	265.225	36.050	265.225	36.050	106.090	30.900	185.658	56.650
6	815	254.616	36.050	254.616	36.050	116.699	30.900	196.266	30.900
7	830	238.702	36.050	238.702	41.200	127.308	25.750	201.571	46.350
8	845	212.180	30.900	222.789	36.050	106.090	20.600	185.658	51.500
9	900	159.135	25.750	159.135	25.750	106.090	12.875	185.658	25.750
10	915	159.135	25.750	159.135	25.750	106.090	12.875	185.658	25.750
11	930	159.135	25.750	159.135	25.750	106.090	12.875	185.658	25.750
12	945	159.135	25.750	159.135	25.750	106.090	12.875	185.658	25.750
13	1000	139.243	29.612	179.027	24.462	79.567	12.875	172.396	23.175
14	1015	139.243	29.612	179.027	24.462	79.567	12.875	172.396	23.175
15	1030	139.243	29.612	179.027	24.462	79.567	12.875	172.396	23.175

--- Remaining periods deleted from output.

TABLE NO. 5
SPECIFIED SATURATION FLOW (# OF LANES OR VEHICLES PER HOUR OF GREEN TIME)

SATFLO	TIME	1 - NBT	2 - NBL	3 - SBT	4 - SBL	5 - EBT	6 - EBL	7 - WBT	8 - WBL
1	700	2.000	1.000	2.000	1.000	2.000	1.000	2.000	1.000
2	715	2.000	1.000	2.000	1.000	2.000	1.000	2.000	1.000
3	730	2.000	1.000	2.000	1.000	2.000	1.000	2.000	1.000
4	745	2.000	1.000	2.000	1.000	2.000	1.000	2.000	1.000
5	800	2.000	1.000	2.000	1.000	2.000	1.000	2.000	1.000
6	815	2.000	1.000	2.000	1.000	2.000	1.000	2.000	1.000
7	830	2.000	1.000	2.000	1.000	2.000	1.000	2.000	1.000
8	845	2.000	1.000	2.000	1.000	2.000	1.000	2.000	1.000
9	900	2.000	1.000	2.000	1.000	2.000	1.000	2.000	1.000
10	915	2.000	1.000	2.000	1.000	2.000	1.000	2.000	1.000
11	930	2.000	1.000	2.000	1.000	2.000	1.000	2.000	1.000
12	945	2.000	1.000	2.000	1.000	2.000	1.000	2.000	1.000
13	1000	2.000	1.000	2.000	1.000	2.000	1.000	2.000	1.000
14	1015	2.000	1.000	2.000	1.000	2.000	1.000	2.000	1.000
15	1030	2.000	1.000	2.000	1.000	2.000	1.000	2.000	1.000

--- Remaining periods deleted from output.

TABLE NO. 6
HEADWAYS (SEC./VEHICLE) TO BE USED IN SATURATION FLOW RATE CALCULATIONS IF THE # OF LANES WERE SPECIFIED

HDWY	TIME	1 - NBT	2 - NBL	3 - SBT	4 - SBL	5 - EBT	6 - EBL	7 - WBT	8 - WBL
1	0	2.200	2.400	2.200	2.300	2.200	2.600	2.200	2.600

TABLE NO. 7
CALCULATED SATURATION FLOWS (VEHICLES PER 15 MINUTES OF GREEN TIME)

XSAT	TIME	1 - NBT	2 - NBL	3 - SBT	4 - SBL	5 - EBT	6 - EBL	7 - WBT	8 - WBL
1	700	818.182	375.000	818.182	391.304	818.182	346.154	818.182	346.154
2	715	818.182	375.000	818.182	391.304	818.182	346.154	818.182	346.154
3	730	818.182	375.000	818.182	391.304	818.182	346.154	818.182	346.154
4	745	818.182	375.000	818.182	391.304	818.182	346.154	818.182	346.154
5	800	818.182	375.000	818.182	391.304	818.182	346.154	818.182	346.154
6	815	818.182	375.000	818.182	391.304	818.182	346.154	818.182	346.154
7	830	818.182	375.000	818.182	391.304	818.182	346.154	818.182	346.154
8	845	818.182	375.000	818.182	391.304	818.182	346.154	818.182	346.154
9	900	818.182	375.000	818.182	391.304	818.182	346.154	818.182	346.154
10	915	818.182	375.000	818.182	391.304	818.182	346.154	818.182	346.154
11	930	818.182	375.000	818.182	391.304	818.182	346.154	818.182	346.154
12	945	818.182	375.000	818.182	391.304	818.182	346.154	818.182	346.154
13	1000	818.182	375.000	818.182	391.304	818.182	346.154	818.182	346.154
14	1015	818.182	375.000	818.182	391.304	818.182	346.154	818.182	346.154
15	1030	818.182	375.000	818.182	391.304	818.182	346.154	818.182	346.154

--- Remaining periods deleted from output.

TABLE NO. 8
MINIMUM GREEN TIME PER CYCLE TO EACH MOVEMENT

MINGRN	TIME	1 - NBT	2 - NBL	3 - SBT	4 - SBL	5 - EBT	6 - EBL	7 - WBT	8 - WBL
1	0	15.000	10.000	15.000	10.000	15.000	10.000	15.000	10.000

TABLE NO. 10
SPECIFIED OR DEFAULT VALUES FROM CONTROL CARD PARAMETERS

CONTRL	TIME	CMIN	CMAX	RED
1	700	30.000	120.000	.000
2	715	30.000	120.000	.000
3	730	30.000	120.000	.000
4	745	30.000	120.000	.000
5	800	30.000	120.000	.000
6	815	30.000	120.000	.000
7	830	30.000	120.000	.000
8	845	30.000	120.000	.000
9	900	30.000	120.000	.000
10	915	30.000	120.000	.000
11	930	30.000	120.000	.000
12	945	30.000	120.000	.000
13	1000	30.000	120.000	.000
14	1015	30.000	120.000	.000
15	1030	30.000	120.000	.000

--- Remaining periods deleted from output.

TABLE NO. 19
LEFT TURN SATURATION FLOW BASED ON OPPOSING THRU VOLUME (PER 15 MINUTE PERIOD)

LFTSAT	TIME	1 - NBT	2 - NBL	3 - SBT	4 - SBL	5 - EBT	6 - EBL	7 - WBT	8 - WBL
1	700	.000	96.360	.000	111.799	.000	118.647	.000	179.877
2	715	.000	105.347	.000	96.360	.000	129.712	.000	202.587
3	730	.000	93.538	.000	93.538	.000	115.172	.000	179.877
4	745	.000	96.360	.000	96.360	.000	111.799	.000	174.609
5	800	.000	83.052	.000	83.052	.000	129.712	.000	202.587
6	815	.000	88.139	.000	88.139	.000	122.226	.000	190.895
7	830	.000	96.360	.000	96.360	.000	118.647	.000	179.877
8	845	.000	105.347	.000	111.799	.000	129.712	.000	202.587
9	900	.000	150.496	.000	150.496	.000	129.712	.000	202.587
10	915	.000	150.496	.000	150.496	.000	129.712	.000	202.587
11	930	.000	150.496	.000	150.496	.000	129.712	.000	202.587
12	945	.000	150.496	.000	150.496	.000	129.712	.000	202.587
13	1000	.000	134.622	.000	168.241	.000	139.718	.000	235.047
14	1015	.000	134.622	.000	168.241	.000	139.718	.000	235.047
15	1030	.000	134.622	.000	168.241	.000	139.718	.000	235.047

--- Remaining periods deleted from output.

TABLE NO. 20
VOLUME SATURATION FLOW RATIOS BASED ON UNADJUSTED VOLUMES

V/S	TIME	1 - NBT	2 - NBL	3 - SBT	4 - SBL	5 - EBT	6 - EBL	7 - WBT	8 - WBL
1	700	.259	.082	.292	.105	.156	.074	.246	.134
2	715	.292	.096	.272	.092	.130	.060	.227	.089
3	730	.298	.124	.298	.105	.156	.074	.253	.149
4	745	.292	.110	.292	.105	.162	.074	.259	.149
5	800	.324	.096	.324	.092	.130	.089	.227	.164
6	815	.311	.096	.311	.092	.143	.089	.240	.089
7	830	.292	.096	.292	.105	.156	.074	.246	.134
8	845	.259	.082	.272	.092	.130	.060	.227	.149
9	900	.194	.069	.194	.066	.130	.037	.227	.074
10	915	.194	.069	.194	.066	.130	.037	.227	.074
11	930	.194	.069	.194	.066	.130	.037	.227	.074
12	945	.194	.069	.194	.066	.130	.037	.227	.074
13	1000	.170	.079	.219	.063	.097	.037	.211	.067
14	1015	.170	.079	.219	.063	.097	.037	.211	.067
15	1030	.170	.079	.219	.063	.097	.037	.211	.067

--- Remaining periods deleted from output.

TABLE NO. 21
VOLUMES ADJUSTED FOR SNEAKERS AND PERMISSIVE LEFT TURNS (PER 15 MINUTE PERIOD)

ADJVOL	TIME	1 - NBT	2 - NBL	3 - SBT	4 - SBL	5 - EBT	6 - EBL	7 - WBT	8 - WBL
1	700	212.180	15.900	238.702	26.200	127.308	25.750	201.571	46.350
2	715	238.702	21.050	222.789	21.050	106.090	20.600	185.658	30.900
3	730	244.007	32.504	244.007	27.354	127.308	25.750	206.876	51.500
4	745	238.702	27.354	238.702	27.354	132.613	25.750	212.180	51.500
5	800	265.225	22.204	265.225	22.204	106.090	30.900	185.658	56.650
6	815	254.616	22.204	254.616	22.204	116.699	30.900	196.266	30.900
7	830	238.702	21.050	238.702	26.200	127.308	25.750	201.571	46.350
8	845	212.180	15.900	222.789	21.050	106.090	20.600	185.658	51.500
9	900	159.135	7.750	159.135	7.750	106.090	12.875	185.658	25.750
10	915	159.135	7.750	159.135	7.750	106.090	12.875	185.658	25.750
11	930	159.135	7.750	159.135	7.750	106.090	12.875	185.658	25.750
12	945	159.135	7.750	159.135	7.750	106.090	12.875	185.658	25.750
13	1000	139.243	13.249	179.027	8.099	79.567	12.875	172.396	23.175
14	1015	139.243	13.249	179.027	8.099	79.567	12.875	172.396	23.175
15	1030	139.243	13.249	179.027	8.099	79.567	12.875	172.396	23.175

--- Remaining periods deleted from output.

TABLE NO. 22
CRITICAL VOLUME SATURATION FLOW RATIOS FOR EACH PHASE BASED ON ADJUSTED VOLUMES

CRITY	TIME	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5	PHASE 6
1	700	.061	.292	.074	.112	.134	.000
2	715	.053	.292	.060	.138	.089	.000
3	730	.083	.298	.074	.104	.149	.000
4	745	.070	.292	.074	.111	.149	.000
5	800	.058	.324	.089	.063	.164	.000
6	815	.057	.311	.089	.151	.089	.000
7	830	.066	.292	.074	.112	.134	.000
8	845	.049	.272	.060	.078	.149	.000
9	900	.020	.194	.037	.153	.074	.000
10	915	.020	.194	.037	.153	.074	.000
11	930	.020	.194	.037	.153	.074	.000
12	945	.020	.194	.037	.153	.074	.000
13	1000	.034	.219	.037	.144	.067	.000
14	1015	.034	.219	.037	.144	.067	.000
15	1030	.034	.219	.037	.144	.067	.000

--- Remaining periods deleted from output.

TABLE NO. 23
SUM OF CRITICAL FLOW RATIOS FOR ALL PHASES

YCAP	TIME	TOTAL
1	700	.674
2	715	.631
3	730	.709
4	745	.695
5	800	.698
6	815	.698
7	830	.679
8	845	.608
9	900	.478
10	915	.478
11	930	.478
12	945	.478
13	1000	.501
14	1015	.501
15	1030	.501

--- Remaining periods deleted from output.

TABLE NO. 24
CYCLE LENGTH (SECONDS)

CYCLE	TIME	TOTAL
1	700	60.000
2	715	60.000
3	730	65.000
4	745	65.000
5	800	65.000
6	815	65.000
7	830	60.000
8	845	60.000
9	900	55.000
10	915	55.000
11	930	55.000
12	945	55.000
13	1000	50.000
14	1015	50.000
15	1030	50.000

--- Remaining periods deleted from output.

TABLE NO. 28
CALCULATED GREEN PLUS AMBER TIME FOR EACH PHASE (SECONDS PER CYCLE)

GRN/P	TIME	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5	PHASE 6
1	700	10.000	32.031	10.745	9.884	17.340	.000
2	715	10.000	32.031	10.745	9.884	17.340	.000
3	730	10.000	32.031	10.745	9.884	17.340	.000
4	745	10.000	32.031	10.745	9.884	17.340	.000
5	800	10.000	32.031	10.745	9.884	17.340	.000
6	815	10.000	32.031	10.745	9.884	17.340	.000
7	830	10.000	32.031	10.745	9.884	17.340	.000
8	845	10.000	32.031	10.745	9.884	17.340	.000
9	900	10.000	19.669	10.000	10.331	10.000	.000
10	915	10.000	19.669	10.000	10.331	10.000	.000
11	930	10.000	19.669	10.000	10.331	10.000	.000
12	945	10.000	19.669	10.000	10.331	10.000	.000
13	1000	10.000	19.669	10.000	10.331	10.000	.000
14	1015	10.000	19.669	10.000	10.331	10.000	.000
15	1030	10.000	19.669	10.000	10.331	10.000	.000
16	1045	10.000	19.669	10.000	10.331	10.000	.000

--- Remaining periods deleted from output.

TABLE NO. 29
GREEN PLUS AMBER TIME FOR EACH THRU MOVEMENT AND PROTECTED LEFT TURN (SECONDS PER CYCLE)

GRN/M	TIME	1 - NBT	2 - NBL	3 - SBT	4 - SBL	5 - EBT	6 - EBL	7 - WBT	8 - WBL
1	700	32.031	10.000	32.031	10.000	20.629	10.745	27.224	17.340
2	715	32.031	10.000	32.031	10.000	20.629	10.745	27.224	17.340
3	730	32.031	10.000	32.031	10.000	20.629	10.745	27.224	17.340
4	745	32.031	10.000	32.031	10.000	20.629	10.745	27.224	17.340
5	800	32.031	10.000	32.031	10.000	20.629	10.745	27.224	17.340
6	815	32.031	10.000	32.031	10.000	20.629	10.745	27.224	17.340
7	830	32.031	10.000	32.031	10.000	20.629	10.745	27.224	17.340
8	845	32.031	10.000	32.031	10.000	20.629	10.745	27.224	17.340
9	900	19.669	10.000	19.669	10.000	20.331	10.000	20.331	10.000
10	915	19.669	10.000	19.669	10.000	20.331	10.000	20.331	10.000
11	930	19.669	10.000	19.669	10.000	20.331	10.000	20.331	10.000
12	945	19.669	10.000	19.669	10.000	20.331	10.000	20.331	10.000
13	1000	19.669	10.000	19.669	10.000	20.331	10.000	20.331	10.000
14	1015	19.669	10.000	19.669	10.000	20.331	10.000	20.331	10.000
15	1030	19.669	10.000	19.669	10.000	20.331	10.000	20.331	10.000

--- Remaining periods deleted from output.

TABLE NO. 30
CALCULATED UNSATURATED GREEN TIME FOR UNPROTECTED LEFT TURNS (SECONDS PER CYCLE)

GRN U	TIME	1 - NBT	2 - NBL	3 - SBT	4 - SBL	5 - EBT	6 - EBL	7 - WBT	8 - WBL
1	700	.000	7.330	.000	10.511	.000	.000	.000	.000
2	715	.000	9.272	.000	7.330	.000	.000	.000	.000
3	730	.000	6.659	.000	6.659	.000	.000	.000	.000
4	745	.000	7.330	.000	7.330	.000	.000	.000	.000
5	800	.000	3.845	.000	3.845	.000	.000	.000	.000
6	815	.000	5.278	.000	5.278	.000	.000	.000	.000
7	830	.000	7.330	.000	7.330	.000	.000	.000	.000
8	845	.000	9.272	.000	10.511	.000	.000	.000	.000
9	900	.000	5.585	.000	5.585	.000	.000	.000	.000
10	915	.000	5.585	.000	5.585	.000	.000	.000	.000
11	930	.000	5.585	.000	5.585	.000	.000	.000	.000
12	945	.000	5.585	.000	5.585	.000	.000	.000	.000
13	1000	.000	3.892	.000	7.179	.000	.000	.000	.000
14	1015	.000	3.892	.000	7.179	.000	.000	.000	.000
15	1030	.000	3.892	.000	7.179	.000	.000	.000	.000
16	1045	.000	3.892	.000	7.179	.000	.000	.000	.000

--- Remaining periods deleted from output.

TABLE NO. 31
CALCULATED EFFECTIVE GREEN/CYCLE RATIO FOR EACH MOVEMENT (INCLUDING LEFT TURN RELEASE ADJUSTMENT)

LAMDA	TIME	1 - NBT	2 - NBL	3 - SBT	4 - SBL	5 - EBT	6 - EBL	7 - WBT	8 - WBL
1	700	.357	.136	.357	.150	.214	.091	.297	.173
2	715	.357	.145	.357	.135	.214	.091	.297	.173
3	730	.357	.133	.357	.132	.214	.091	.297	.173
4	745	.357	.136	.357	.135	.214	.091	.297	.173
5	800	.357	.123	.357	.123	.214	.091	.297	.173
6	815	.357	.128	.357	.127	.214	.091	.297	.173
7	830	.357	.136	.357	.135	.214	.091	.297	.173
8	845	.357	.145	.357	.150	.214	.091	.297	.173
9	900	.269	.187	.269	.186	.281	.108	.281	.108
10	915	.269	.187	.269	.186	.281	.108	.281	.108
11	930	.269	.187	.269	.186	.281	.108	.281	.108
12	945	.269	.187	.269	.186	.281	.108	.281	.108
13	1000	.269	.173	.269	.201	.281	.108	.281	.108
14	1015	.269	.173	.269	.201	.281	.108	.281	.108
15	1030	.269	.173	.269	.201	.281	.108	.281	.108

--- Remaining periods deleted from output.

TABLE NO. 33
CALCULATED DEGREE OF SATURATION (VOLUME/CAPACITY)   (IF X = 999.999, NO GREEN TIME)

X	TIME	1 - NBT	2 - NBL	3 - SBT	4 - SBL	5 - EBT	6 - EBL	7 - WBT	8 - WBL
1	700	.727	.611	.818	.714	.727	.821	.831	.774
2	715	.818	.668	.764	.695	.606	.657	.765	.516
3	730	.836	.936	.836	.811	.727	.821	.853	.860
4	745	.818	.815	.818	.794	.757	.821	.875	.860
5	800	.909	.789	.909	.766	.606	.986	.765	.946
6	815	.873	.758	.873	.738	.666	.986	.809	.516
7	830	.818	.713	.818	.794	.727	.821	.831	.774
8	845	.727	.573	.764	.624	.606	.657	.765	.860
9	900	.722	.370	.722	.361	.462	.343	.809	.687
10	915	.722	.370	.722	.361	.462	.343	.809	.687
11	930	.722	.370	.722	.361	.462	.343	.809	.687
12	945	.722	.370	.722	.361	.462	.343	.809	.687
13	1000	.632	.460	.812	.316	.347	.343	.751	.618
14	1015	.632	.460	.812	.316	.347	.343	.751	.618
15	1030	.632	.460	.812	.316	.347	.343	.751	.618

--- Remaining periods deleted from output.

TABLE NO. 36
CALCULATED VALUES OF UNIFORM DELAY (SECONDS/VEHICLE)

DELAYU	TIME	1 - NBT	2 - NBL	3 - SBT	4 - SBL	5 - EBT	6 - EBL	7 - WBT	8 - WBL
1	700	22.353	32.565	23.376	32.363	29.258	35.742	26.265	31.587
2	715	23.376	32.376	22.752	33.024	28.386	35.176	25.604	30.039
3	730	23.592	34.333	23.592	33.729	29.258	35.742	26.493	32.139
4	745	23.376	33.580	23.376	33.521	29.484	35.742	26.724	32.139
5	800	24.498	34.063	24.498	33.982	28.386	36.326	25.604	32.710
6	815	24.036	33.685	24.036	33.619	28.815	36.326	26.041	30.039
7	830	23.376	33.065	23.376	33.521	29.258	35.742	26.265	31.587
8	845	22.353	31.887	22.752	31.885	28.386	35.176	25.604	32.139
9	900	19.876	21.286	19.876	21.316	17.843	24.774	20.088	25.769
10	915	19.876	21.286	19.876	21.316	17.843	24.774	20.088	25.769
11	930	19.876	21.286	19.876	21.316	17.843	24.774	20.088	25.769
12	945	19.876	21.286	19.876	21.316	17.843	24.774	20.088	25.769
13	1000	19.293	22.280	20.494	20.429	17.202	24.774	19.675	25.564
14	1015	19.293	22.280	20.494	20.429	17.202	24.774	19.675	25.564
15	1030	19.293	22.280	20.494	20.429	17.202	24.774	19.675	25.564

--- Remaining periods deleted from output.

TABLE NO. 37
CALCULATED VALUES OF RANDOM AND SATURATION DELAY (SECONDS/VEHICLE)

DELAYR	TIME	1 - NBT	2 - NBL	3 - SBT	4 - SBL	5 - EBT	6 - EBL	7 - WBT	8 - WBL
1	700	1.901	5.821	2.942	7.308	3.019	15.217	3.672	8.671
2	715	2.942	6.653	2.246	7.479	1.860	9.818	2.673	3.627
3	730	3.238	15.952	3.238	10.914	3.019	15.217	4.111	11.454
4	745	2.942	11.105	2.942	10.238	3.434	15.217	4.620	11.454
5	800	4.905	10.970	4.905	10.063	1.860	20.755	2.673	14.910
6	815	3.960	9.746	3.960	8.966	2.358	20.755	3.292	3.627
7	830	2.942	8.088	2.942	10.238	3.019	15.217	3.672	8.671
8	845	1.901	4.846	2.246	5.433	1.860	9.818	2.673	11.454
9	900	2.402	1.818	2.402	1.709	.825	2.935	3.451	9.351
10	915	2.402	1.818	2.402	1.709	.825	2.935	3.451	9.351
11	930	2.402	1.818	2.402	1.709	.825	2.935	3.451	9.351
12	945	2.402	1.818	2.402	1.709	.825	2.935	3.451	9.351
13	1000	1.656	2.776	3.624	1.300	.514	2.935	2.635	7.607
14	1015	1.656	2.776	3.624	1.300	.514	2.935	2.635	7.607
15	1030	1.656	2.776	3.624	1.300	.514	2.935	2.635	7.607

--- Remaining periods deleted from output.

TABLE NO. 38
AVERAGE UNIT DELAY (SECONDS/VEHICLE)

AVDEL	TIME	1 - NBT	2 - NBL	3 - SBT	4 - SBL	5 - EBT	6 - EBL	7 - WBT	8 - WBL
1	700	24.254	38.386	26.318	39.671	32.277	50.959	29.937	40.257
2	715	26.318	39.030	24.998	40.504	30.246	44.994	28.277	33.665
3	730	26.830	50.285	26.830	44.643	32.277	50.959	30.604	43.593
4	745	26.318	44.685	26.318	43.759	32.918	50.959	31.345	43.593
5	800	29.403	45.033	29.403	44.045	30.246	57.080	28.277	47.620
6	815	27.997	43.431	27.997	42.585	31.173	57.080	29.332	33.665
7	830	26.318	41.153	26.318	43.759	32.277	50.959	29.937	40.257
8	845	24.254	36.733	24.998	37.318	30.246	44.994	28.277	43.593
9	900	22.278	23.104	22.278	23.025	18.668	27.709	23.538	35.120
10	915	22.278	23.104	22.278	23.025	18.668	27.709	23.538	35.120
11	930	22.278	23.104	22.278	23.025	18.668	27.709	23.538	35.120
12	945	22.278	23.104	22.278	23.025	18.668	27.709	23.538	35.120
13	1000	20.950	25.056	24.118	21.730	17.717	27.709	22.310	33.170
14	1015	20.950	25.056	24.118	21.730	17.717	27.709	22.310	33.170
15	1030	20.950	25.056	24.118	21.730	17.717	27.709	22.310	33.170

--- Remaining periods deleted from output.

TABLE NO. 39
TOTAL DELAY PER APPROACH (VEHICLE HOURS PER 15 MINUTE PERIOD)

TDELAY	TIME	1 - NBT	2 - NBL	3 - SBT	4 - SBL	5 - EBT	6 - EBL	7 - WBT	8 - WBL
1	700	1.429	.329	1.745	.454	1.141	.364	1.676	.518
2	715	1.745	.391	1.547	.406	.891	.257	1.458	.289
3	730	1.819	.647	1.819	.511	1.141	.364	1.759	.624
4	745	1.745	.511	1.745	.501	1.213	.364	1.847	.624
5	800	2.166	.451	2.166	.441	.891	.490	1.458	.749
6	815	1.980	.435	1.980	.426	1.011	.490	1.599	.289
7	830	1.745	.412	1.745	.501	1.141	.364	1.676	.518
8	845	1.429	.315	1.547	.374	.891	.257	1.458	.624
9	900	.985	.165	.985	.165	.550	.099	1.214	.251
10	915	.985	.165	.985	.165	.550	.099	1.214	.251
11	930	.985	.165	.985	.165	.550	.099	1.214	.251
12	945	.985	.165	.985	.165	.550	.099	1.214	.251
13	1000	.810	.206	1.199	.148	.392	.099	1.068	.214
14	1015	.810	.206	1.199	.148	.392	.099	1.068	.214
15	1030	.810	.206	1.199	.148	.392	.099	1.068	.214

--- Remaining periods deleted from output.

TABLE NO. 44
CALCULATED NUMBER OF VEHICLES STOPPED (PER 15 MINUTE PERIOD)

STOP	TIME	1 - NBT	2 - NBL	3 - SBT	4 - SBL	5 - EBT	6 - EBL	7 - WBT	8 - WBL
1	700	184.303	29.118	216.831	39.218	118.487	25.300	188.149	44.257
2	715	216.831	34.130	196.967	34.411	95.797	19.920	168.936	28.059
3	730	223.697	45.900	223.697	40.042	118.487	25.300	194.776	50.034
4	745	216.831	40.034	216.831	39.918	124.379	25.300	201.519	50.034
5	800	252.479	35.011	252.479	34.910	95.797	30.856	168.936	56.017
6	815	237.817	34.815	237.817	34.722	106.970	30.856	181.636	28.059
7	830	216.831	34.492	216.831	39.918	118.487	25.300	188.149	44.257
8	845	184.303	28.812	196.967	33.809	95.797	19.920	168.936	50.034
9	900	144.322	22.483	144.322	22.471	87.701	11.924	172.784	24.806
10	915	144.322	22.483	144.322	22.471	87.701	11.924	172.784	24.806
11	930	144.322	22.483	144.322	22.471	87.701	11.924	172.784	24.806
12	945	144.322	22.483	144.322	22.471	87.701	11.924	172.784	24.806
13	1000	122.582	26.602	167.415	20.861	63.414	11.924	157.147	22.147
14	1015	122.582	26.602	167.415	20.861	63.414	11.924	157.147	22.147
15	1030	122.582	26.602	167.415	20.861	63.414	11.924	157.147	22.147

--- Remaining periods deleted from output.

TABLE NO. 45
CALCUATED EXCESS FUEL CONSUMPTION (GALLONS PER 15 MINUTE PERIOD)

EXFUEL	TIME	1 - NBT	2 - NBL	3 - SBT	4 - SBL	5 - EBT	6 - EBL	7 - WBT	8 - WBL
1	700	2.701	.489	3.215	.665	1.870	.472	2.887	.754
2	715	3.215	.576	2.898	.587	1.493	.354	2.564	.454
3	730	3.328	.847	3.328	.707	1.870	.472	3.003	.875
4	745	3.215	.707	3.215	.700	1.971	.472	3.124	.875
5	800	3.825	.621	3.825	.614	1.493	.603	2.564	1.010
6	815	3.566	.609	3.566	.603	1.676	.603	2.776	.454
7	830	3.215	.592	3.215	.700	1.870	.472	2.887	.754
8	845	2.701	.477	2.898	.562	1.493	.354	2.564	.875
9	900	2.034	.324	2.034	.324	1.207	.179	2.456	.399
10	915	2.034	.324	2.034	.324	1.207	.179	2.456	.399
11	930	2.034	.324	2.034	.324	1.207	.179	2.456	.399
12	945	2.034	.324	2.034	.324	1.207	.179	2.456	.399
13	1000	1.712	.390	2.394	.297	.869	.179	2.213	.350
14	1015	1.712	.390	2.394	.297	.869	.179	2.213	.350
15	1030	1.712	.390	2.394	.297	.869	.179	2.213	.350

--- Remaining periods deleted from output.

L E F T   T U R N   C H E C K   (PER 15 MINUTE PERIOD)

PERIOD NO.	TIME	NORTHBOUND VOL	NORTHBOUND CAP	SOUTHBOUND VOL	SOUTHBOUND CAP	EASTBOUND VOL	EASTBOUND CAP	WESTBOUND VOL	WESTBOUND CAP
1	700	31.	51.	41.	58.	26.	31.	46.	60.
2	715	36.	54.	36.	52.	21.	31.	31.	60.
3	730	46.	50.	41.	51.	26.	31.	52.	60.
4	745	41.	51.	41.	52.	26.	31.	52.	60.
5	800	36.	46.	36.	47.	31.	31.	57.	60.
6	815	36.	48.	36.	49.	31.	31.	31.	60.
7	830	36.	51.	41.	52.	26.	31.	46.	60.
8	845	31.	54.	36.	58.	21.	31.	52.	60.
9	900	26.	70.	26.	71.	13.	38.	26.	38.
10	915	26.	70.	26.	71.	13.	38.	26.	38.
11	930	26.	70.	26.	71.	13.	38.	26.	38.
12	945	26.	70.	26.	71.	13.	38.	26.	38.
13	1000	30.	64.	24.	78.	13.	38.	23.	38.
14	1015	30.	64.	24.	78.	13.	38.	23.	38.
15	1030	30.	64.	24.	78.	13.	38.	23.	38.
16	1045	30.	64.	24.	78.	13.	38.	23.	38.
29	1400	21.	73.	23.	73.	19.	38.	27.	38.
30	1415	21.	73.	23.	73.	19.	38.	27.	38.
31	1430	21.	73.	23.	73.	19.	38.	27.	38.
32	1445	21.	73.	23.	73.	19.	38.	27.	38.
33	1500	30.	70.	31.	75.	26.	38.	28.	38.
34	1515	30.	70.	31.	75.	26.	38.	28.	38.
35	1530	30.	70.	31.	75.	26.	38.	28.	38.
36	1545	30.	70.	31.	75.	26.	38.	28.	38.
37	1600	31.	53.	41.	60.	26.	31.	46.	57.
38	1615	36.	59.	36.	56.	21.	31.	31.	60.
39	1630	46.	52.	41.	53.	26.	31.	52.	57.
40	1645	41.	53.	41.	54.	26.	31.	52.	57.
41	1700	36.	47.	36.	49.	31.	31.	57.	57.
42	1715	36.	49.	36.	51.	31.	31.	31.	57.
43	1730	36.	53.	41.	54.	26.	31.	46.	57.
44	1745	31.	56.	36.	60.	21.	31.	52.	57.

DESIGN AND EVALUATION SUMMARY

INTERSECTION NAME	RUN NO. AND TITLE	CONTROLLER TYPE	CONTROLLER DIAL	SEQUENCE N/S	SEQUENCE E/W	PHASES	LOST TIME /PH	LOST TIME TOTAL	STEP SIZE	STOP PENALTY
FLORIDA & GATOR	1: EXAMPLE NO. 3	PRETIMED	3	LT	ETW	5	3.5	14.0	5.0	30.0

M E A S U R E S   O F   E F F E C T I V E N E S S

MOVEMENTS:	DELAY (VEH-HRS)	STOPS (%)	EXC FUEL (GAL)	EXC LEFT (VEH)	MAXIMUM QUEUE	V/C RATIO	LEFT TURN TREATMENT PROTECTION	LEFT TURN TREATMENT VEH/CYC	SEQUENCE PH 1	PH 2	PH 3	PH 4	PH 5	PH 6
NB THRU :	41.60	90.8	79.84		22.4	.93				XXXX				
LEFT :	9.46	92.5	15.01	.0	4.1	.94	PERM	1.0	XXXX					
SB THRU :	43.77	91.6	83.57		22.4	.93				XXXX				
LEFT :	9.56	92.1	15.27	.0	3.6	.81	PERM	1.0	XXXX					
EB THRU :	25.43	87.7	47.12		12.0	.78					XXXX	XXXX		
LEFT :	8.24	96.8	11.67	.0	2.7	.99	REST	.0			XXXX			
WB THRU :	42.40	91.8	79.86		18.6	.91						XXXX	XXXX	
LEFT :	12.62	96.4	18.64	.0	5.0	.99	REST	.0					XXXX	
SUMMARY :	193.09	91.3	350.99	.0	22.4	.99								

DESIGN AND EVALUATION SUMMARY

INTERSECTION NAME	RUN NO. AND TITLE	CONTROLLER TYPE	CONTROLLER DIAL	SEQUENCE N/S	SEQUENCE E/W	PHASES	[illegible] /PH	[illegible] TOTAL	[illegible] SIZE	[illegible]
FLORIDA & GATOR 1:	EXAMPLE NO. 3	PRETIMED	3	LT	ETW	5	3.5	14.0	5.0	30.0

M E A S U R E S O F E F F E C T I V E N E S S S I G N A L T I M I N G

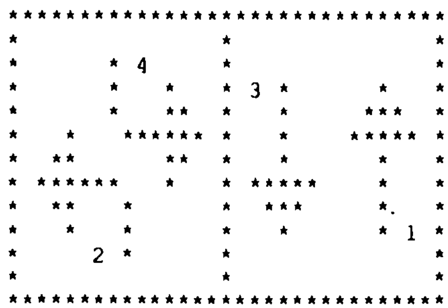
ANALYSIS: PERIOD :	DELAY (VEH-HRS)	STOPS (%)	EX. FUEL (GAL)	EX. LEFT (VEH)	MAXIMUM QUEUE	V/C RATIO	ALL RED (SEC)	DIAL NO.	CYCLE (SEC)	PH 1 (%)	PH 2 (%)	PH 3 (%)	PH 4 (%)	PH 5 (%)	PH 6 (%)
700- 715:	7.66	91.5	13.05	.0	19.3	.83	.0	1	80.0:	12.5	40.0	13.4	12.4	21.7	
715- 730:	6.98	90.7	12.14	.0	19.3	.82	.0	1							
730- 745:	8.68	93.4	14.43	.0	19.9	.94	.0	1							
745- 800:	8.55	93.2	14.28	.0	19.3	.87	.0	1							
800- 815:	8.81	94.4	14.55	.0	22.4	.99	.0	1							
815- 830:	8.21	93.4	13.85	.0	21.1	.99	.0	1							
830- 845:	8.10	92.5	13.70	.0	19.3	.83	.0	1							
845- 900:	6.90	89.9	11.92	.0	17.5	.86	.0	1							
900- 915:	4.41	90.1	8.96	.0	11.5	.81	.0	2	60.0:	16.7	32.8	16.7	17.2	16.7	
915- 930:	4.41	90.1	8.96	.0	11.5	.81	.0	2							
930- 945:	4.41	90.1	8.96	.0	11.5	.81	.0	2							
945-1000:	4.41	90.1	8.96	.0	11.5	.81	.0	2							
1000-1015:	4.14	89.7	8.40	.0	11.2	.81	.0	2							
1015-1030:	4.14	89.7	8.40	.0	11.2	.81	.0	2							
1030-1045:	4.14	89.7	8.40	.0	11.2	.81	.0	2							
1045-1100:	4.14	89.7	8.40	.0	11.2	.81	.0	2							
1400-1415:	3.82	87.9	7.84	.0	9.3	.72	.0	2							
1415-1430:	3.82	87.9	7.84	.0	9.3	.72	.0	2							
1430-1445:	3.82	87.9	7.84	.0	9.3	.72	.0	2							
1445-1500:	3.82	87.9	7.84	.0	9.3	.72	.0	2							
1500-1515:	4.31	89.1	8.71	.0	9.6	.76	.0	2							
1515-1530:	4.31	89.1	8.71	.0	9.6	.76	.0	2							
1530-1545:	4.31	89.1	8.71	.0	9.6	.76	.0	2							
1545-1600:	4.31	89.1	8.71	.0	9.6	.76	.0	2							
1600-1615:	7.49	92.6	13.05	.0	17.5	.86	.0	3	75.0:	13.3	36.7	13.8	15.0	21.2	
1615-1630:	6.84	89.8	11.89	.0	16.9	.81	.0	1							
1630-1645:	8.34	94.0	14.18	.0	17.3	.90	.0	3							
1645-1700:	8.38	94.2	14.28	.0	18.6	.91	.0	3							
1700-1715:	8.71	95.1	14.56	.0	19.7	.99	.0	3							
1715-1730:	8.06	94.2	13.84	.0	18.5	.98	.0	3							
1730-1745:	7.93	93.5	13.70	.0	17.5	.86	.0	3							
1745-1800:	6.75	91.0	11.92	.0	15.8	.90	.0	3							
SUMMARY :	193.09	91.3	350.99	.0	22.4	.99	PERFORMANCE IMPROVED .6% BY TIMING OPTIMIZATION								

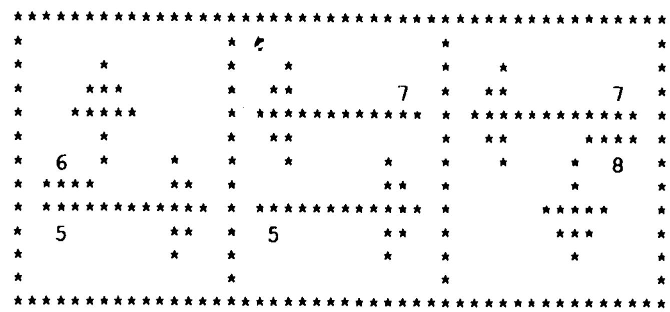
2 PHASE N-S VS 3 PHASE E-W

SEQUENCE: 4 (LT) SEQUENCE: 10 (ETW)

EXAMPLE NO. 3

FLORIDA & GATOR





S O A P   I N P U T   E C H O

NO.	CARD ID	A	B	NBT	NBL	SBT	SBL	EBT	EBL	WBT	WBL	COMMENT
39	:END	0	0	0	0	0	0	0	0	0	0	:

+++ END OF SOAP JOB +++

+++ GOOD NEWS: NO ERRORS ENCOUNTERED DURING THIS JOB +++

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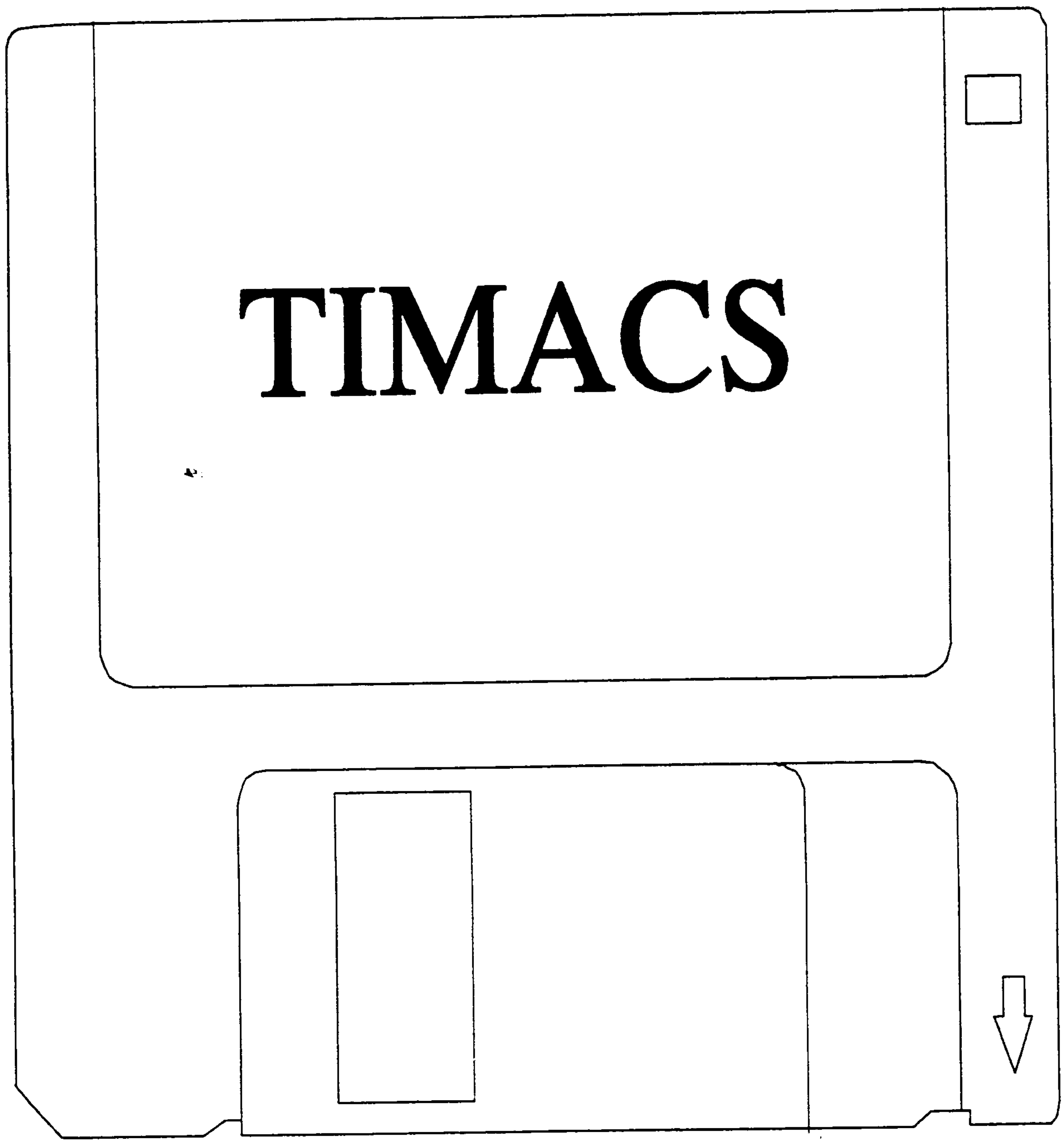
TIMACS

T R A F F I C   A C T U A T E D   C O N T R O L L E R   S E T T I N G S

LOCATION: BROAD & MAIN   DIALS: 1   PHASES: 4   DATE: 11-11-1992

CONTROLLER: COORDINATOR:
WALK REST MODIFIER ACTIVE

PHASE:	NON-ACTUATED	NON-ACT + 1	NON-ACT +2	NON-ACT + 3
NEMA MOVEMENTS DIRECTIONS	2 + 6 EW THRU	3 + 7 NS LEFT	4 + 8 NS THRU	1 + 5 EW LEFT

DIAL 1 : 120 SEC CYCLE, 25 SEC OFFSET

PED WALK TIME	8	0	8	0
PEDESTRIAN FDW	10	0	10	0
CHANGE (Y + R)	5	5	5	5
VEHICLE MINIMUM	N/A	10	15	10
COMPUTED SPLIT	43	27	30	20

T R A F F I C   A C T U A T E D   C O N T R O L L E R   S E T T I N G S

LOCATION: BROAD & MAIN   DIALS: 1   PHASES: 4   DATE: 11-11-1992

CONTROLLER: COORDINATOR:
WALK REST MODIFIER ACTIVE

PHASE:	NON-ACTUATED	NON-ACT + 1	NON-ACT +2	NON-ACT + 3
NEMA MOVEMENTS	2 + 6	3 + 7	4 + 8	1 + 5
DIRECTIONS	EW THRU	NS LEFT	NS THRU	EW LEFT

		DIAL 1	DIAL 2	DIAL 3	DIAL 4	DIAL 5	DIAL 6
CYCLE LENGTH	(SEC)	120					
YIELD POINT	(SEC)	53					
	(%)	44					
FORCE OFF NON-ACT + 1	(SEC)	37					
	(%)	31					
FORCE OFF NON-ACT + 2	(SEC)	67					
	(%)	56					
FORCE OFF NON-ACT + 3	(SEC)	87					
	(%)	73					
BEGIN PP1	(SEC)	0					
(NO PED OR PHASE OMITS)	(%)	0					
END PP1	(SEC)	12					
	(%)	10					
BEGIN PP2	(SEC)	12					
(NON-ACT+ 1 PHASE OMIT)	(%)	10					
END PP2	(SEC)	34					
	(%)	28					
BEGIN PP3	(SEC)	34					
(NON-ACT+ 2 PED OMIT)	(%)	28					
END PP3	(SEC)	37					
	(%)	31					
BEGIN PP4	(SEC)	37					
(NON-ACT+ 2 PHASE OMIT)	(%)	31					
END PP4	(SEC)	62					
	(%)	52					

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APPENDIX II

TRAFFIC MODEL SUMMARY COMPARISON TABLES

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TRAFFIC MODEL SUMMARY COMPARISON TABLES

ls in this handbook deal with integrated signal systems, urban network simulation and on with the freeway system. In deciding which traffic model(s) is appropriate for project study, it is helpful to compare the models side-by-side in terms of their program features. The following summary comparisons tables were therefore deemed

NSYT-7F (Network and Arterial) versus PASSER II (Arterial) Signal Timing
F-NETSIM vs. CORFLO NETFLO 1 vs. CORFLO NETFLO 2 Urban Network lation
SIM versus FREFLO Freeway Network Simulation

nd Arterial Signal Timing

ost commonly used programs, TRANSYT-7F and PASSER II, provide the analyst with are packages that provide "similar" capabilities, but really attack the problem from pproaches. PASSER II is very effective at selecting signal phasing alternatives and T-7F has been recognized for its ability to analyze cycle length, green splits, and offsets. ANSYT-7F is a "platoon level" simulator of traffic, it is accepted that it can more "simulate" the behavior of traffic as compared to PASSER II while also outputing a larger of statistics as well.

lysts have felt that the above programs could and should be run in "tandem" and the recent of the updated Arterial Analysis Package (AAP) permits this to be accomplished while zing the task of translating data between the two packages.

rk, Arterial, and Intersection Simulation

se of TRAF-NETSIM for traffic simulation has been available in some form since the mid s. The current release, TRAF-NETSIM Version 3.1 provides detailed simulation capabilities ined with extensive Measures-of-Effectiveness (MOE) output in a microcomputer environment. detailed simulation does not come without a negative aspect - that being execution times which e very long depending mainly on the size of network, number of vehicles on the network, and simulation time.

re the network problem to be analyzed is large and the level of detail in computation of the E's are not as critical to the analysis, CORFLO modules NETFLO 1 and 2 are more opriate. The reduced level of computation detail permits much shorter execution times than AF-NETSIM and permits larger networks to be simulated.

Freeway Simulation

Urban areas are experiencing increased freeway congestion while construction of new freeways is in most cases not feasible for a number of reason. Improvements to existing freeways dominate most freeway design and operations analysis efforts. Because the facilities are already congested, the level of detail required in any specific freeway improvement project is critical because the marginal change in performance with respect to any design element is at a much higher rate than at lower congestion levels. FRESIM provides a high level of detail in its simulation and generated MOEs. Like TRAF-NETSIM, such a level of detail can require significant execution time. Thus it is most appropriately used when detailed design or operational analysis is required.

FREFLO sacrifices some of FRESIM's high level of computational detail for a faster execution time. FREFLO can therefore model much larger networks with a greatly reduced execution time. It therefore is a good tool for large system planning efforts or for preliminary system design alternative selection.

Traffic Model Summary Comparison Tables

The Summary Comparison Tables in this Chapter provide a detailed and quick means for judging which traffic model is most appropriate for meeting project objectives.

TRANSYT-7F (Rel 7.0) / PASSER II-90 Comparison

TRAFFIC MODEL SUMMARY COMPARISON TABLES

ected models in this handbook deal with integrated signal systems, urban network simulation and ir integration with the freeway system. In deciding which traffic model(s) is appropriate for usion in a project study, it is helpful to compare the models side-by-side in terms of their pabilities or program features. The following summary comparisons tables were therefore deemed ppropriate:

(1) TRANSYT-7F (Network and Arterial) versus PASSER II (Arterial) Signal Timing
(2) TRAF-NETSIM vs. CORFLO NETFLO 1 vs. CORFLO NETFLO 2 Urban Network Simulation
(3) FRESIM versus FREFLO Freeway Network Simulation

Network and Arterial Signal Timing

The two most commonly used programs, TRANSYT-7F and PASSER II, provide the analyst with two software packages that provide "similar" capabilities, but really attack the problem from different approaches. PASSER II is very effective at selecting signal phasing alternatives and TRANSYT-7F has been recognized for its ability to analyze cycle length, green splits, and offsets. Since TRANSYT-7F is a "platoon level" simulator of traffic, it is accepted that it can more accurately "simulate" the behavior of traffic as compared to PASSER II while also outputing a larger number of statistics as well.

Some analysts have felt that the above programs could and should be run in "tandem" and the recent release of the updated Arterial Analysis Package (AAP) permits this to be accomplished while minimizing the task of translating data between the two packages.

Network, Arterial, and Intersection Simulation

The use of TRAF-NETSIM for traffic simulation has been available in some form since the mid 1970's. The current release, TRAF-NETSIM Version 3.1 provides detailed simulation capabilities combined with extensive Measures-of-Effectiveness (MOE) output in a microcomputer environment. Such detailed simulation does not come without a negative aspect - that being execution times which can be very long depending mainly on the size of network, number of vehicles on the network, and total simulation time.

Where the network problem to be analyzed is large and the level of detail in computation of the MOE's are not as critical to the analysis, CORFLO modules NETFLO 1 and 2 are more appropriate. The reduced level of computation detail permits much shorter execution times than TRAF-NETSIM and permits larger networks to be simulated.

TRANSYT-7F (Rel 7.0) / PASSER II-90 Comparison

Freeway Simulation

Urban areas are experiencing increased freeway congestion while construction of new freeways in most cases not feasible for a number of reason. Improvements to existing freeways dominate most freeway design and operations analysis efforts. Because the facilities are already congested the level of detail required in any specific freeway improvement project is critical because marginal change in performance with respect to any design element is at a much higher rate at lower congestion levels. FRESIM provides a high level of detail in its simulation and generated MOEs. Like TRAF-NETSIM, such a level of detail can require significant execution time. Thus it is most appropriately used when detailed design or operational analysis is required.

FREFLO sacrifices some of FRESIM's high level of computational detail for a faster execution time. FREFLO can therefore model much larger networks with a greatly reduced execution time. It therefore is a good tool for large system planning efforts or for preliminary system design alternative selection.

Traffic Model Summary Comparison Tables

The Summary Comparison Tables in this Chapter provide a detailed and quick means for judging which traffic model is most appropriate for meeting project objectives.

TRANSYT-7F (Rel 7.0) / PASSER II-90 Comparison

	TRANSYT-7F	PASSER II
Function	Optimized arterial (and network) signal timing where bandwidth is unimportant or unattainable and performance optimization desired.	Optimized arterial signal timing where driver perceived progression is important.
Model Type	Macroscopic, deterministic optimization.	Deterministic optimization.
Optimization Objective	Disutility Index (DI) defined as: [delay and stops] or [excess fuel consumption] or [excess operating cost] plus optionally [double count links] and/or [maximum back of queue penalty] Performance Index defined as: - DI (from above) - PROS (progression opportunities) - PROS / DI Options: - bandwidth constraints - link delay and stops specific weights	Bandwidth Efficiency (E) = (sum of both through bands) / (2 x cycle length) Options: - directional prioritization permitted - progression bands may vary by +/- 2 mph
Optimization Technique	"Hill-climbing" technique as offsets and splits varied. Explicit external bandwidth constraints can be optionally specified.	Time-series search-and-find optimization for cycle length, phase sequence, and offsets (Webster split with post bandwidth determination fine-tuning adjustments).
Phasing Optimization	User specified phase sequences, not an optimization variable.	Selection based on bandwidth efficiency optimization.

	TRANSYT-7F	PASSER II
Cycle Optimization	Selection based on a "coarse" simulation and user specified minimum and maximum values.	Selection based on bandwidth efficiency optimization and user specified minimum and maximum values.
Offsets Optimization	Selection based on overall optimization subject to optionally specified bandwidth constraints.	Selection based on bandwidth efficiency optimization.
Split Optimization	Splits based on overall optimization subject to user minimums and optionally specified bandwidth constraints. For semi-actuated phases (intervals), timing set to achieve a user specified desired degree of saturation. Slack time assigned to non-actuated phases.	Webster split - subject to user minimums.
Signal Conventions	Interval based.	NEMA phase based (single or dual ring with fixed overlap sequence).
Left Turn Treatment	Protected, Permitted, Protected plus Permitted, Sneakers (left on clearance)	Protected, Permitted, Protected plus Permitted, Permitted plus Protected
Existing Evaluation	Evaluate existing via user specified cycle length, phasing, and splits.	Evaluate existing via phases and minimum greens equal to splits.
Actuated Signals	For semi-actuated phases (intervals), timing set to achieve a user specified desired degree of saturation.	Factor or 0.85 applied to pretimed delay calculation.
Preprocessors	7FDIM (Native) EZ-TRANSYT © Transtek Software PRE-TRANSYT © Strong Concepts Quick-7F, CalTrans AAP © Univ. of FL (Arterial Analysis Package)	PASSETUP © TTI (Native) AAP © Univ. of Fl. (Arterial Analysis Package) PREPASSR © Strong Concepts
User Aids	AAP QuickHCS McT7F © University of Florida (Program Package Shell)	PASETUP adjusted volume ASSISTANT PASETUP adjusted saturation flow ASSISTANT PASETUP minimum green time ASSISTANT AAP QuickHCS

	TRANSYT-7F	PASSER II
Input Data Reports	Input data deck echo.	Run control and systemwide data. - systemwide data - embedded data (parameters) - intersection data
Cycle Length Evaluation Reports	Average delay (sec/veh) Percent stops Fuel consumption (gal/hr) Disutility index DI Number of saturated links Performance index PI	Bandwidth efficiency versus cycle length.
Existing Timing Reports	Intersection, route, and system performance with initial settings report: See best solution report for specific MOE's.	Same as best solutions report when phasing and offsets are user specified, minimum cycle length equals maximum cycle length, and sum of critical minimum greens equals cycle length.
Controller Timings Reports	Intersection controller settings (by interval): - interval length (sec) (%) - pin settings (%) - allowable movements per interval - offset	Pin settings (by NEMA phase/movement) - dual-ring phase split (sec) (%) - concurrent phases (sec) - cycle count (sec) (%)
Intersection (Movement) Performance Reports	Intersection and movement performance with optimal settings report: - degree of saturation - total travel (veh-mi) - total travel time (veh-hr) - total delay (veh-hr) - average delay (sec/veh) - uniform stops (no.) (%) - maximum back of queue and queue capacity - fuel consumption	Best solution report by intersection and movement: - phase sequence - offset (sec. and %) - splits (sec. and %) - degree of saturation and V/C based LOS - total delay (veh-hr) - average delay (sec/veh) and delay based LOS - probability of queue clearance and queue LOS - stops (veh/hr) (%) - fuel consumption

	TRANSYT-7F	[illegible]
System and Route/Artery Reports	Systemwide performance report: - total travel (veh-mi/hr) - total travel time (veh-hr/hr) - total uniform delay (veh-hr/hr) - total random delay (veh-hr/hr) - total delay (veh-hr/hr) - average delay (sec/veh) - passenger Delay (pax-hr/hr) - total stops (veh/hr) (%) - system speed (mph) - fuel Consumption (gal/hr) - operating cost ($/hr) - performance index DI, PI, or PROS Route (directional) summary report (user specified or an AAP optionally requested): - total travel (veh-mi) - total travel time (veh-hr) - average travel time (sec/veh) - total delay (veh-hr) - average delay (sec/veh) - total Stops (no.) (%) - maximum back of queue and capacity - fuel Consumption (gal) Route (total) summary report (same MOE's as above system report).	**Total system performance:** - total (veh-hr) and average delay (sec/veh) - total stops (veh/hr) (%) - fuel consumption (gal/hr) - bandwidth efficiency versus cycle length table Best solution report for artery: - bandwidth efficiency - bandwidth attainability, $A=(B_r+B_f)/(G'_f+G'_r)$ = sum of bandwidths / sum of critical arterial greens - cycle length - bandwidths
Graphical Outputs	Time-space diagram. Time-location diagram. Flow profiles. Platoon Dispersion Diagram (via PPD program and TRANSYT-7F .GDT file).	Time-space diagram. LEART (simple arterial simulation/animation)

	TRANSYT-7F	PASSER II
Limitations	Though program adds a queue penalty, the queue can exceed link storage capacity (spillback) while not affecting upstream links. Optimization based on minimizing disutility may result in poor perceived progression. Queue length penalty based on left turn link length equal to 80% of through lane link length by default. User may specify storage capacity to be used for queue length penalty.	Main objective is progression opportunity which extends throughout the artery while ignoring progression opportunities which may occur in portions of the artery. No explicit consideration is given to spillback (blocking queues). Left turn lanes have same length as through lanes. Optimization process may select a phase sequence at an intersection that is only marginally better than existing phase sequence. "Fine-tuning" of offsets at non-critical intersections may not provide the most optimal secondary progression. Bandwidth Optimization can sometimes result in short cycle lengths which can cause high degrees of saturation and delay. PASSER II manual contains suggested procedure for selection of cycle length. Webster timing split can provide green time to cross street that can be better utilized by arterial street if a higher degree of saturation is acceptable for the cross street. PASSER II goes through only one iteration pass for determining timing split even if left turns have a permitted treatment. Left turn capacity and green time determination are interdependent.

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TRAF-NETSIM / CORFLO NETFLO 1 / CORFLO NETFLO 2 Comparison

TRAF-NETSIM / CORFLO NETFLO 1 / CORFLO NETFLO 2 Comparison

	TRAF-NETSIM	CORFLO NETFLO 1	CORFLO NETFLO 2
Function	Detailed urban street network and vehicle simulation.	Intermediate detailed urban street network and vehicle simulation.	Less detailed urban street network and vehicle simulation.
Model Type and Primary Vehicle Movement Model	Microscopic, stochastic vehicle and driver car-following simulation.	Event stepping, stochastic vehicle and driver simulation.	Macroscopic platoon formation and dispersion modelled as flow histograms.
Simulation Timing	Time stepping (1 second) simulation with vehicle state updated every time step. Multiple time period capability. Control devices updated every second.	Normally event based. Each vehicle is moved ahead as far as possible each time the vehicle is processed and is then scheduled to be processed again some time (event) in the future. Multiple time period capability. Pre-timed control devices normally updated at change of interval. Actuated devices updated every second due to interaction with detectors.	Flow histograms are processed every "time interval" usually equal to the average network cycle length. Multiple time period capability.
Relative Execution Speed	Slow	Fast	Fast
Fleet Components	Carpools, Cars, Trucks, Buses.	Carpools, Cars, Trucks, Buses.	Cars, Trucks, Buses (No carpools).
HOV Lanes	Buses and carpools.	Buses and carpools.	Buses only.

	TRAF-NETSIM	CORFLO NETFLO 1	CORFLO NETFLO 2
Link Representation, Operation, and Inputs	Link and pocket lengths, 1 or 2 turn pockets for either left and/or right turns, channelized lanes, grade, headway, lost time, free flow speed, right-turn-on-red, pedestrians. Up to 7 approach lanes. Turn percentages and destination. Conditional link-to-link turning percentages. Short and long term incidents/blockages. Link-to-link lane alignment. Parking location and maneuvers.	Link and pocket lengths, 1 or 2 turn pockets for either left and/or right turns, channelized lanes, grade, headway, lost time, free flow speed, right-turn-on-red, pedestrians. Up to 6 approach lanes. Turn percentages and destination. Percentage of time a lane is blocked. Diversion.	Link and pocket lengths, 1 or 2 turn pockets for either left and/or right turns, channelized lanes, grade, headway, lost time, free flow speed, right-turn-on-red, pedestrians. Up to 6 approach lanes. Turn percentages and destination. Percentage of time a lane is blocked.
Bus Operation	Follows fixed path where routes are defined by a series of stations and routes have a fixed headway. Stations are stops or pullouts.	Same as TRAF-NETSIM. Follows fixed path where routes are defined by a series of stations and routes have a fixed headway.	Same as TRAF-NETSIM. Follows fixed path where routes are defined by a series of stations and routes have a fixed headway.
Pedestrians	Stochastically assigned blockages of turning vehicles.	Stochastically assigned blockages of turning vehicles	Stochastically assigned blockages of turning vehicles.

	TRAF-NETSIM	CORFLO NETFLO 1	CORFLO NETFLO 2
Signs and Pretimed Signals	Stop and Yield signs. Up to 12 Intervals with offset coordination. Time Period specific phasing patterns.	Stop and Yield signs. Up to 9 Intervals with offset coordination. Time Period specific phasing patterns.	Stop and Yield signs. Up to 9 Intervals with offset coordination. Time Period specific phasing patterns.
Actuated Signals	Type 170 / NEMA, single or dual-ring, fully actuated or semi-actuated with detector(s) fully specified for each lane and approach. Background cycle with yield points, permissive periods, and force-offs for each phase. Most all Type 170 and NEMA signal control parameters may be input. Detector inputs include lane, location, length, detector group type, delay time, carry-over time, and passage or presence. Pedestrian actuated phases.	Fully or semi-actuated, single ring controller with presence detector location and length specified for each lane and approach (up to 5 approaches). For coordinated signal, inputs are yield point and yield interval for non-actuated phase 1; minimum initial green time and force off points for other than phase 1; and recall switch. For non-coordinated actuated control, phase 1 can be actuated or non-actuated. Non-actuated input is minimum duration. Actuated inputs are minimum initial interval and maximum phase duration beyond minimum initial; and recall switch.	No actuated signals.

actuated phases.

	TRAF-NETSIM	CORFLO-N[illegible]	[illegible]
Stochastic Features	Driver type (10). Vehicle type based on user specified fleet component percentages (up to 16). Free flow speed entered for link but adjusted for vehicle and driver type. Turn movement assignment. Queue discharge headway.	Driver type (10). Vehicle type based on user specified fleet component percentages (up to 16). Free flow speed entered for link but adjusted for vehicle and driver type. Turn movement assignment. Queue discharge headway.	
Queue Modeling	Spillback and spillover explicitly modeled.	Spillback and spillover explicitly modeled.	Spillback modelled.
Environmental Outputs	Fuel consumption and emissions by link and vehicle type.	Fuel consumption and emissions by link and vehicle type.	Fuel consumption and emissions by link and vehicle type.
Other Features	Source and sink nodes. Fleet component vehicle occupancies. Vehicle type specifications. Link aggregation outputs. TRAF-NETSIM and FRESIM can be joined into a single network for simulation. (When CORSIM released by FHWA.)	Source and sink nodes. Fleet component vehicle occupancies. Works with TRAF traffic assignment module. NETFLO 1 & 2 and FREFLO subnetworks can be joined into a single network for simulation of large systems.	Source and sink nodes. Fleet component vehicle occupancies. Works with TRAF traffic assignment module. NETFLO 1 & 2 and FREFLO subnetworks can be joined into a single network for simulation of large systems.

	TRAF-NETSIM	CORFLO NETFLO 1	CORFLO NETFLO 2
Changeable Embedded Parameters	Left turn jumper probabilities, left and right turn speeds, end-of-stopped queue lane switching gap, probability of joining a spillback, left turn lagger probability, vehicle fleet type length, near and far side gap distribution, amber phase response, left turn gap response, pedestrian delay distribution, free-flow speed distributions, short term event duration distribution, lost time/headway distribution, and bus dwell time distribution.	None	None
Preprocessors	TRAF-EDIT - "Smart" and "Quick" line editor. NEDIT - full screen editor. TURNVOL - turning volume estimator given turning percentages and entry volumes. Also estimates graphic file size requirements.	TRAF-EDIT - "Smart" and "Quick" line editor. TURNVOL - turning volume estimator given turning percentages and entry volumes.	TRAF-EDIT - "Smart" and "Quick" line editor. TURNVOL - turning volume estimator given turning percentages and entry volumes.

	TRAF-NETSIM	[illegible]	[illegible]
Outputs Outputs continued next page	Complete input echo reports. Intermediate link specific reports. - veh. content by movement and lane. - veh. discharged, stopped. - control device indications. Cumulative statistics link reports. - veh. trips and miles. - veh. minutes of move, delay, and total time. - sec./veh. total, delay, queue, and stop time. - average link stops, volume, speed, occupancy, storage, and phase failures. - average and maximum queue by lane. - person miles, trips, delay, and travel time. - movement specific veh. miles, trips, speed, and stops. - movement specific veh. minutes moving, delay, and total time.	Complete input echo reports. Intermediate link specific reports. - veh. content by movement and queues by lane. - vehicles in and out. - control device indications. Cumulative statistics link reports. - veh. trips and miles. - veh. minutes of move, delay, and total time. - sec./veh. total, delay, queue, and stop time. - average link stops, volume, speed, occupancy, and storage. - person miles, trips, delay, and travel time. - movement specific veh. miles, trips, speed, and stops. - movement specific veh. minutes moving, delay, and total time.	Complete input echo reports. Intermediate link specific reports. - veh. content by approach and queues by movement. - vehicles discharged. - control device indications. Cumulative statistics link reports. - veh. trips and miles. - veh. minutes of move, delay, and total time. - sec./veh. total and delay time. - average link stops, volume, and speed. - person miles, trips, delay, and travel time. - movement specific veh. miles, trips, speed, and stops. - movement specific veh. minutes moving, delay, and total time.

	TRAF-NETSIM	CORFLO NETFLO 1	CORFLO NETFLO 2
Outputs (Continued)	- movement specific seconds/vehicle total, delay, queue, and stop time. Bus route and link statistics. - bus and person trips. - total, moving, delay time, and stops. TRAF-NETSIM section specific vehicle miles; delay and total time; average speed, stops, and content.	- movement specific seconds/vehicle total, delay, queue, and stop time. Bus route and link statistics. - bus and person trips. - total, moving, and delay time, and stops. Traffic assignment results.	- movement specific seconds/vehicle total, move and delay time. Bus route and link statistics. - bus and person trips. - total, moving, and delay time, and stops. Traffic assignment results.
Postprocessors	GTRAF SNETG (static) and ANETG (animated) graphics.	GCOR SGCOR (static) graphics.	GCOR SGCOR (static) graphics.
Capacity	Links - 500. Nodes - 250. Actuated controllers - 100. Vehicles - 10,000	Links - 250. Nodes - 70. Actuated controllers - 20. Vehicles - 10,000	Links - 500. Nodes - 240. Actuated controllers - None
Limitations	No explicit U-turns, pre-emptive phases, merge logic, or discretionary lane changing. Lane changes for downstream turns occur by lane "jumping" at upstream end of link. Turn percentages cannot be assigned by vehicle type nor can lane distribution be assigned by user.	No explicit U-turns, pre-emptive phases, merge logic, or discretionary lane changing. Lane changes for downstream turns occur by lane "jumping" at upstream end of link. Turn percentages cannot be assigned by vehicle type nor can lane distribution be assigned by user.	Turn pockets modelled as channelized lanes. No spillover modelling. Spillback/Capacity Reduction model for feeding links based on link storage capacity only. Turn percentages cannot be assigned by vehicle type nor can lane distribution be assigned by user.

FRESIM / FREFLO Comparison

FRESIM / FREFLO Comparison

	FRESIM	FREFLO
Function	Very detailed urban freeway network (individual freeway components) and vehicle/driver simulation for detailed design and operational analysis.	Less detailed urban freeway network simulation for large area analysis with short execution times.
Model Type and Primary Vehicle Movement Model	Microscopic, stochastic vehicle and driver car-following simulation.	Macroscopic, discrete roadway segment, input-output (conservation) model based on a dynamic speed-density equilibrium model.
Simulation Timing	Time stepping (normally 1 second) simulation with vehicle state updated every time step. Multiple time period capability. Control devices (ramp meters) updated every time step.	Time interval based updates. Multiple time period capability.
Relative Execution Speed	Slow	Fast
Multiple Time Period Features	Entry volumes. Turning percentages. Origin-Destination percentages. Incidents specification (actually specified as beginning at some time after the start of simulation for a given duration).	Entry volumes. Turning percentages. Link characteristics. Incident specification. Load factors (Occupancies) Bus flows.
Fleet Components	Carpools, Cars, Trucks, Buses.	Carpools, Cars, Trucks, Buses.
HOV Lanes	HOV lane designation and/or separate HOV roadway segment. [Note: Unknown if HOV modeling will be available with initial release.]	Special purpose lanes for buses and carpools with regular and special purpose lane specific turn percentages. One to nine lanes.

	FRESIM	[illegible]
Bus Operations	Currently no provision for bus operation even though buses are represented by a vehicle type.	Bus paths can be specified. Bus volume specified as a mean headway.
Link Representation / Operation	Up to 5 mainline freeway links. Up to 3 auxiliary lanes - acceleration, deceleration, and full. Ramps and freeway-to-freeway connectors can have up to 3 lanes. Lane drops and adds. Multiple destination lanes. Free-flow speed. Link-to-link lane alignment. Advanced warning signs for exit ramps, incidents, and lane drops. Merging, weaving, and lane-changes explicitly modelled. Truck restrictions or bias to specific lanes. Lane barriers.	Up to 9 lanes per link. User specified lane capacity - vph. Free-flow speed. Equilibrium speed-density relationship user choice. One or two source links and one on-ramp per link One or two destination (through movement) links and one off-ramp per link. One or two destination (through movement) link and one off-ramp turning percentages per link. On-ramps place traffic directly onto freeway while off-ramps take it directly off the freeway. Merging and weaving are not modelled nor are ramp links. Ramp links act as point sources and sinks of traffic flow. Ramps do not connect to other links (networks). Connections between freeways or other networks is accomplished by using one of the two source or destination links in place of a ramp link.

	FRESIM	FREFLO
Incidents and Temporary Events	Incident modelling by link, lane, length, duration, and severity (blockage and rubber-necking factor).	Reduced lanes or constraint on capacity for regular or special purpose lanes.
Ramp Metering	Clock Time, Speed Control, Demand Capacity, Gap-Acceptance.	Capacity constrained.
Input Report and Link Specific Outputs	Complete input echo reports. Intermediate link specific reports. - link vehicle content and discharge. - link average delay and speed. - link lane changes. - link vehicle content by lane. Cumulative statistics link reports. - vehicles in, out, miles, minutes, and lane changes. - current and average vehicle content. - vehicle minutes/vehicle mile of total and delay time. - ratio moving/total time. - seconds/vehicle total, moving, and delay time. - average volume/lane/hour, density, and speed. - fuel consumption and miles-per-gallon by vehicle type. - vehicle emissions (HC, COs, NOX) by vehicle type	Complete input echo reports. Trip table and traffic assignment report if traffic assignment employed by user. Intermediate link specific reports. - vehicles content by movement and lane. - vehicles discharged by type. - link volumes for regular and special lanes. - speed by vehicle type and for regular and special lanes. - density by vehicle type and for regular and special lanes. Cumulative statistics link reports. - vehicle trips and miles. - vehicle minutes of move, delay, and total time. - ratio moving/total time. - minutes/mile total and delay time. - seconds/vehicle total and delay time. - average link volume and speed. - person miles, trips, delay, and travel time.

	FRESIM	[illegible]
System Outputs	System-wide performance report: - vehicle-miles - vehicle-minutes - moving/total trip time ratio - average network content - current network content - average network speed - total delay - travel time in minutes/vehicle-mile - delay time in minutes/vehicle-mile - fuel consumption and miles-per-gallon by vehicle type - vehicle emissions (HC, CO, NOX) by vehicle type Detector processing reports: - point processing (normally volume, speed, and/or occupancy) - MOE algorithm off-line estimation - On-line incident detection report - Off-line incident detection report	System-wide performance report: - vehicle trips and miles. - vehicle hours of move, delay, and total time. - ratio moving/total time. - minutes/mile total and delay time. - minutes/vehicle-trip. - average speed. - person miles, trips, delay, and travel time.
Preprocessors	FEDIT - FRESIM Editor (full-screen) TURNVOL - turning volume estimator given turning percentages and entry volumes. INTOFRE - converts INTRAS (predecessor to FRESIM) input file to FRESIM input file.	TRAFEdit - "Smart" and "Quick" line editors. FEDIT - FRESIM Editor can generate FREFLO input file excluding features unique to FREFLO. TURNVOL - turning volume estimator given turning percentages and entry volumes.

	FRESIM	FREFLO
Postprocessors	CONTOUR provides character based printer plot of speed and density by time period for first freeway segment. Animation and static graphics program planned for the future.	GCOR program SCORG (static) graphics. Curved links and overpasses can be explicitly coded for graphics.
Capacity	200 Links 120 Nodes 3000 Vehicles 20 freeway segments as defined by a unique pair of freeway (not ramp) Entry and Exit nodes.	500 Links 250 Nodes
Other Features	Program computed with optional user overridden roadway segment specific Origin-Destination percentages for controlling vehicle paths. TRAF-NETSIM and FRESIM can be joined into a single network for simulation. (When CORSIM released by FHWA.)	CORFLO traffic assignment module may be applied to FREFLO. NETFLO 1 & 2 and FREFLO subnetworks can be joined into a single network for simulation of large systems.
Additional Strengths		One of the component CORFLO modules.
Limitations	Cannot model bus operations Cannot model lane width effects Ramps cannot have lane adds/drops or auxiliary lanes.	Lane changing, merging, and weaving not modelled.

APPENDIX III

TRAFFIC MODEL SPECIFIC REFERENCES

(Jan 1982 - Nov 1991 and some additional references for 1992)

PASSER II

TRANSYT

TRAF-NETSIM

CORFLO (NETFLO 1 & 2 AND FREFLO)

FRESIM

ROADSIM

PASSER III

MAXBAND

SOAP

FREQ

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PASSER II

...ING SIGNALS TO COORDINATED TRAFFIC SIGNAL SYSTEMS. Machemehl-R.B.; Lee-C.E. Texas Univ. at ...in. Center for Transportation Research. Texas State Dept. of Highways and Public Transportation, Austin. Federal ...way Administration, Austin, TX. Texas Div. FHWATX84232601F, Aug 83. 94p.

...LYSIS OF REDUCED-DELAY OPTIMIZATION AND OTHER ENHANCEMENTS TO PASSER 2-80 - PASSER ...4. Final Report. Research rept. Mar-Aug 83. Chang-E.C.; Messer-C.J.; Marsden-B.G. Texas Transportation Inst., ...ege Station. Federal Highway Administration, Austin, TX. Texas Div. Texas State Dept. of Highways and Public ...nsportation, Austin. TTI218833751F, FHWATX84503751F. Apr 84. 129p.

...TERIAL ANALYSIS PACKAGE (AAP) USER'S MANUAL. Courage, KG; Wallace, CE; Reaves, DP. Florida ...iversity, Gainesville Transportation Research Center Gainesville Florida 32611; Federal Highway Administration Office ... Research and Development, 400 7th Street, SW Washington D.C. 20590. Nov 1986 311p. REPORT NO: ...HWA-IP-86-001; FCP 32Q9-16. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road ...pringfield Virginia 22161

...RTERIAL SIGNAL TIMING OPTIMIZATION USING PASSER II-87. Chang, ECP; Messer, CJ; Garzia, RU. Institute ... Transportation Engineers. ITE Journal VOL. 58 NO. 11 Nov 1988 pp 27-31 Figs. 3 Ref.. AVAILABLE FROM: Institute ... Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

ARTERIAL SIGNAL TIMING OPTIMIZATION USING PASSER II-87. MICROCOMPUTER USER'S GUIDE. FINAL REPORT. Chang, EC-P; Lei, JC-K; Messer, CJ. Texas Transportation Institute Texas A&M University College Station Texas 77843; Texas State Department of Highways & Public Transp Transportation Planning Division, P.O. Box 5051 Austin Texas 78763; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Jul 1988 105p 28 Fig. 1 Tab. 14 Ref. 2 App.. REPORT NO: FHWA/TX-88/467-1; Res Rept 467-1. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

ARTERIAL SIGNAL TIMING OPTIMIZATION USING PASSER II-90: PROGRAM USER'S MANUAL (REVISED). Final research rept. Chang-E.C.P.; Messer-C.J. Texas Transportation Inst., College Station. Federal Highway Administration, Austin, TX. Texas Div. Texas Dept. of Transportation, Austin. Transportation Planning Div. TTI21886467, RR4672F, FHWATX904672F. Jun 91. 120p.

DIRECTIONAL WEIGHTING FOR MAXIMAL BANDWIDTH ARTERIAL SIGNAL OPTIMIZATION PROGRAMS. VOLUME 1. TECHNICAL REPORT. FINAL REPORT. Chang, ECP; Messer, CJ. Texas Transportation Institute Texas A&M University College Station Texas 77843; Federal Highway Administration Turner Fairbank Hwy Res Cntr, 6300 Georgetown Pike McLean Virginia 22101. Jul 1985 86p. REPORT NO: FHWA/RD-86/20. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

DIRECTIONAL WEIGHTING FOR MAXIMAL BANDWIDTH ARTERIAL SIGNAL OPTIMIZATION PROGRAMS. Chang, EC-P; Messer, CJ; Cohen, SL. Transportation Research Board. Transportation Research Record N1057 1986 pp 10-19 8 Fig. 6 Tab. 20 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

EVALUATION TOOLS OF URBAN INTERCHANGE DESIGN AND OPERATION. Radwan, AE; Hatton, RL. Transportation Research Board. Transportation Research Record N1280 1990 pp 148-155 6 Fig. 5 Tab. 11 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

HEURISTIC PROGRAMMING APPROACH TO ARTERIAL SIGNAL TIMING. Rogness, RO; Messer, CJ. Transportation Research Board. Transportation Research Record N906 1983 pp 67-75 3 Fig. 6 Tab. 25 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

IMPLEMENTATION OF TRAFFIC SIGNAL TIMING PLANS IN COORDINATED ARTERIAL SYSTEMS. Courage, KG. Florida University, Gainesville Transportation Research Center Gainesville Florida 32611. Jan 1990 25p. REPORT NO: UTC-UF-268-3. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

INVESTIGATION OF OPTIMAL TIME TO CHANGE ARTERIAL TRAFFIC SIGNAL-TIMING PLAN. Jrew, BK; Parsonson, PS; Chang, EC-P. Transportation Research Board. Transportation Research Record N1057 1986 pp 20-29 6 Fig. 10 Tab. 6 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

PASSER II-84 MICROCOMPUTER ENVIRONMENT SYSTEM--PRACTICAL SIGNAL-TIMING TOOL. Chang, EC-P; Marsden, BG; Derr, BR. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 113 NO. 6 Nov 1987 pp 625-641 Figs. Tabs. Refs.. REPORT NO: ASCE Paper 21941. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017

POSSIBLE PASSER II ENHANCEMENTS. Rogness, RO (North Dakota State University). Transportation Research Board. Transportation Research Record N881 1982 pp 42-48 5 Fig. 6 Tab. 8 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

PROGRESSION THROUGH A SERIES OF INTERSECTIONS WITH TRAFFIC ACTUATED CONTROLLERS. VOLUME 1: TECHNICAL REPORT. FINAL REPORT. Skabardonis, A. Deakin, Harvey, Skabardonis, Incorporated P.O. Box 9156 Berkeley California 94709; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Oct 1988 141p 22 Fig. 29 Tab. 31 Ref. 1 App.. REPORT NO: FHWA-RD-89-132. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

PROGRESSION THROUGH A SERIES OF INTERSECTIONS WITH TRAFFIC ACTUATED CONTROLLERS. VOLUME 2: USER'S GUIDE. FINAL REPORT. Skabardonis, A. Deakin, Harvey, Skabardonis, Incorporated P.O. Box 9156 Berkeley California 94709; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Oct 1988 30p 7 Fig. 2 Tab. 8 Ref.. REPORT NO: FHWA-RD-89-133. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

THE ARTERIAL ANALYSIS PACKAGE. Gibson, DRP; Williams, L. Federal Highway Administration, Office of R&D. Public Roads VOL. 50 NO. 3 Dec 1986 pp 91-96 Figs. 3 Ref.. AVAILABLE FROM: Government Printing Office Superintendent of Documents Washington D.C. 20402

THE PASSER II-84 SYSTEM: A PRACTICAL SIGNAL TIMING TOOL. Marsden, BG; Chang, CP; Derr, BR. Institute of Transportation Engineers. ITE Journal VOL. 57 NO. 3 Mar 1987 pp 31-36 Figs. 1 Tab. 13 Ref.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

THE PASSER II-87 MICROCOMPUTER PROGRAM. Chang, EC-P. Printerhall Limited. Traffic Engineering and Control VOL. 29 NO. 11 Nov 1988 pp 574-578 Figs. Tabs.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London England

TRAFFIC SIGNAL TIMING PROGRAM PASSER II - 84. Chang, E C-P; Messer, CJ. Texas Transportation Institute. Texas Transportation Researcher VOL. 20 NO. 2 Apr 1984 pp 7-9. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

TRANSYT-7F OR PASSER II, WHICH IS BETTER - A COMPARISON THROUGH FIELD STUDIES. Shui-Ying Wong, Federal Highway Administration Office of Traffic Operations Washington D.C. 20590. Transportation Research Board. Transportation Research Record N1324, 1991, pp 83-97. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418.

WARRANTS FOR INTERCONNECTION OF ISOLATED TRAFFIC SIGNALS. Research rept. Sep 79-Aug 86 (Final). Chang-E.C.; Messer-C.J. Texas Transportation Inst., College Station. Texas State Dept. of Highways and Public Transportation, Austin. Transportation Planning Div. Federal Highway Administration, Austin, TX. Texas Div. TTI21880293, FHWATX86672931F. Aug 86. 77p.

...TS NEW IN SIGNAL TIMING OPTIMIZATION MODELS?. Wilbur, AD. Institute of Transportation Engineers. ITE ...al VOL. 61 NO. 4 Apr 1991 pp 41-45 Figs. 1 Tab. Refs.. AVAILABLE FROM: Institute of Transportation Engineers ...School Street, SW, Suite 410 Washington D.C. 20024-2729

TRANSYT-7F

...ICROCOMPUTER VERSION OF TRANSYT. Lines, CJ; Logie, M. PTRC Education and Research Services Limited. ...nning & Transport Res & Comp, Sum Ann Mtg, Proc VOL. P249 1984 p 71. AVAILABLE FROM: PTRC Education ... Research Services Limited 110 Strand London WC2 England

...PERMITTED-MOVEMENT MODEL FOR TRANSYT-7F. Wallace, CE; White, FJ; Wilbur, AD. Transportation Research ...ard. Transportation Research Record N1112 1987 pp 45-51 2 Fig. 2 Tab. 18 Ref.. AVAILABLE FROM: Transportation ...esearch Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

... PROGRESSION-BASED OPTIMIZATION MODEL IN TRANSYT-7F. Hadi, A. and Wallace, C.; Transportation ...esearch Center, University of Florida, Gainesville, Fl. Transportation Research Board 71st Annual Meeting Preprint.

A SURVEY OF TRANSYT-7F APPLICATIONS. Wilbur, T. Printerhall Limited. Traffic Engineering and Control VOL. 26 NO. 10 Oct 1985 pp 498-501 1 Fig. 7 Ref.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London England

ACCOMMODATING TRANSIT IN TRANSYT. Yagar, S. Transportation Research Board. Transportation Research Record N1181 1988 pp 68-76 11 Fig. 1 Tab. 4 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

ADVANCES IN THE PC INTERFACE OF THE TRANSYT-7F TRAFFIC SIMULATION MODEL. LEONARD, JD; RECKER, WW. INSTITUTE OF TRANSPORTATION ENGINEERS MEETING 1989 PP 536-541 ENGLISH

APPLICATION OF TRANSYT-7F IN CHINA. Wong, SY. Institute of Transportation Engineers. ITE Journal VOL. 58 NO. 8 Aug 1988 pp 38-42 Figs. Tabs. Refs.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

ARTERIAL ANALYSIS PACKAGE (AAP) USER'S MANUAL. Courage, KG; Wallace, CE; Reaves, DP. Florida University, Gainesville Transportation Research Center Gainesville Florida 32611; Federal Highway Administration Office of Research and Development, 400 7th Street, SW Washington D.C. 20590. Nov 1986 311p. REPORT NO: FHWA-IP-86-001; FCP 32Q9-16. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

ARTERIAL PRIORITY OPTION FOR THE TRANSYT-7F TRAFFIC-SIGNAL-TIMING PROGRAM. Moskaluk, MJ; Parsonson, PS. Transportation Research Board. Transportation Research Record N1181 1988 pp 57-60 2 Fig. 2 Tab. 2 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

ARTERIAL PRIORITY OPTION FOR THE TRANSYT-7F TRAFFIC-SIGNAL-TIMING PROGRAM. MOSKALUK, J; PARSONSON, PS. NATIONAL RESEARCH COUNCIL TRANSPORTATION RESEARCH WASHINGTON DC. 1988 27 PP ENGLISH

ARTERIAL PROGRESSION--NEW DESIGN APPROACH. Wallace, CE; Courage, KG (Florida University, Gainesville). Transportation Research Board. Transportation Research Record N881 1982 pp 53-59 4 Fig. 2 Tab. 9 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

ARTERIAL SIGNAL TIMING OPTIMIZATION USING PASSER II-90: PROGRAM USER'S MANUAL (REVISED). Final research rept. Chang-E.C.P.; Messer-C.J. Texas Transportation Inst., College Station. Federal Highway Administration, Austin, TX. Texas Div. Texas Dept. of Transportation, Austin. Transportation Planning Div. TTI21886467, RR4672F, FHWATX904672F. Jun 91. 120p.

ASSESSING THE TRAFFIC IMPACTS OF TRANSPORTATION AND LAND DEVELOPMENT SCENARIOS. Deakin, EA; Skabardonis, A. Eno Foundation for Transportation, Incorporated. Transportation Quarterly VOL. 39 NO. 4 Oct 1985 pp 605-626. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

AT LAST - A TRANSYT MODEL DESIGNED FOR AMERICAN TRAFFIC ENGINEERS. Wallace, CE (Florida University, Gainesville). Institute of Transportation Engineers. ITE Journal VOL 53 NO. 8 Aug 1983 pp 28-31 11 Ref.. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

AUTOMATIC UPDATING OF TRAFFIC VOLUME DATA FOR SIGNAL TIMING PLAN DEVELOPMENT. FINAL REPORT. VOLUME 1. Kell, JH; Fullerton, IJ. JHK and Associates P.O. Box 3727 San Francisco California 94119; Federal Highway Administration Turner Fairbank Hwy Res Cntr, 6300 Georgetown Pike McLean Virginia 22101. Jul 1987 45p. REPORT NO: FHWA/RD-87/081; Rept No 4725. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

AUTOMATIC UPDATING OF TRAFFIC VOLUME DATA FOR SIGNAL TIMING PLAN DEVELOPMENT. FINAL REPORT. VOLUME 2. Kell, JH; Fullerton, IJ. JHK and Associates P.O. Box 3727 San Francisco California 94119; Federal Highway Administration Turner Fairbank Hwy Res Cntr, 6300 Georgetown Pike McLean Virginia 22101. Jul 1987 264p. REPORT NO: FHWA/RD-87/112; Rept No 4725. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

CALIBRATION OF TRANSYT PLATOON DISPERSION MODEL FOR PASSENGER CARS UNDER LOW-FRICTION FLOW CONDITIONS (ABRIDGMENT). McCoy, PT; Balderson, EA; Hsueh, RT; Mohaddes, AK (Nebraska University, Lincoln). Transportation Research Board. Transportation Research Record N905 1983 pp 48-52 1 Fig. 5 Tab. 8 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

CASE STUDY EVALUATION OF THE SAFETY AND OPERATIONAL BENEFITS OF TRAFFIC SIGNAL COORDINATION. Berg, WD; Kaub, AR; Belscamper, BW. Transportation Research Board. Transportation Research Record N1057 1986 pp 58-64 9 Fig. 4 Tab. 4 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

COMPARATIVE ASSESSMENT OF 1985 HCM DELAY MODEL. Sadegh, A; Radwan, AE. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 114 NO. 2 Mar 1988 pp 194-208 Figs. Tabs. Refs. Apps.. REPORT NO: ASCE Paper 22278. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017

COMPARISON OF MACROSCOPIC MODELS FOR SIGNALIZED INTERSECTION ANALYSIS. Hagen, LT; Courage, KG. Transportation Research Board. Transportation Research Record N1225 1989 pp 33-44 14 Fig. 10 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

CONCURRENT USE OF MAXBAND AND TRANSYT SIGNAL TIMING PROGRAMS FOR ARTERIAL SIGNAL OPTIMIZATION. Cohen, SL (Federal Highway Administration). Transportation Research Board. Transportation Research Record N906 1983 pp 81-84 2 Tab. 7 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

DELAY MODELS FOR MIXED PLATOON AND SECONDARY FLOWS. Rouphail, NM. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 114 NO. 3 Mar 1988 pp 131-152 Figs. Tabs. Refs. Apps.. REPORT NO: ASCE Paper 22254. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017

DESIGN, PERFORMANCE AND PLANNING OF SIGNALIZED ARTERIAL TRAFFIC NETWORKS. Final rept. Rao-T.S.C.S. California Univ., Berkeley. Dept. of Civil Engineering. RAOTRAFFIC871, Dec 87. 398p.

ENERGY AND EMISSION CONSEQUENCES OF IMPROVED TRAFFIC SIGNAL SYSTEMS. Kahng, SJ; May, AD (California University, Berkeley). Transportation Research Board. Transportation Research Record N881 1982 pp 34-41 11 Fig. 3 Tab. 23 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

EVALUATION OF SIGNAL TIMING VARIABLES BY USING A SIGNAL TIMING OPTIMIZATION PROGRAM. Mao, CM; Messer, CJ; Rogness, RO (Texas State Department of Highways & Public Transp; Texas Transportation Institute; North Dakota State University). Transportation Research Board. Transportation Research Record N881 1982 pp 48-52 12 Fig. 11 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

EVALUATION TOOLS OF URBAN INTERCHANGE DESIGN AND OPERATION. Radwan, AE; Hatton, RL. Transportation Research Board. Transportation Research Record N1280 1990 pp 148-155 6 Fig. 5 Tab. 11 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

FHWA-SPONSORED PROJECT PROVES COST EFFECTIVENESS OF SIGNAL TIMING OPTIMIZATION. Euler, GW; Schoene, GW (Federal Highway Administration). Transportation Research Board. Transportation Research News N103 Nov 1982 pp 2-4 2 Tab. 1 Phot.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

FLOW PROFILE COMPARISON OF A MICROSCOPIC CAR-FOLLOWING MODEL AND A MACROSCOPIC PLATOON DISPERSION MODEL FOR TRAFFIC SIMULATION. Mekemson, J., VICOR Associates, Manassas, Va. and Gantz, D. George Mason University, Fairfax, Va. 1990 Winter Simulation Conference Proceedings.

FUEL CONSUMPTION AND EMISSION VALUES FOR TRAFFIC MODELS. FINAL REPORT. McGill, R. Oak Ridge National Laboratory Post Office Box X Oak Ridge Tennessee 37830. May 1985 93p. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

FUEL CONSUMPTION AND EMISSION VALUES FOR TRAFFIC MODELS. McGill, R. Oak Ridge National Laboratory Post Office Box X Oak Ridge Tennessee 37830 ; Federal Highway Administration Turner Fairbank Hwy Res Cntr, 6300 Georgetown Pike McLean Virginia 22101. May 1985 Final Rpt. 90p 20 Fig. 18 Tab. 7 Ref. 5 App.. REPORT NO: FHWA/RD-85/053. AVAILABLE FROM: Federal Highway Administration Turner Fairbank Hwy Res Cntr, 6300 Georgetown Pike Washington D.C. 20590

FUEL EFFICIENT TRAFFIC SIGNAL OPERATION AND EVALUATION: GARDEN GROVE DEMONSTRATION PROJECT. Wagner-McGee Associates 4660 Kenmore Avenue, Suite 825 Alexandria Virginia 22304; California Energy Commission 1516-19th Street Sacramento California 95814. Feb 1983 76p. REPORT NO: P-400-83-004

HEURISTIC PROGRAMMING APPROACH TO ARTERIAL SIGNAL TIMING. Rogness, RO; Messer, CJ. Transportation Research Board. Transportation Research Record N906 1983 pp 67-75 3 Fig. 6 Tab. 25 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

IMPLEMENTATION OF TRAFFIC SIGNAL TIMING PLANS IN COORDINATED ARTERIAL SYSTEMS. Courage, KG. Florida University, Gainesville Transportation Research Center Gainesville Florida 32611. Jan 1990 25p. REPORT NO: UTC-UF-268-3. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

IMPLEMENTING TRANSYT TRAFFIC SIGNAL TIMING. Dock, FC. Roads and Transportation Association of Canada 1765 St Laurent Boulevard Ottawa Ontario K1G 3V4 Canada. Sep 1984 pp B3-B29 8 Fig. 5 Tab. 12 Ref.. AVAILABLE FROM: Roads and Transportation Association of Canada 1765 St Laurent Boulevard Ottawa Ontario K1G 3V4 Canada

IMPROVED GRAPHIC TECHNIQUES IN SIGNAL PROGRESSION. Wallace, CE; Courage, KG (Florida University, Gainesville). Transportation Research Board. Transportation Research Record N957 1984 pp 47-55 11 Fig. 12 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

IMPROVED SIGNAL TIMING PLAN SELECTION. Kessmann, RW; Ku, CS. Kessmann and Associates, Incorporated Houston Texas. Aug 1985 22p. REPORT NO: REPT-1502.02. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

IMPROVING SIGNAL TIMING. VOLUME 2. PRETIMED ARTERIAL ROADWAYS. Vermeulen, MJ; Lermat, NP; May, AD. California University, Berkeley Institute of Transportation Studies, 109 McLaughlin Hall Berkeley California 94720. May 1984 204p. REPORT NO: UCB-ITS-RR-84-4; FHWA-CA-TO-83-3-2. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

INTERSECTION, DIAMOND, AND THREE-LEVEL DIAMOND GRADE SEPARATION BENEFIT-COST ANALYSIS BASED ON DELAY SAVINGS. Rymer, B; Urbanik, T, II. Transportation Research Board. Transportation Research Record N1239 1989 pp 23-29 8 Fig. 2 Tab. 4 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

INVESTIGATION OF OPTIMAL TIME TO CHANGE ARTERIAL TRAFFIC SIGNAL-TIMING PLAN. Jrew, BK; Parsonson, PS; Chang, EC-P. Transportation Research Board. Transportation Research Record N1057 1986 pp 20-29 6 Fig. 10 Tab. 6 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

ITDS: PAST, PRESENT, AND FUTURE. Rathi, AJ; Santiago, AJ; Valentine, DE; Chin, SM. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 116 NO. 6 Nov 1990 pp 799-808 Figs. Refs. 1 App. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017-2398

MAKING TRANSYT USAGE EASY WITH MICROS: A CASE STUDY. SESSION 4. Strong, DW; Eckols, RH (Barton-Aschman Associates, Incorporated). Institute of Transportation Engineers. Compendium of Technical Papers, 1984 pp 9-13 4 Fig. 8 Ref.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

MAXBAND-86: PROGRAM FOR OPTIMIZING LEFT-TURN PHASE SEQUENCE IN MULTIARTERIAL CLOSED NETWORKS. Chang, EC-P; Cohen, SL; Liu, C; Chaudhary, NA; Messer, C. Transportation Research Board. Transportation Research Record N1181 1988 pp 61-67 1 Fig. 3 Tab. 16 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

MEASURES OF QUEUEING PERFORMANCE FOR A TRAFFIC NETWORK. Bell-M.C.. Newcastle upon Tyne Univ. (England). Transport Operations Research Group. TORGRR33. Oct 80. 29p. UNITED-KINGDOM.

MODELING OF SHARED LANE USE IN TRANSYT-7F. Wallace, CE; White, FJ. Transportation Research Board. Transportation Research Record N1194 1988 pp 160-166 2 Fig. 13 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

OPTIMIZATION OF LEFT-TURN PHASE SEQUENCE IN SIGNALIZED CLOSED NETWORKS. Final rept. Cohen-S.L. Federal Highway Administration, McLean, VA. Traffic Systems Div. FHWARD88157, May 88. 38p.

PLAN-CHANGE ALGORITHMS FOR AREA TRAFFIC CONTROL SYSTEMS. Bell-M.C.; Gault-H.E.; Taylor-I.G. Newcastle upon Tyne Univ. (England). Transport Operations Research Group. RR51, Apr 83. 49p. UNITED-KINGDOM.

PLATOON DISPERSION FACTOR IN TRANSYT FOR SWEDISH TRAFFIC CONDITIONS. Hammarstroem, U. National Swedish Road & Traffic Research Institute Fack S-581 01 Linkoeping Sweden. 1988 26p. REPORT NO: VTI/MEDDELANDE-569A. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

POSSIBLE PASSER II ENHANCEMENTS. Rogness, RO (North Dakota State University). Transportation Research Board. Transportation Research Record N881 1982 pp 42-48 5 Fig. 6 Tab. 8 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

PREDICTING AREA TRAFFIC CONTROL PERFORMANCE WITH TRANSYT/8 AND AN ELEMENTAL MODEL OF FUEL CONSUMPTION. Luk, JYK; Akcelik, R. Australian Road Research Board 500 Burwood Road Vermont South Victoria 3133 Australia 0572-1431. VOL. 12 NO. 4 1984 pp 87-101 2 Fig. 7 Tab. 10 Ref.

PRELIMINARY TESTING AND EVALUATION OF NEW COMPUTER PROGRAMS FOR TRAFFIC ANALYSIS, TASK: EVALUATION OF SUPERCOMPUTER POTENTIAL. Parker-L.E.G. Ontario. Ministry of Transportation. Research and Development Branch, Regina. c1990. 135p. CANADA.

PROGRESSION THROUGH A SERIES OF INTERSECTIONS WITH TRAFFIC ACTUATED CONTROLLERS. VOLUME 1: TECHNICAL REPORT. FINAL REPORT. Skabardonis, A. Deakin, Harvey, Skabardonis, Incorporated P.O. Box 9156 Berkeley California 94709; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Oct 1988 141p 22 Fig. 29 Tab. 31 Ref. 1 App.. REPORT NO: FHWA-RD-89-132. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

PROGRESSION THROUGH A SERIES OF INTERSECTIONS WITH TRAFFIC ACTUATED CONTROLLERS. VOLUME 2: USER'S GUIDE. FINAL REPORT. Skabardonis, A. Deakin, Harvey, Skabardonis, Incorporated P.O. Box 9156 Berkeley California 94709; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Oct 1988 30p 7 Fig. 2 Tab. 8 Ref.. REPORT NO: FHWA-RD-89-133. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

QUEUEING MODEL FOR TRANSYT 7. Bell-M.C.. Newcastle upon Tyne Univ. (England). Transport Operations Research Group. Science Research Council, Swindon (England). TORGRR34. Oct 80. 30p. UNITED-KINGDOM.

REVIEW OF TRAFFIC MODELLING TECHNIQUES. Pretty, RL (Queensland University, Australia). Society of Automotive Engineers (Australasia) 191 Royal Parade Parkville Victoria 3052 Australia. May 1982 pp 1-9 21 Ref.. REPORT NO: Paper 22

ROUNDABOUT CONTROL IS SIGNAL SUCCESS. Belcher, M (West Midland County Council). Specialist and Professional Press. Surveyor VOL. 163 NO. 4780 Feb 1984 pp 13-14 1 Fig. 1 Phot.

SIGNAL SYSTEMS: METHODOLOGY FOR PROJECT SELECTION. VOLUME 2. FINAL REPORT. Carter-E.C. Maryland Univ., College Park. Dept. of Civil Engineering. Federal Highway Administration, Baltimore, MD. Maryland Div. Maryland State Highway Administration, Baltimore. AW085285046 VOL2, FHWAMD8820. Feb 88. 155p.

SIGNAL SYSTEMS: METHODOLOGY FOR PROJECT SELECTION. VOLUME 1. SUMMARY REPORT. Carter-E.C. Maryland Univ., College Park. Dept. of Civil Engineering. Federal Highway Administration, Baltimore, MD. Maryland Div. Maryland State Highway Administration, Baltimore. AW085285046 VOL1, FHWAMD8819. Feb 88. 33p.

SIGNAL TIMING BASED ON TRANSYT-7F. Davis, SW (City of Fort Wayne, Indiana). Purdue University. Engineering Bulletin of Purdue University N153 1982 pp 131-133. AVAILABLE FROM: Purdue University West Lafayette Indiana 47907

SINGLE-ARTERIAL VERSUS NETWORKWIDE OPTIMIZATION IN SIGNAL NETWORK OPTIMIZATION PROGRAMS (DISCUSSION AND CLOSURE). Johnson, V; Cohen, SL; Chang, ECP. Transportation Research Board. Transportation Research Record N1142 1987 pp 6-15 7 Fig. 11 Tab. 3 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

SOME MEASUREMENTS OF ROBERTSON'S PLATOON DISPERSION FACTOR. Axhausen, KW; Korling, H-G. Transportation Research Board. Transportation Research Record N1112 1987 pp 71-77 5 Fig. 9 Tab. 17 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

STATE OF THE ART REPORT. TRAFFIC MANAGEMENT. TRAFFIC CONTROL. Kinslea Press Limited. Municipal Engineer VOL. 1 NO. 3 Oct 1984 pp 255-274 11 Fig. 11 Phot. 120 Ref.. AVAILABLE FROM: Kinslea Press Limited Central Buildings, 24 Southwark Street, London Bridge London England

THE ARTERIAL ANALYSIS PACKAGE. Gibson, DRP; Williams, L. Federal Highway Administration, Office of R&D. Public Roads VOL. 50 NO. 3 Dec 1986 pp 91-96 Figs. 3 Ref.. AVAILABLE FROM: Government Printing Office Superintendent of Documents Washington D.C. 20402

THE BANDWIDTH-CONSTRAINED TRANSYT SIGNAL-OPTIMIZATION PROGRAM (DISCUSSION AND CLOSURE). Cohen, SL; Liu, CC; Chang, EC-P. Transportation Research Board. Transportation Research Record N1057 1986 pp 1-9 5 Fig. 5 Tab. 13 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

THE USE OF TRANSYT AT SIGNALIZED ROUNDABOUTS. Lines, CJ; Crabtree, MR. Printerhall Limited. Traffic Engineering and Control VOL. 29 NO. 6 Jun 1988 pp 332-337 Figs. 9 Ref.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London England

THE VALUE OF FIXED-TIME SIGNAL CO-ORDINATION IN DEVELOPING COUNTRIES. II. IMPROVED BUS MODELING AND RESULTS. Willumsen, LG; Coeymans, JE. Printerhall Limited. Traffic Engineering and Control VOL. 30 NO. 3 Mar 1989 pp 126-134 Figs. Tabs. Refs.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London England

TIMING PLAN SENSITIVITY TO CHANGES IN PLATOON DISPERSION SETTINGS. Guebert, AA; Sparks, G. ENGINEERING FOUNDATION. TRAFFIC CONTROL METHODS. PROCEEDINGS OF THE FIFTH 1990 131-45

TRANSYT-7F AND NETSIM, COMPARISON OF ESTIMATED AND SIMULATED PERFORMANCE DATA. Dudek, G; Goode, L; Poole, M. Institute of Transportation Engineers, ITE Journal, Vol 53., No. 8, Aug 1983, pp 32-34.

TRANSYT-7F OR PASSER II, WHICH IS BETTER - A COMPARISON THROUGH FIELD STUDIES. Shui-Ying Wong, Federal Highway Administration Office of Traffic Operations Washington D.C. 20590. Transportation Research Board. Transportation Research Record N1324, 1991, pp 83-97. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418.

TRANSYT-7F USER'S MANUAL. Wallace, CE; Courage, KG; Reaves, DP; Schoene, GW; Euler, GW. Florida University, Gainesville Transportation Research Center Gainesville Florida 32611; Federal Highway Administration Office of Traffic Operations Washington D.C. 20590. Jun 1984 510p. REPORT NO: UF-TRC-U32 FP-06/07. AVAILABLE FROM: Florida University, Gainesville Transportation Research Center Gainesville Florida 32611

USE OF THREE-DIMENSIONAL CONJUGATE DIRECTIONS SEARCH METHOD TO IMPROVE TRANSYT-7F COMPUTATIONAL EFFICIENCY. Tsay, H-S; Wang, K-T. Transportation Research Board. Transportation Research Record N1225 1989 pp 116-129 7 Fig. 3 Tab. 11 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

USING TRANSYT FOR TRAFFIC SIGNAL OPTIMIZATION IN PARRAMATTA. Luk, JYK; Lowrie, PR; Sims, AG (New South Wales Department of Main Roads,Australia). Australian Road Research Board 500 Burwood Road Vermont South Victoria 3133 Australia 0572-1431. 1982 pp 12-22 7 Fig. 5 Tab. 21 Ref.

WARRANTS FOR INTERCONNECTION OF ISOLATED TRAFFIC SIGNALS. Research rept. Sep 79-Aug 86 (Final). Chang-E.C.; Messer-C.J. Texas Transportation Inst., College Station. Texas State Dept. of Highways and Public Transportation, Austin. Transportation Planning Div. Federal Highway Administration, Austin, TX. Texas Div. TTI21880293, FHWATX86672931F. Aug 86. 77p.

WHAT'S NEW IN SIGNAL TIMING OPTIMIZATION MODELS?. Wilbur, AD. Institute of Transportation Engineers. ITE Journal VOL. 61 NO. 4 Apr 1991 pp 41-45 Figs. 1 Tab. Refs.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024-2729

TRAF-NETSIM

A COMPARISON OF ARTERIAL AND NETWORK SOFTWARE PROGRAMS. Sadegh, A; Radwan, AE; Mathias, JS. Institute of Transportation Engineers. ITE Journal VOL. 57 NO. 8 Aug 1987 pp 35-39 Tabs. 2 Ref.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

ADDING SIGNALS TO COORDINATED TRAFFIC SIGNAL SYSTEMS. Machemehl-R.B.; Lee-C.E. Texas Univ. at Austin. Center for Transportation Research. Texas State Dept. of Highways and Public Transportation, Austin. Federal Highway Administration, Austin, TX. Texas Div. FHWATX84232601F, Aug 83. 94p.

BENEFIT-COST EVALUATION OF LEFT-TURN LANES ON UNCONTROLLED APPROACHES OF RURAL INTERSECTIONS (ABRIDGMENT). McCoy, PT; Hoppe, WJ; Dvorak, DV. Transportation Research Board. Transportation Research Record N1026 1985 pp 40-43 2 Tab. 26 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

CAPACITY AND LEVEL OF SERVICE BY SIMULATION--A CASE STUDY OF TRAF-NETSIM. HIGHWAY CAPACITY AND LEVEL OF SERVICE. PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON HIGHWAY CAPACITY, KARLSRUHE, GERMANY, 24-27 JULY 1991. Wong, S-Y. Balkema (AA) P.O. Box 1675 3000 BR Rotterdam Netherlands 90 5410 011 7. 1991 pp 467-483 12 Fig. 7 Tab. 10 Ref.. AVAILABLE FROM: Balkema (AA) Publishers Old Post Road Brookfield Vermont 05036

CASE STUDY EVALUATION OF THE SAFETY AND OPERATIONAL BENEFITS OF TRAFFIC SIGNAL COORDINATION. Berg, WD; Kaub, AR; Belscamper, BW. Transportation Research Board. Transportation Research Record N1057 1986 pp 58-64 9 Fig. 4 Tab. 4 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

COMPARATIVE ASSESSMENT OF 1985 HCM DELAY MODEL. Sadegh, A; Radwan, AE. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 114 NO. 2 Mar 1988 pp 194-208 Figs. Tabs. Refs. Apps.. REPORT NO: ASCE Paper 22278. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017

COMPARING CAPACITIES AND DELAY ESTIMATES BY HIGHWAY CAPACITY SOFTWARE AND TRAF-NETSIM TO FIELD STUDIES. Wong, S. (Federal Highway Administration, Washington, D.C.). Institute of Transportation Engineers, ITE 1990 Compendium of Technical Papers, pp. 224-227.

COMPARISON OF SOAP AND NETSIM: PRETIMED AND ACTUATED SIGNAL CONTROLS. Nemeth, ZA (Ohio State University). Transportation Research Board. Transportation Research Record N905 1983 pp 84-89 13 Fig. 2 Tab. 3 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

CONCURRENT USE OF MAXBAND AND TRANSYT SIGNAL TIMING PROGRAMS FOR ARTERIAL SIGNAL OPTIMIZATION. Cohen, SL (Federal Highway Administration). Transportation Research Board. Transportation Research Record N906 1983 pp 81-84 2 Tab. 7 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

CONGESTION-BASED CONTROL SCHEME FOR CLOSELY SPACED, HIGH TRAFFIC DENSITY NETWORKS. Lieberman, EB; Rathi, AK; King, GF; Schwartz, SI. Transportation Research Board. Transportation Research Record N1057 1986 pp 49-57 2 Fig. 5 Tab. 10 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

DELAY AT LIGHT RAIL TRANSIT GRADE CROSSINGS. Research rept. Sep 83-Sep 87. Cline-J.C.; Urbanik-T.; Rymer-B. Texas Transportation Inst., College Station. Federal Highway Administration, Austin, TX. Texas Div. Texas State Dept. of Highways and Public Transportation, Austin. TTI2108433910, FHWATX8733910. Mar 86. 67p.

DELAY ALLEVIATED BY LEFT-TURN BYPASS LANES. Bruce, EL; Hummer, JE. Transportation Research Board. Transportation Research Record N1299 1991 pp 1-8 3 Fig. 3 Tab. 10 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

DELAY MODELS FOR MIXED PLATOON AND SECONDARY FLOWS. Rouphail, NM. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 114 NO. 3 Mar 1988 pp 131-152 Figs. Tabs. Refs. Apps.. REPORT NO: ASCE Paper 22254. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017

DEMAND-RESPONSE DECENTRALIZED URBAN TRAFFIC CONTROL. PART 2. NETWORK EXTENSIONS. Gartner, NH; Kaltenbach, MH; Miyamoto, MM. Lowell University, Massachusetts Lowell Massachusetts 01854. Jul 1983 159p. REPORT NO: ULRF-05-2998-2; DOT/OST/P34-85/009. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

DEMONSTRATION OF TRAF-NETSIM FOR TRAFFIC OPERATIONS MANAGEMENT. FINAL REPORT. Sulzberg, JD; Demetsky, MJ. Virginia Transportation Research Council P.O. Box 3817, University Station Charlottesville Virginia 22903; Virginia Department of Transportation 1221 East Broad Street Richmond Virginia 23219; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Aug 1991 73p 6 Fig. 11 Tab. 34 Ref. 6 App.. REPORT NO: FHWA/VA-92-R3; VTRC 92-R3. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

DIRECTIONAL WEIGHTING FOR MAXIMAL BANDWIDTH ARTERIAL SIGNAL OPTIMIZATION PROGRAMS. Chang, EC-P; Messer, CJ; Cohen, SL. Transportation Research Board. Transportation Research Record N1057 1986 pp 10-19 8 Fig. 6 Tab. 20 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

EFFECT OF BUS TURNOUTS ON TRAFFIC CONGESTION AND FUEL CONSUMPTION. Cohen, SL (Federal Highway Administration). Transportation Research Board. Transportation Research Record N901 1983 pp 33-38 4 Fig. 3 Tab. 13 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

EFFECT OF LEFT-TURN BAYS ON FUEL CONSUMPTION ON UNCONTROLLED APPROACHES TO STOP-SIGN-CONTROLLED INTERSECTIONS. Dvorak, DV; McCoy, PT (Nebraska University, Lincoln). Transportation Research Board. Transportation Research Record N901 1983 pp 50-53 4 Fig. 7 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

EFFECTS OF PROHIBITING LEFT-TURNS AT SIGNALIZED INTERSECTIONS. FINAL REPORT. Habib, P; Thornhill, W; Kaplan, W. Polytechnic Institute of New York 333 Jay Street Brooklyn New York 11201 Federal Highway Administration Turner Fairbank Hwy Res Cntr, 6300 Georgetown Pike McLean Virginia 22101. Jul 1984 54p. REPORT NO: FHWA/RD-84/083; FCP 31A2-022. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

EVALUATION OF CONTROL STRATEGIES FOR BUS PREEMPTION OF TRAFFIC SIGNALS. Smith, MJ. New Jersey Department of Transportation Bureau of Transportation Systems Research, 1035 Parkway Ave Trenton New Jersey 08625; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Mar 1985 Final Rpt. 53p 5 Fig. 2 Tab. 3 App.. REPORT NO: FHWA-NJ-RD-85-003. AVAILABLE FROM: New Jersey Department of Transportation Bureau of Transportation Systems Research, 1035 Parkway Ave Trenton New Jersey 08625

EVALUATION OF ROADWAY SITES FOR QUEUE MANAGEMENT. Final rept. Miller-H.J.; Demetsky-M.J. Virginia Transportation Research Council, Charlottesville. Federal Highway Administration, Richmond, VA. Virginia Div. Virginia Dept. of Transportation, Richmond. VTRC92R5, FHWAVA92R5. Dec 91. 126p.

EVALUATION TOOLS OF URBAN INTERCHANGE DESIGN AND OPERATION. Radwan, AE; Hatton, RL. Transportation Research Board. Transportation Research Record N1280 1990 pp 148-155 6 Fig. 5 Tab. 11 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

FIRST-GENERATION UTCS SIMULATION. Eiger, A; Chin, S-M (Rensselaer Polytechnic Institute). Transportation Research Board. Transportation Research Record N906 1983 pp 57-60 5 Fig. 5 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

FLASHING SIGNALS IN PEAK PERIODS. DEMETSKY, MJ; MORENO, LE (VIRGINIA HIGHWAY AND TRANSPORTATION RESEARCH; COUNCIL). TRANSPORTATION QUARTERLY VOL. 39 JAN19 1985 ENGLISH. REPORT NO: 85

W PROFILE COMPARISON OF A MICROSCOPIC CAR-FOLLOWING MODEL AND A MACROSCOPIC PLATOON ERSION MODEL FOR TRAFFIC SIMULATION. Mekemson, J., VICOR Associates, Manassas, Va. and Gantz, eorge Mason University, Fairfax, Va. 1990 Winter Simulation Conference Proceedings.

EL CONSUMPTION AND EMISSION VALUES FOR TRAFFIC MODELS. FINAL REPORT. McGill, R. Oak Ridge ional Laboratory Post Office Box X Oak Ridge Tennessee 37830. May 1985 93p. AVAILABLE FROM: National chnical Information Service 5285 Port Royal Road Springfield Virginia 22161

EL CONSUMPTION AND EMISSION VALUES FOR TRAFFIC MODELS. McGill, R. Oak Ridge National Laboratory st Office Box X Oak Ridge Tennessee 37830 ; Federal Highway Administration Turner Fairbank Hwy Res Cntr, 300 Georgetown Pike McLean Virginia 22101. May 1985 Final Rpt. 90p 20 Fig. 18 Tab. 7 Ref. 5 App.. REPORT O: FHWA/RD-85/053. AVAILABLE FROM: Federal Highway Administration Turner Fairbank Hwy Res Cntr, 6300 eorgetown Pike Washington D.C. 20590

DENTICAL TRAFFIC STREAMS IN THE TRAF-NETSIM SIMULATION PROGRAM. Rathi, AK; Santiago, AJ. Printerhall Limited. Traffic Engineering and Control VOL. 31 NO. 6 Jun 1990 pp 351-355 3 Fig. 1 Tab. 6 Ref.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London W1P 3PE England

IMPACT OF ARTERIAL LANE OBSTRUCTIONS. VOLUME 2: RESEARCH REPORT. FINAL REPORT. Torres, JF; Halati, A; Danesh, M. JFT Associates 5555 Inglewood Boulevard, Suite 102 Culver City California 90230; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Feb 1986 119p. REPORT NO: FHWA/RD-86/139. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

IMPACT OF ARTERIAL LANE OBSTRUCTIONS. VOLUME 3: LANE BLOCKAGE LOGIC CHANGES IN NETSIM. FINAL REPORT. Danesh, M; Halati, A; Torres, JF. JFT Associates 5555 Inglewood Boulevard, Suite 102 Culver City California 90230; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Feb 1986 25p. REPORT NO: FHWA/RD-86/140. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

IMPROVED SIGNAL TIMING PLAN SELECTION. Kessmann, RW; Ku, CS. Kessmann and Associates, Incorporated Houston Texas. Aug 1985 22p. REPORT NO: REPT-1502.02. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

ITDS: PAST, PRESENT, AND FUTURE. Rathi, AJ; Santiago, AJ; Valentine, DE; Chin, SM. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 116 NO. 6 Nov 1990 pp 799-808 Figs. Refs. 1 App. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017-2398

MICROSCOPIC SIMULATION OF TRAFFIC IN NETWORKS: SUPERCOMPUTER EXPERIENCE. Mahmassani, HS; Jayakrishnan, R; Herman, R. American Society of Civil Engineers. Journal of Computing in Civil Engineering VOL. 4 NO. 1 Jan 1990 pp 1-19 Figs. Tabs. Refs. 2 App.. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017-2398

NETSIM FOR MICROCOMPUTERS. Sibley, SW. Federal Highway Administration, Office of R&D. Public Roads VOL. 49 NO. 2 Sep 1985 pp 54-59 3 Ref.. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

OPAC: A DEMAND-RESPONSIVE STRATEGY FOR TRAFFIC SIGNAL CONTROL. Gartner, NH (Lowell University). Transportation Research Board. Transportation Research Record N906 1983 pp 75-81 7 Fig. 1 Tab. 25 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

PROGRESSION THROUGH A SERIES OF INTERSECTIONS WITH TRAFFIC ACTUATED CONTROLLERS. VOLUME 1: TECHNICAL REPORT. FINAL REPORT. Skabardonis, A. Deakin, Harvey, Skabardonis, Incorporated P.O. Box 9156 Berkeley California 94709; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Oct 1988 141p 22 Fig. 29 Tab. 31 Ref. 1 App.. REPORT NO: FHWA-RD-89-132. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

PROGRESSION THROUGH A SERIES OF INTERSECTIONS WITH TRAFFIC ACTUATED CONTROLLERS. VOLUME 2: USER'S GUIDE. FINAL REPORT. Skabardonis, A. Deakin, Harvey, Skabardonis, Incorporated P.O. Box 9156 Berkeley California 94709; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Oct 1988 30p 7 Fig. 2 Tab. 8 Ref.. REPORT NO: FHWA-RD-89-133. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

SIGNAL SYSTEMS: METHODOLOGY FOR PROJECT SELECTION. VOLUME 2. FINAL REPORT. Carter-E.C. Maryland Univ., College Park. Dept. of Civil Engineering. Federal Highway Administration, Baltimore, MD. Maryland Div. Maryland State Highway Administration, Baltimore. AW085285046 VOL2, FHWAMD8820. Feb 88. 155p.

SIGNAL SYSTEMS: METHODOLOGY FOR PROJECT SELECTION. VOLUME 1. SUMMARY REPORT. Carter-E.C. Maryland Univ., College Park. Dept. of Civil Engineering. Federal Highway Administration, Baltimore, MD. Maryland Div. Maryland State Highway Administration, Baltimore. AW085285046 VOL1, FHWAMD8819. Feb 88. 33p.

SOME EXPERIENCE WITH THREE URBAN NETWORK MODELS: SATURN, TRANSYT/8 AND NETSIM. Luk, JYK; Stewart, RW (Waterloo University). Australian Road Research Board. Australian Road Research VOL. 14 NO. 2 Jun 1984 pp 82-87 2 Fig. 4 Tab. 18 Ref.

STATISTICAL ANALYSIS OF OUTPUT RATIOS IN TRAFFIC SIMULATION. Gafarian, AV; Halati, A. Transportation Research Board. Transportation Research Record N1091 1986 p 29-36 2 Fig. 4 Tab. 5 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

THE BANDWIDTH-CONSTRAINED TRANSYT SIGNAL-OPTIMIZATION PROGRAM (DISCUSSION AND CLOSURE). Cohen, SL; Liu, CC; Chang, EC-P. Transportation Research Board. Transportation Research Record N1057 1986 pp 1-9 5 Fig. 5 Tab. 13 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

THE DEVELOPMENT OF UTCS/NETSIM/ICG: AN INTEGRATED URBAN TRAFFIC CONTROL SYSTEM - NETWORK SIMULATION - INTERACTIVE COMPUTER GRAPHICS PROGRAM. Eiger, A; Chin, S-M. Rensselaer Polytechnic Institute Department of Civil Engineering Troy New York 12181; Department of Transportat[illegible]n Office of University Research, 400 7th Street, SW Troy New York 12181. 1982 Final Rpt 50p. REPORT NO: DC[illegible]RSPA-DMA-50/83/5. AVAILABLE FROM: Rensselaer Polytechnic Institute Department of Civil Engineering T[illegible] New York 12181

THE NETSIM GRAPHICS SYSTEM. Andrews, B; Lieberman, EB; Santiago, AJ. Transportation Research Board. Transportation Research Record N1112 1987 pp 124-131 14 Fig. 6 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

THE NEW NETSIM SIMULATION PROGRAM. Rathi, AK; Santiago, AJ. Printerhall Limited. Traffic Engineering and Control VOL. 31 NO. 5 May 1990 pp 317-320 14 Ref.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London W1P 3PE England

TRAF II NETSIM USER GUIDE. FINAL REPORT. Hagerty, BR. Michigan Department of Transportation State Highways Building, 425 West Ottawa, P.O. Box 30050 Lansing Michigan 48909; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Mar 1987 v.p. 1 App.. REPORT NO: FHWA-MI-RD-87-01. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

TRAF SYSTEM - TECHNICAL SUMMARY. Final rept. Lieberman-E.; Yedlin-M.; Andrews-B.; Sheridan-K. KLD Associates, Inc., Huntington, NY. Federal Highway Administration, Washington, DC. KLDTR135, FHWARD83084. Apr 85. 34p.

FFIC SIGNAL TIMING MODELS FOR OVERSATURATED SIGNALIZED INTERCHANGES. (Interim Report March 9-January 1992). Kim-Y.; Messer-C.J. Texas Transportation Inst., College Station. Federal Highway inistration, Austin, TX. Texas Div. Texas Dept. of Transportation, Austin. Transportation Planning Div. 218881148, RR11482, FHWATX9211482. Jan 92. 123p.

AFFIC SIMULATION: COURSE NOTES. Young, W; Allsop, R; Cornwell, RR; Gipps, PG; Hoban, CJ; Vandebona, Johnston, DK; Luk, JYK; Taylor, MAP; Richardson, AJ (University College, London; Road Traffic Authority). nash University, Australia Department of Civil Engineering, Wellington Road Clayton Victoria 3168 Australia 86746-337-6. 1984 Monograph n.p. Figs. Tabs. Phots. Refs.

RAFFIC SOFTWARE INTEGRATED SYSTEM (TSIS). Santiago, AJ; Rathi, AK. ENGINEERING FOUNDATION. RAFFIC CONTROL METHODS. PROCEEDINGS OF THE FIFTH 1990 307-13

RAF-NETSIM: HOW IT WORKS, WHAT IT DOES. Wong, S. (Federal Highway Administration, Washington, D.C.). stitute of Transportation Engineers, ITE Journal, Vol. 60. No. 4, Apr 1990, pp 22-27.

TRANSYT-7F AND NETSIM, COMPARISON OF ESTIMATED AND SIMULATED PERFORMANCE DATA. Dudek, G; Goode, L; Poole, M. Institute of Transportation Engineers, ITE Journal, Vol 53., No. 8, Aug 1983, pp 32-34.

UNDERSTANDING THE CUMULATIVE STATISTICS FROM TRAF-NETSIM. Chen, H. and Thor, C. PC-TRANSmission Vol 4., No. 2, October 1989.

URBAN NETWORK TRAFFIC SIMULATION: TRAF-NETSIM PROGRAM. Rathi, AK; Santiago, AJ. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 116 NO. 6 Nov 1990 pp 734-743 Refs. 1 App.. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017-2398

USER'S GUIDE FOR TRAF II NETSIM (OBJ)P Q 444 14 ON OBJECTS: SURFACE STREET TRAFFIC SIMULATION MODEL. HAGERTY, BR. MICHIGAN DEPT OF TRANSPORTATION LANSING MICH. 1987 ENGLISH

USING TRAF-NETSIM TO EVALUATE THE EFFECTS OF DRAWBRIDGE OPENINGS ON ADJACENT SIGNALIZED INTERSECTIONS. Yauch, P; Gray, J; Lewis, W. Institute of Transportation Engineers, ITE Journal, Vol. 58, No. 5, May 1988, pp 35-39.

VARIABILITY ASSESSMENT FOR TRAF-NETSIM. Chang, G-L; Kanaan, A. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 116 NO. 5 Sep 1990 pp 636-657 Figs. Tabs. Refs. 3 App.. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017-2398

VARIANCE REDUCTION APPLIED TO URBAN NETWORK TRAFFIC SIMULATION. Rathi-A.K.; Venigalla-M.M. Oak Ridge National Lab., TN. Department of Energy, Washington, DC. Sep 91. 31p.

CORFLO (NETFLO I & II AND FREFLO)

A REVIEW OF CANDIDATE FREEWAY-ARTERIAL CORRIDOR TRAFFIC MODELS. Van Aerde, M; Yagar, S; Ugge, A; Case, ER. Transportation Research Board. Transportation Research Record N1132 1987 pp 53-65 3 Tab. 45 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

ANNUAL TRANSPORTATION CONVENTION, 29 JULY-2 AUGUST 1985. SESSION: OPERATION AND UTILIZATION OF ROADS AND STREETS 2. Council for Scientific & Industrial Res S Africa P.O. Box 395 Pretoria South Africa 0-7988-3576-1. Aug 1985 163p. REPORT NO: CSIR-S-350-VOL-7-TO. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

ENHANCED FREFLO: MODELING OF CONGESTED ENVIRONMENTS. Rathi, AK; Lieberman, EB; Yedlin, M. Transportation Research Board. Transportation Research Record N1112 1987 pp 61-71 5 Fig. 9 Tab. 7 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

EVALUATION OF FREEWAY IMPROVEMENT ALTERNATIVES USING CORFLO. Liu, C. (AEPCO, Rockville, Md.) and Kanaan, A. (VIGGEN Corporation, Reston, Va.). Proceedings of the American Society of Civil Engineers Microcomputers in Transportation Conference, 1992.

EVALUATION OF VEHICLE ACTUATED SIGNAL CONTROL IN URBAN STREET NETWORK. Joubert, HS; Lockwood, DN. National Institute for Transport & Rd Res, S Af P.O. Box 395 Pretoria 0001 Transvaal South Africa. Aug 1986 18p. REPORT NO: CSIR-RR-468. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

FREEWAY SIMULATION AND CONTROL. Babcock, PS, IV; May, AD; Auslander, DM; Tomizuka, M. California University, Berkeley Institute of Transportation Studies Berkeley California 94720; California Department of Transportation 1120 N Street Sacramento California 95814; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Dec 1982 Final Rpt. 469p. REPORT NO: UCB-ITS-RR-82-13. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

MACRO VS MICRO FREEWAY SIMULATION: A CASE STUDY. Liu, C. and Kanaan, A. (AEPCO, Inc., Rockville, Md.), Santiago, A. (Federal Highway Administration, Mclean, Va.), and Holt, G. (City of Columbus, Columbus, Oh.). Proceedings of the American Society of Civil Engineers Microcomputers in Transportation Conference, 1992.

MACROSCOPIC SIMULATION FOR URBAN TRAFFIC MANAGEMENT. VOLUME 1: EXECUTIVE SUMMARY. Lieberman, E. KLD Associates Incorporated 300 Broadway Huntington Station New York 11746 TR-94; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Jan 1982 Final Rpt. 25p. REPORT NO: FHWA-RD-80-113. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

MACROSCOPIC SIMULATION FOR URBAN TRAFFIC MANAGEMENT: VOLUME 2: TRAFLO USER'S GUIDE. Lieberman, E; Andrews, B; Davila, M; Yedlin, M. KLD Associates Incorporated 300 Broadway Huntington Station New York 11746 TR-92; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Jan 1982 Final Rpt. 214p. REPORT NO: FHWA-RD-80-114. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

REVIEW OF FREEWAY CORRIDOR TRAFFIC MODELS. FINAL REPORT. Van Aerde, M; Yagar, S. Ontario Ministry of Transportation & Communic, Can 1201 Wilson Avenue Downsview Ontario M3M 1J8 Canada. Jun 1985 62p Tabs. Refs.. AVAILABLE FROM: Ontario Ministry of Transportation & Communic, Can 1201 Wilson Avenue Downsview Ontario M3M 1J8 Canada

TRAF SYSTEM - TECHNICAL SUMMARY. Final rept. Lieberman-E.; Yedlin-M.; Andrews-B.; Sheridan-K. KLD Associates, Inc., Huntington, NY. Federal Highway Administration, Washington, DC. KLDTR135, FHWARD83084. Apr 85. 34p.

TRAFLO-M MACROSCOPIC TRAFFIC SIMULATION MODEL USER'S MANUAL. Goldblatt, R; Hagerty, B; Laban, T. KLD Associates Incorporated 300 Broadway Huntington Station New York 11746; Michigan Department of Transportation State Highways Building, 425 West Ottawa, P.O. Box 30050 Lansing Michigan 48909; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Oct 1984 Final Rpt. v.p. Figs. Tabs. Refs. 7 App.. REPORT NO: FHWA-MI-RD-85-01. AVAILABLE FROM: KLD Associates Incorporated 300 Broadway Huntington Station New York 11746

TRAFLO-M MACROSCOPIC TRAFFIC SIMULATION MODEL. USER'S MANUAL FOR (OBJ)P/Q/444/11 ON OBJECTS, (OBJ)P/Q/444/13 ON OBJECTS. Hagerty, BR. KLD Associates Incorporated 300 Broadway Huntington Station New York 11746. Oct 1984 450p. REPORT NO: FHWA/MI/RD-85/01. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

FRESIM

EMERGING TECHNOLOGICAL TOOLS FOR DETAILED FREEWAY DESIGN AND OPERATIONAL ANALYSIS: TRAF-FRESIM, FSMTUTOR, AND FEDIT. Mekemson, J. and Kanaan, A. (VICOR Associates, Manassas, Va.). Proceedings of the 1991 Annual Meeting of the Institute of Transportation Engineers, Washington, D.C.

FEDIT USER INTERFACE FOR FHWA'S TRAF-FRESIM MODEL. Mekemson, J. (VICOR Associates, Inc., Manassas, Va.). Proceedings of the 1992 American Society of Civil Engineers Microcomputers in Transportation Conference.

FRESIM - A FREEWAY SIMULATION MODEL FOR ANALYZING OPERATIONAL AND GEOMETRIC ALTERNATIVES. Halati, A; Torres, J; JFT & Associates, Pacific Palisades, Ca. and Cohen, S; Federal Highway Administration, McLean, Va. Paper submitted to Transportation Research Board for 1991 Annual Meeting.

MACRO VS MICRO FREEWAY SIMULATION: A CASE STUDY. Liu, C. and Kanaan, A. (AEPCO, Inc., Rockville, Md.), Santiago, A. (Federal Highway Administration, Mclean, Va.), and Holt, G. (City of Columbus, Columbus, Oh.). Proceedings of the American Society of Civil Engineers Microcomputers in Transportation Conference, 1992.

ROADSIM

TWO-LANE TRAFFIC SIMULATION: A FIELD EVALUATION OF ROADSIM. Morales, JM; Paniati, JF. Transportation Research Board. Transportation Research Record N1100 1986 pp 29-39 11 Fig. 4 Tab. 6 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

TRAF SYSTEM - TECHNICAL SUMMARY. Final rept. Lieberman-E.; Yedlin-M.; Andrews-B.; Sheridan-K. KLD Associates, Inc., Huntington, NY. Federal Highway Administration, Washington, DC. KLDTR135, FHWARD83084. Apr 85. 34p.

PASSER III

A REPORT ON THE USERS MANUAL FOR THE MICROCOMPUTER VERSION OF PASSER III-88. INTERIM REPORT. Fambro, DB; Chaudhary, NA; Messer, CJ; Garza, RU. Texas Transportation Institute Texas A&M University College Station Texas 77843; Texas State Department of Highways & Public Transp Transportation Planning Division, P.O. Box 5051 Austin Texas 78763; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Sep 1988 132p 22 Fig. 4 Tab. 8 Ref. 6 App.. REPORT NO: FHWA/TX-88/478-1; Res Rept 478-1. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

APPLICATION GUIDE FOR THE MICROCOMPUTER VERSION OF PASSER III-88. INTERIM REPORT (REVISED). Fambro, DB; Bonneson, JA. Texas Transportation Institute Texas A&M University College Station Texas 77843; Texas State Department of Highways & Public Transp Transportation Planning Division, P.O. Box 5051 Austin Texas 78763; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Apr 1990 68p 33 Fig. 4 Tab. 17 Ref. 1 App.. REPORT NO: FHWA/TX-90/478-2F; Res Rept 478-2F. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

EVALUATION TOOLS OF URBAN INTERCHANGE DESIGN AND OPERATION. Radwan, AE; Hatton, RL. Transportation Research Board. Transportation Research Record N1280 1990 pp 148-155 6 Fig. 5 Tab. 11 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

MAXBAND

A COMPROMISED APPROACH TO OPTIMIZE TRAFFIC SIGNAL COORDINATION PROBLEMS DURING UNSATURATED CONDITIONS. Lan, C; Messer, C; Chaudhary, N; Chang, E., Texas Transportation Institute, Texas A&M University, College Station, Tx. Paper submitted for presentation at the 71st Annual Meeting of The Transportation Research Board, Washington, D.C.

CONCURRENT USE OF MAXBAND AND TRANSYT SIGNAL TIMING PROGRAMS FOR ARTERIAL SIGNAL OPTIMIZATION. Cohen, SL (Federal Highway Administration). Transportation Research Board. Transportation Research Record N906 1983 pp 81-84 2 Tab. 7 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

DIRECTIONAL WEIGHTING FOR MAXIMAL BANDWIDTH ARTERIAL SIGNAL OPTIMIZATION PROGRAMS. VOLUME 1. TECHNICAL REPORT. FINAL REPORT. Chang, ECP; Messer, CJ. Texas Transportation Institute Texas A&M University College Station Texas 77843; Federal Highway Administration Turner Fairbank Hwy Res Cntr, 6300 Georgetown Pike McLean Virginia 22101. Jul 1985 86p. REPORT NO: FHWA/RD-86/20. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

DIRECTIONAL WEIGHTING FOR MAXIMAL BANDWIDTH ARTERIAL SIGNAL OPTIMIZATION PROGRAMS. Chang, EC-P; Messer, CJ; Cohen, SL. Transportation Research Board. Transportation Research Record N1057 1986 pp 10-19 8 Fig. 6 Tab. 20 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

MAXBAND-86: PROGRAM FOR OPTIMIZING LEFT-TURN PHASE SEQUENCE IN MULTIARTERIAL CLOSED NETWORKS. Chang, EC-P; Cohen, SL; Liu, C; Chaudhary, NA; Messer, C. Transportation Research Board. Transportation Research Record N1181 1988 pp 61-67 1 Fig. 3 Tab. 16 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

MAXBAND PROGRAM FOR ARTERIAL SIGNAL TIMING PLANS. Cohen, SL; Little, JDC. Federal Highway Administration, Office of R&D. Public Roads VOL. 46 NO. 2 Sep 1982 pp 61-65 9 Ref.. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

OPTIMIZATION OF LEFT TURN PHASE SEQUENCE IN SIGNALIZED NETWORKS USING MAXBAND 86. FINAL REPORT. VOLUME 1: SUMMARY REPORT. Messer, CJ; Hogg, GL; Chaudhary, NA; Chang, ECP. Texas Transportation Institute Texas A&M University College Station Texas 77843; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Aug 1987 102p. REPORT NO: FHWA/RD-87/109. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

OPTIMIZATION OF LEFT TURN PHASE SEQUENCE IN SIGNALIZED NETWORKS USING MAXBAND 86. FINAL REPORT. VOLUME 2: MAXBAND USER'S MANUAL. Messer, CJ; Hogg, GL; Chaudhary, NA; Chang, ECP. Texas Transportation Institute Texas A&M University College Station Texas 77843; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Aug 1987 304p. REPORT NO: FHWA/RD-87/110. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

OPTIMIZATION OF LEFT TURN PHASE SEQUENCE IN SIGNALIZED NETWORKS USING MAXBAND 86. FINAL REPORT. VOLUME 3: MAXBAND PROGRAMMER'S MANUAL. Messer, CJ; Hogg, GL; Chaudhary, NA; Chang, ECP. Texas Transportation Institute Texas A&M University College Station Texas 77843; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Aug 1987 297p. REPORT NO: FHWA/RD-87/111. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

PROGRESSION THROUGH A SERIES OF INTERSECTIONS WITH TRAFFIC ACTUATED CONTROLLERS. VOLUME 1: TECHNICAL REPORT. FINAL REPORT. Skabardonis, A. Deakin, Harvey, Skabardonis, Incorporated P.O. Box 9156 Berkeley California 94709; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Oct 1988 141p 22 Fig. 29 Tab. 31 Ref. 1 App.. REPORT NO: FHWA-RD-89-132. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

RESSION THROUGH A SERIES OF INTERSECTIONS WITH TRAFFIC ACTUATED CONTROLLERS. VOLUME ER'S GUIDE. FINAL REPORT. Skabardonis, A. Deakin, Harvey, Skabardonis, Incorporated P.O. Box 9156 ley California 94709; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Oct 30p 7 Fig. 2 Tab. 8 Ref.. REPORT NO: FHWA-RD-89-133. AVAILABLE FROM: National Technical Information ice 5285 Port Royal Road Springfield Virginia 22161

GLE-ARTERIAL VERSUS NETWORKWIDE OPTIMIZATION IN SIGNAL NETWORK OPTIMIZATION PROGRAMS CUSSION AND CLOSURE). Johnson, V; Cohen, SL; Chang, ECP. Transportation Research Board. nsportation Research Record N1142 1987 pp 6-15 7 Fig. 11 Tab. 3 Ref.. AVAILABLE FROM: Transportation earch Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

E BANDWIDTH-CONSTRAINED TRANSYT SIGNAL-OPTIMIZATION PROGRAM (DISCUSSION AND CLOSURE). ohen, SL; Liu, CC; Chang, EC-P. Transportation Research Board. Transportation Research Record N1057 1986 p 1-9 5 Fig. 5 Tab. 13 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 onstitution Avenue, NW Washington D.C. 20418

SOAP

ARTERIAL ANALYSIS PACKAGE (AAP) USER'S MANUAL. Courage, KG; Wallace, CE; Reaves, DP. Florida University, Gainesville Transportation Research Center Gainesville Florida 32611; Federal Highway Administration Office of Research and Development, 400 7th Street, SW Washington D.C. 20590. Nov 1986 311p. REPORT NO: FHWA-IP-86-001; FCP 32Q9-16. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

COMPARATIVE ASSESSMENT OF 1985 HCM DELAY MODEL. Sadegh, A; Radwan, AE. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 114 NO. 2 Mar 1988 pp 194-208 Figs. Tabs. Refs. Apps.. REPORT NO: ASCE Paper 22278. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017

COMPARISON OF MACROSCOPIC MODELS FOR SIGNALIZED INTERSECTION ANALYSIS. Hagen, LT; Courage, KG. Transportation Research Board. Transportation Research Record N1225 1989 pp 33-44 14 Fig. 10 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

GUIDELINES FOR LEFT-TURN TREATMENTS AT SIGNAL CONTROLLED INTERSECTIONS. Nemeth, ZA; Mekemson. Ohio State University Engineering Experiment Station, 2070 Neil Avenue Columbus Ohio 43210; Ohio Department of Transportation P.O. Box 899 Columbus Ohio 43216-0899; Federal Highway Administration Washington D.C. 20590. Jun 1983 Final Rpt. 284p Figs. Tabs. Refs. 4 App.. REPORT NO: FHWA-OH-83-003

INVESTIGATION OF OPTIMAL TIME TO CHANGE ARTERIAL TRAFFIC SIGNAL-TIMING PLAN. Jrew, BK; Parsonson, PS; Chang, EC-P. Transportation Research Board. Transportation Research Record N1057 1986 pp 20-29 6 Fig. 10 Tab. 6 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

THE ARTERIAL ANALYSIS PACKAGE. Gibson, DRP; Williams, L. Federal Highway Administration, Office of R&D. Public Roads VOL. 50 NO. 3 Dec 1986 pp 91-96 Figs. 3 Ref.. AVAILABLE FROM: Government Printing Office Superintendent of Documents Washington D.C. 20402

TRAFSIG: A COMPUTER PROGRAM FOR SIGNAL SETTINGS AT AN ISOLATED UNDER- OR OVERSATURATED, FIXED-TIME CONTROLLED INTERSECTION. Reljc, S. Printerhall Limited. Traffic Engineering and Control VOL. 29 NO. 11 Nov 1988 pp 562-566 Figs. Tabs. Refs.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London England

FREQ

A REVIEW OF CANDIDATE FREEWAY-ARTERIAL CORRIDOR TRAFFIC MODELS. Van Aerde, M; Yagar, S; Ugge, A; Case, ER. Transportation Research Board. Transportation Research Record N1132 1987 pp 53-65 3 Tab. 45 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

FREEWAY SURVEILLANCE AND CONTROL SYSTEM USING SIMULATION MODEL. Ju, R-S; Maze, TH. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 115 NO. 4 Jul 1989 pp 425-437 Figs. Tabs. Refs. 1 App. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017-2398

REVIEW OF FREEWAY CORRIDOR TRAFFIC MODELS. FINAL REPORT. Van Aerde, M; Yagar, S. Ontario Ministry of Transportation & Communic, Can 1201 Wilson Avenue Downsview Ontario M3M 1J8 Canada. Jun 1985 62p Tabs. Refs.. AVAILABLE FROM: Ontario Ministry of Transportation & Communic, Can 1201 Wilson Avenue Downsview Ontario M3M 1J8 Canada

USE AND EFFECTIVENESS OF SYNTHETIC ORIGIN-DESTINATION DATA IN A MACROSCOPIC FREEWAY SIMULATION MODEL. Stokes, RW; Morris, DE. Institute of Transportation Engineers. ITE Journal VOL. 56 NO. 4 Apr 1986 pp 43-47 14 Ref.. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

APPENDIX IV

REFERENCES

(No Abstracts)

References on Traffic Models for Simulation, Operational Analysis, Signal Timing, Traffic Flow Theory, Capacity, System Control, Case Applications, Fuel Consumption, and Vehicle Emissions (Jan 1982 - Nov 1991 and some additional references for 1992)

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...rences on Traffic Models for Simulation, Operational Analysis, Signal ...ing, Traffic Flow Theory, Capacity, System Control, Case Applications, ... Consumption, and Vehicle Emissions (Jan 1982 - Nov 1991 and some ...itional references for 1992)

...EHAVIORAL APPROACH TO RISK ESTIMATION OF REAR-END COLLISIONS AT SIGNALIZED INTERSECTIONS. ...halel, D; Prashker, JN. Transportation Research Board. Transportation Research Record N1114 1987 pp 96-102. ...AILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. ...418

...COMPARISON OF ARTERIAL AND NETWORK SOFTWARE PROGRAMS. Sadegh, A; Radwan, AE; Mathias, JS. ...titute of Transportation Engineers. ITE Journal VOL. 57 NO. 8 Aug 1987 pp 35-39 Tabs. 2 Ref.. AVAILABLE FROM: ...stitute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

... COMPARISON OF OBSERVED, ESTIMATED AND SIMULATED QUEUE LENGTHS AND DELAYS AT ...VERSATURATED SIGNALIZED JUNCTIONS. Shawaly, EAA; Ashworth, R; Laurence, CJD. Printerhall Limited. Traffic Engineering and Control VOL. 29 NO. 12 Dec 1988 pp 637-642 Figs. Tabs.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London England

A COMPARISON OF TWO FREEWAY TRAFFIC SIMULATION MODELS. COHEN, S; ARON, M; PIERRELEE, J. RECHERCHE-TRANSPORTS-SECURITE N28 Dec 1990 PP 113-118 FRENCH. SIMON COHEN, MAURICE ARON, JEAN-CLAUDE PIERRELEE ILLUSTRATED INCLUDES BIBLIOGRAPHICAL REFERENCES

A COMPROMISED APPROACH TO OPTIMIZE TRAFFIC SIGNAL COORDINATION PROBLEMS DURING UNSATURATED CONDITIONS. Lan, C; Messer, C; Chaudhary, N; Chang, E., Texas Transportation Institute, Texas A&M University, College Station, Tx. Paper submitted for presentation at the 71st Annual Meeting of The Transportation Research Board, Washington, D.C.

A CRITIQUE OF CURRENT URBAN ROAD APPRAISAL TECHNIQUES. CITIES AND ROADS. PAPERS FROM TRANSPORT 2000 SEMINAR, UNIVERSITY OF LONDON, 26 NOVEMBER 1985. Mogridge, MJH. Transport 2000 Limited Walkden House, 10 Melton Street London England. 1986 pp 39-40. AVAILABLE FROM: Transport 2000 Limited Walkden House, 10 Melton Street London England

A DECENTRALIZED CONTROL STRATEGY FOR FREEWAY REGULATION. Goldstein, NB; Kumar, KSP (Minnesota University, Minneapolis). Pergamon Press Limited. Transportation Research. Part B: Methodological VOL. 16B NO. 4 1982 pp 279-290 8 Fig. 3 Tab. 19 Ref.

A DELAY MODEL FOR MULTIWAY STOP-SIGN INTERSECTIONS. Richardson, AJ. Transportation Research Board. Transportation Research Record N1112 1987 pp 107-114 8 Fig. 3 Tab. 11 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

A MACROPARTICLE TRAFFIC SIMULATION MODEL TO INVESTIGATE PEAK-PERIOD COMMUTER DECISION DYNAMICS. CHANG, G; MAHMASSANI, HS; HERMAN, R. 1985 ENGLISH

A MACROSCOPIC MODEL FOR THE ANALYSIS OF TRAFFIC OPERATIONS ON RURAL HIGHWAYS. FINAL REPORT. Sananez, JC; Wingerd, L; May, AD. California University, Berkeley Institute of Transportation Studies, 109 McLaughlin Hall Berkeley California 94720; California Department of Transportation P.O. Box 1499 Sacramento California 95807; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Apr 1985 Final Rpt. 388p Figs. Tabs. Refs. 4 App.. REPORT NO: FHWA-CA-TO-85-01. AVAILABLE FROM: California University, Berkeley Institute of Transportation Studies Berkeley California 94720

A MARTINGALE APPROACH TO ESTIMATION AND CONTROL OF TRAFFIC FLOW ON MOTORWAYS. Van Maarseveen, MFAM (Instituut Tno Voor Wiskunde, Informatieverwerking). Instituut TNO voor Wiskunde Informatieverwerking en Statistiek, Schoemakerstraat 97 Delft Netherlands. Oct 1982 Monograph 8p 5 Fig. 1 Tab. 11 Ref.

A METHODOLOGY FOR THE ASSESSMENT OF TRUCK LANE NEEDS IN THE TEXAS HIGHWAY NETWORK. FINAL REPORT. Mahmassani, HS; Walton, CM; Mouskos, K; Massimi, JJ; Levinton, I. Texas University, Austin Center for Transportation Research Austin Texas 78712; Texas State Department of Highways & Public Transp Transportation Planning Division, P.O. Box 5051 Austin Texas 78763; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Nov 1985 90p. REPORT NO: FHWA/TX-86/46+356-3F. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

A MICROCOMPUTER-BASED SIMULATION PROGRAM FOR INTERSECTION SITES DURING RECONSTRUCTION. Michalopoulos, PG; Plum, R. Transportation Research Board. Transportation Research Record N1112 1987 pp 132-139 6 Fig. 1 Tab. 6 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

A MICROCOMPUTER VERSION OF TRANSYT. Lines, CJ; Logie, M. PTRC Education and Research Services Limited. Planning & Transport Res & Comp, Sum Ann Mtg, Proc VOL. P249 1984 p 71. AVAILABLE FROM: PTRC Education and Research Services Limited 110 Strand London WC2 England

A MODEL FOR SIMULATING TRAFFIC ON TWO- LANE RURAL ROADS: USER GUIDE AND MANUAL FOR TRARR VERSION 3.0. Hoban, CJ; Fawcett, GJ; Robinson, GK. Australian Road Research Board 500 Burwood Road Vermont South Victoria 3133 Australia 0313895X 0-86910-182-X. May 1985 Monograph 96p 23 Fig. 8 Tab. 23 Ref.. REPORT NO: ATM 10A

A NATIONAL SURVEY OF SINGLE-POINT URBAN INTERCHANGES. INTERIM REPORT. Bonneson, JA; Messer, CJ. Texas Transportation Institute Texas A&M University College Station Texas 77843; Texas State Department of Highways & Public Transp Transportation Planning Division, P.O. Box 5051 Austin Texas 78763; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Mar 1989 62p 17 Fig. 3 Tab. 11 Ref. 1 App.. REPORT NO: FHWA/TX-88/1148-1; Res Rept 1148-1. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

A NOTE ON THE NEGLECT OF THE DOPPLER EFFECT IN THE MODELLING OF TRAFFIC FLOW AS A LINE OF STATIONARY POINT SOURCES. Academic Press Incorporated, Limited. Journal of Sound and Vibration VOL. 85 NO. 3 Dec 1982 pp 442-444 4 Ref.

A PERMITTED-MOVEMENT MODEL FOR TRANSYT-7F. Wallace, CE; White, FJ; Wilbur, AD. Transportation Research Board. Transportation Research Record N1112 1987 pp 45-51 2 Fig. 2 Tab. 18 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

A PROBABILISTIC APPROACH FOR DETERMINING THE CHANGE INTERVAL (DISCUSSION AND CLOSURE). Mahalel, D; Zaidei, D; Stein, H. Transportation Research Board. Transportation Research Record N1069 1986 pp 39-45 5 Fig. 27 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

A PROGRESSION-BASED OPTIMIZATION MODEL IN TRANSYT-7F. Hadi, A. and Wallace, C.; Transportation Research Center, University of Florida, Gainesville, Fl. Transportation Research Board 71st Annual Meeting Preprint.

A PROPOSED ANALYTICAL TECHNIQUE FOR THE DESIGN AND ANALYSIS OF MAJOR FREEWAY WEAVING SECTIONS. FINAL REPORT. Cassidy, M; Chan, P; Robinson, B; May, AD. California University, Berkeley Institute of Transportation Studies, 109 McLaughlin Hall Berkeley California 94720; California Department of Transportation 1120 N Street Sacramento California 95814; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Jul 1990 316p Figs. Tabs. 37 Ref. 7 App.. REPORT NO: FHWACAUCBITSRR-90-16; UCB-ITS-RR-90-16. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

A REASSESSMENT OF THE TRAFFIC SIGNAL CHANGE INTERVAL. Wortman, RH; Fox, TC. Transportation Research Board. Transportation Research Record N1069 1986 pp 62-68 7 Fig. 23 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

ONSHIP BETWEEN VEHICLE DETECTOR OCCUPANCY AND DELAY AT SIGNAL-CONTROLLED JUNCTIONS. P. Printerhall Limited. Traffic Engineering and Control VOL. 29 NO. 3 Mar 1988 pp 131-134 Figs. 1 Tab. 2 Ref.. LE FROM: Printerhall Limited 29 Newman Street London England

RT ON THE USERS MANUAL FOR THE MICROCOMPUTER VERSION OF PASSER III-88. INTERIM REPORT. DB; Chaudhary, NA; Messer, CJ; Garza, RU. Texas Transportation Institute Texas A&M University College Station 7843; Texas State Department of Highways & Public Transp Transportation Planning Division, P.O. Box 5051 Austin 8763; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Sep 1988 132p 22 Fig. 4 Tab. 8 App.. REPORT NO: FHWA/TX-88/478-1; Res Rept 478-1. AVAILABLE FROM: National Technical Information 5285 Port Royal Road Springfield Virginia 22161

IEW OF CANDIDATE FREEWAY-ARTERIAL CORRIDOR TRAFFIC MODELS. Van Aerde, M; Yagar, S; Ugge, A; ER. Transportation Research Board. Transportation Research Record N1132 1987 pp 53-65 3 Tab. 45 Ref.. ABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C.

VIEW OF THE CHARACTERISTICS OF TRAFFIC FLOW FROM THE POINT OF VIEW OF PASSENGER TRAFFIC TROL. Cvetanovic, L. Ro Prometni Centar. Suvrement Promet VOL. 8 NO. 3 1986 pp 127-134 7 Ref. Serbian. LABLE FROM: Ro Prometni Centar Cvijete Zuzoric 5 Zagreb Croatia Yugoslavia

OAD CLASSIFICATION FOR USE IN TRAFFIC MODELLING. Phillips, G; Reeson, D (Local Government Operational earch Unit). Transport and Road Research Laboratory. TRRL Supplementary Report N763 1984 9p 4 Fig. 3 Tab. 7 Ref.. AILABLE FROM: Transport and Road Research Laboratory Old Wokingham Road Crowthorne RG11 6AU Berkshire gland

SIMULATION MODEL FOR THE EVALUATION OF WEAVING CAPACITY. HIGHWAY CAPACITY AND LEVEL OF ERVICE. PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON HIGHWAY CAPACITY, KARLSRUHE, ERMANY, 24-27 JULY 1991. Nakamura, H; Kuwahara, M; Koshi, M. Balkema (AA) P.O. Box 1675 3000 BR Rotterdam etherlands 90 5410 011 7. 1991 pp 259-270 14 Fig. 2 Tab. 9 Ref.. AVAILABLE FROM: Balkema (AA) Publishers Old Post oad Brookfield Vermont 05036

SIMULATION STUDY OF ROAD IMPROVEMENT ALTERNATIVES FOR THE BRUCE HIGHWAY FROM CABBAGE TREE CREEK TO KOLAN RIVER. Cox, RL (Queensland Main Roads Department, Australia). Australian Road Research Board 500 Burwood Road Vermont South Victoria 3133 Australia 0 86910 127 7. 1983 pp 155-170 5 Fig. 2 Tab. 3 Phot. 2 Ref.

A SPECIAL PURPOSE PARALLEL COMPUTER FOR TRAFFIC SIMULATION. GROL, HJM; BAKKER, AF. TRANSPORTATION RESEARCH BOARD NATIONAL RESEARCH WASHINGTON DC. Jan 1991 16 PP ENGLISH

A SURVEY OF TRANSYT-7F APPLICATIONS. Wilbur, T. Printerhall Limited. Traffic Engineering and Control VOL. 26 NO. 10 Oct 1985 pp 498-501 1 Fig. 7 Ref.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London England

A TIME-SERIES FORECAST OF AVERAGE DAILY TRAFFIC VOLUME. Benjamin, J. Pergamon Press Limited. Transportation Research. Part A: General VOL. 20A NO. 1 Jan 1986 pp 51-60 4 Fig. 3 Tab. 10 Ref.. AVAILABLE FROM: Pergamon Press Limited Headington Hill Hall Oxford OX3 0BW England

A TRAFFIC FLOW MODEL WITH TIME DEPENDENT O-D PATTERNS. Vaughan, R; Hurdle, VF; Hauer, E (Newcastle University, Canada; Toronto University, Canada). VNU Science Press Bv P.O. Box 2073 Utrecht Netherlands 90-6764-008-5. 1984 pp 155-178 12 Fig. 7 Ref.

A TRAFFIC MODEL OF PLATOON AND SECONDARY FLOWS. RAUPHAIL, NM. ARCHIVES OF TRANSPORT QUARTERLY VOL. 2 NO. 2 1990 PP 85-97 ENGLISH

A USERS GUIDE TO SIMPLE APPLICATIONS OF TRARR. Hoban, CJ. Australian Road Research Board 500 Burwood Road Vermont South Victoria 3133 Australia 0 86910 127 7. 1983 pp 49-90 17 Fig. 5 Tab. 13 Ref.

ACCOMMODATING TRANSIT IN TRANSYT. Yagar, S. Transportation Research Board. Transportation Research Record N1181 1988 pp 68-76 11 Fig. 1 Tab. 4 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

ACCURACY OF CAPACITY MODELS FOR PERMISSIVE LEFT TURNS FROM AN EXCLUSIVE LANE. SESSION 7. Schorr, SM; Jovanis, PP (Forensic Engineering Services, Pennsylvania; Northwestern University, Evanston). Institute of Transportation Engineers. Compendium of Technical Papers, 1984 pp 1-6 6 Tab. 7 Ref.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

ACCURACY OF O-D ESTIMATES FROM TRAFFIC COUNTS. Lam, WHK; Lo, HP. Printerhall Limited. Traffic Engineering and Control VOL. 31 NO. 6 Jun 1990 pp 358-367 10 Fig. 7 Tab. 8 Ref.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London W1P 3PE England

ADAPTIVE SIGNAL CONTROL AT ISOLATED INTERSECTIONS. Lin, FB; Vijayakumar, S. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 114 NO. 5 Sep 1988 pp 555-573 Figs. Refs. 2 App.. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017

ADDING SIGNALS TO COORDINATED TRAFFIC SIGNAL SYSTEMS. Machemehl-R.B.; Lee-C.E. Texas Univ. at Austin. Center for Transportation Research. Texas State Dept. of Highways and Public Transportation, Austin. Federal Highway Administration, Austin, TX. Texas Div. FHWATX84232601F, Aug 83. 94p.

ADVANCES IN THE PC INTERFACE OF THE TRANSYT-7F TRAFFIC SIMULATION MODEL. LEONARD, JD; RECKER, WW. INSTITUTE OF TRANSPORTATION ENGINEERS MEETING 1989 PP 536-541 ENGLISH

AN ANALYSIS OF FUEL CONSUMPTION MODELS. Moore, SE (Nairn (RJ) and Partners Proprietary Limited). Society of Automotive Engineers (Australasia) 191 Royal Parade Parkville Victoria 3052 Australia. May 1982 pp 1-13 19 Ref.. REPORT NO: Paper 6

AN ANALYSIS OF THE CHARACTERISTICS AND CONGESTION IMPACTS OF TRUCK-INVOLVED FREEWAY ACCIDENTS. FINAL REPORT. Recker, WW; Golob, TF; Hsueh, C-W; Nohalty, P. California University, Irvine Institute of Transportation Studies Irvine California 92717; California Department of Transportation 1120 N Street Sacramento California 95814; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Dec 1988 174p Figs. Tabs. Refs. 3 App.. REPORT NO: FHWACAUCIITS-RR-88-2; F85T017. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

AN APPROXIMATE ANALYSIS OF THE HYDRODYNAMIC THEORY ON TRAFFIC FLOW AND A FORMULATION OF A TRAFFIC SIMULATION MODEL. SASAKI, T; FUKUYAMA, M; NAMIKAWA, Y. VNU SCIENCE PRESS UTRECHT NETHERLANDS. 1984 PP 1-20 ENGLISH. TSUNA SASAKI, MASAHARU FUKUYAMA AND YOSHIHARU NAMIKAWA ILLUSTRATED INCLUDES BIBLIOGRAPHICAL REFERENCES NOTE: SOURCE IS MONOGRAPHIC, NOT A SERIES INTERNATIONAL SYMPOSIUM ON TRANSPORTATION AND TRAFFIC THEORY 9TH : 1984 : DELFT, NETHERLANDS PROCEEDINGS OF THE NINTH INTERNATIONAL SYMPOSIUM ON TRANSPORTATION AND TRAFFIC THEORY, DELFT, THE NETHERLANDS, 11-13 JULY 1984

AN EVALUATION OF LEFT-TURN ANALYSIS PROCEDURES. Machemehl, RB. Institute of Transportation Engineers. ITE Journal VOL. 56 NO. 11 Nov 1986 pp 37-41 Figs. 1 Tab. 13 Ref.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

AN EVALUATION OF SIGNAL TIMING AND COORDINATION PROCEDURES VOLUME I: TECHNICAL REPORT; VOLUME II: FIELD MANUAL. Arnold, ED, Jr. Virginia Highway & Transportation Research Council P.O. Box 3817, University Station Charlottesville Virginia 22903; Virginia Department of Highways and Transportation 1221 East Broad Street Richmond Virginia 23219 Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Aug 1985 Final Rpt. v.p. Figs. Tabs. 13 Ref. 3 App.. REPORT NO: FHWA-VA-86-08-09; VHTRC 86-R8, Vol. I. AVAILABLE FROM: Virginia Highway & Transportation Research Council P.O. Box 3817, University Station Charlottesville Virginia 22903

AN EXTENDED TRAFFIC MODEL FOR FREEWAY CONTROL. Cremer, M; May, AD. STUDIES. ITS RESEARCH REPORT NUCB- May 1985 78P. REPORT NO: ITS-RR

NTERACTIVE SIMULATION PROGRAM FOR INTERSECTION DESIGN AND OPERATIONAL ANALYSIS. FINAL ORT. Plum, R; Michalopoulos, P; Yuan, B. Minnesota University, Minneapolis Department of Civil and Mineral neering Minneapolis Minnesota 55455-0220; Minnesota Department of Transportation Materials and Research oratory, 1400 Gervais Avenue Maplewood Minnesota 55109. Jun 1990 114p 20 Fig. 3 Tab. 19 Ref. 1 App.. REPORT MN/RC-91/07; 9RD0004. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield inia 22161

OVERVIEW OF THE PHAROS TRAFFIC SIMULATOR. REECE, D; SHAFER, SA. VAN GORCUM. ROAD USER HAVIOR : THEORY AND PRACTICE 1988 PP 285-293 ENGLISH

ALYSIS OF EXISTING FORMULAS FOR DELAY, OVERFLOW, AND STOPS. Cronje, WB (Stellenbosch University, uth Africa). Transportation Research Board. Transportation Research Record N905 1983 pp 89-93 2 Fig. 3 Tab. 6 Ref.. VAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 0418

NALYSIS OF FREEWAY RECONSTRUCTION ALTERNATIVES USING TRAFFIC SIMULATION. Cohen, SL; Clark, J. ransportation Research Board. Transportation Research Record N1132 1987 pp 8-13 8 Fig. 2 Tab. 8 Ref.. AVAILABLE ROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

NALYSIS OF THE PROPOSED USE OF DELAY-BASED LEVELS OF SERVICE AT SIGNALIZED INTERSECTIONS. erry, DS; Pfefer, RC. Transportation Research Board. Transportation Research Record N1091 1986 p 78-86 2 Fig. 16 Tab. Ref. 1 App.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

ANALYSIS OF REDUCED-DELAY OPTIMIZATION AND OTHER ENHANCEMENTS TO PASSER 2-80 - PASSER 2-84. Final Report. Research rept. Mar-Aug 83. Chang-E.C.; Messer-C.J.; Marsden-B.G. Texas Transportation Inst., College Station. Federal Highway Administration, Austin, TX. Texas Div. Texas State Dept. of Highways and Public Transportation, Austin. TTI218833751F, FHWATX84503751F. Apr 84. 129p.

ANNUAL TRANSPORTATION CONVENTION, 29 JULY-2 AUGUST 1985. SESSION: OPERATION AND UTILIZATION OF ROADS AND STREETS 2. Council for Scientific & Industrial Res S Africa P.O. Box 395 Pretoria South Africa 0-7988-3576-1. Aug 1985 163p. REPORT NO: CSIR-S-350-VOL-7-TO. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

ANTICIPATORY TRAFFIC MODELING AND ROUTE GUIDANCE IN INTELLIGENT VEHICLE-HIGHWAY SYSTEMS. KAUFMAN, DE; SMITH, RL; LEE, J. UNIVERSITY OF MICHIGAN TRANSPORTATION RESEARCH. IVHS TECHNICAL REPORT ; N90-2 Feb 1990 ENGLISH

ANTICIPATORY TRAFFIC MODELING AND ROUTE GUIDANCE: A GENERAL MATHEMATICAL FORMULATION. LAFORTUNE, S. UNIVERSITY OF MICHIGAN TRANSPORTATION RESEARCH. IVHS TECHNICAL REPORT ; N90-6 Sep 1990 ENGLISH

APPLICATION OF TRANSYT-7F IN CHINA. Wong, SY. Institute of Transportation Engineers. ITE Journal VOL. 58 NO. 8 Aug 1988 pp 38-42 Figs. Tabs. Refs.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

APPLICATION GUIDE FOR THE MICROCOMPUTER VERSION OF PASSER III-88. INTERIM REPORT (REVISED). Fambro, DB; Bonneson, JA. Texas Transportation Institute Texas A&M University College Station Texas 77843; Texas State Department of Highways & Public Transp Transportation Planning Division, P.O. Box 5051 Austin Texas 78763; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Apr 1990 68p 33 Fig. 4 Tab. 17 Ref. 1 App.. REPORT NO: FHWA/TX-90/478-2F; Res Rept 478-2F. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

APPLICATION OF SIMULATION TO EVALUATE THE OPERATION OF MAJOR FREEWAY WEAVING SECTIONS. Skabardonis, A; Cassidy, M; May, AD; Cohen, S. Transportation Research Board. Transportation Research Record N1225 1989 pp 91-98 8 Fig. 14 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

APPRAISAL OF EIGHT SMALL AREA TRAFFIC MANAGEMENT MODELS. Australian Road Research Board. Australian Road Research VOL 13 NO. 1 Mar 1983 pp 25-33 7 Tab. 49 Ref.

APPRAISAL OF TRAFFIC STREAM FRICTION. Mahalel, D (Technion-Israel Institute of Technology). Pergamon Press Limited. Transportation Research. Part A: General VOL. 18A NO. 3 May 1984 pp 225-230 6 Fig. 13 Ref.

ARCADY2 AND PICADY2: ENHANCED VERSIONS OF TRRL PROGRAMS FOR USE IN JUNCTION DESIGN. Semmens, MC; Taylor, ME (Transport and Road Research Laboratory). Printerhall Limited. Traffic Engineering and Control VOL 26 NO. 5 May 1985 pp 271-272 2 Ref.

ARCADY2: AN ENHANCED PROGRAM TO MODEL CAPACITIES, QUEUES AND DELAYS AT ROUNDABOUTS. RESEARCH REPORT. Semmens, MC. Transport and Road Research Laboratory Old Wokingham Road Crowthorne RG11 6AU Berkshire England 0266-5247. 1985 31p Figs. Tabs. Refs.. REPORT NO: RR 35. AVAILABLE FROM: Transport and Road Research Laboratory Old Wokingham Road Crowthorne RG11 6AU Berkshire England

ARFCOM: MODELS FOR ESTIMATING LIGHT TO HEAVY VEHICLE FUEL CONSUMPTION. Biggs, DC. AUSTRALIAN ROAD RESEARCH BOARD. RESEARCH REPORT NARR Sep 1988 61P. REPORT NO: 152

ARTERIAL ANALYSIS PACKAGE (AAP) USER'S MANUAL. Courage, KG; Wallace, CE; Reaves, DP. Florida University, Gainesville Transportation Research Center Gainesville Florida 32611; Federal Highway Administration Office of Research and Development, 400 7th Street, SW Washington D.C. 20590. Nov 1986 311p. REPORT NO: FHWA-IP-86-001; FCP 32Q9-16. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

ARTERIAL PRIORITY OPTION FOR THE TRANSYT-7F TRAFFIC-SIGNAL-TIMING PROGRAM. Moskaluk, MJ; Parsonson, PS. Transportation Research Board. Transportation Research Record N1181 1988 pp 57-60 2 Fig. 2 Tab. 2 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

ARTERIAL PRIORITY OPTION FOR THE TRANSYT-7F TRAFFIC-SIGNAL-TIMING PROGRAM. MOSKALUK, J; PARSONSON, PS. NATIONAL RESEARCH COUNCIL TRANSPORTATION RESEARCH WASHINGTON DC. 1988 27 PP ENGLISH

ARTERIAL PROGRESSION--NEW DESIGN APPROACH. Wallace, CE; Courage, KG (Florida University, Gainesville). Transportation Research Board. Transportation Research Record N881 1982 pp 53-59 4 Fig. 2 Tab. 9 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

ARTERIAL SIGNAL TIMING OPTIMIZATION USING PASSER II-87. Chang, ECP; Messer, CJ; Garzia, RU. Institute of Transportation Engineers. ITE Journal VOL 58 NO. 11 Nov 1988 pp 27-31 Figs. 3 Ref.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

ARTERIAL SIGNAL TIMING OPTIMIZATION USING PASSER II-87. MICROCOMPUTER USER'S GUIDE. FINAL REPORT. Chang, EC-P; Lei, JC-K; Messer, CJ. Texas Transportation Institute Texas A&M University College Station Texas 77843; Texas State Department of Highways & Public Transp Transportation Planning Division, P.O. Box 5051 Austin Texas 78763; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Jul 1988 105p 28 Fig. 1 Tab. 14 Ref. 2 App.. REPORT NO: FHWA/TX-88/467-1; Res Rept 467-1. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

ARTERIAL SIGNAL TIMING OPTIMIZATION USING PASSER II-90: PROGRAM USER'S MANUAL (REVISED). Final research rept. Chang-E.C.P.; Messer-C.J. Texas Transportation Inst., College Station. Federal Highway Administration, Austin, TX. Texas Div. Texas Dept. of Transportation, Austin. Transportation Planning Div. TTI21886467, RR4672F, FHWATX904672F. Jun 91. 120p.

ASSESSING THE TRAFFIC IMPACTS OF FREEWAY INCIDENTS AND DRIVER INFORMATION. Garrison, D; Mannering, F. Institute of Transportation Engineers. ITE Journal VOL. 60 NO. 8 Aug 1990 pp 19-23 Figs. 14 Ref.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024-2729

ASSESSING THE TRAFFIC IMPACTS OF TRANSPORTATION AND LAND DEVELOPMENT SCENARIOS. Deakin, EA; Skabardonis, A. Eno Foundation for Transportation, Incorporated. Transportation Quarterly VOL. 39 NO. 4 Oct 1985 pp 5-626. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

ASSESSING TRAFFIC AND EMERGENCY BENEFITS OF RAILROAD GRADE SEPARATIONS. Easa, SM; McColl, DR. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 113 NO. 6 Nov 1987 pp 593-608 Figs. Tabs. Refs.. REPORT NO: ASCE Paper 21939. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017

AT LAST - A TRANSYT MODEL DESIGNED FOR AMERICAN TRAFFIC ENGINEERS. Wallace, CE (Florida University, Gainesville). Institute of Transportation Engineers. ITE Journal VOL 53 NO. 8 Aug 1983 pp 28-31 11 Ref.. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

AUTOMATIC DETECTION OF TRAFFIC INCIDENTS ON A SIGNAL-CONTROLLED ROAD NETWORK. Thancanamootoo, S; Bell, MGH. NEWCASTLE-UPON-TYNE. RESEARCH REPORT N76 Jun 1988 34P

AUTOMATIC UPDATING OF TRAFFIC VOLUME DATA FOR SIGNAL TIMING PLAN DEVELOPMENT. FINAL REPORT. VOLUME 1. Kell, JH; Fullerton, IJ. JHK and Associates P.O. Box 3727 San Francisco California 94119; Federal Highway Administration Turner Fairbank Hwy Res Cntr, 6300 Georgetown Pike McLean Virginia 22101. Jul 1987 45p. REPORT NO: FHWA/RD-87/081; Rept No 4725. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

AUTOMATIC UPDATING OF TRAFFIC VOLUME DATA FOR SIGNAL TIMING PLAN DEVELOPMENT. FINAL REPORT. VOLUME 2. Kell, JH; Fullerton, IJ. JHK and Associates P.O. Box 3727 San Francisco California 94119; Federal Highway Administration Turner Fairbank Hwy Res Cntr, 6300 Georgetown Pike McLean Virginia 22101. Jul 1987 264p. REPORT NO: FHWA/RD-87/112; Rept No 4725. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

BANDWIDTH-CONSTRAINED DELAY OPTIMIZATION FOR SIGNAL SYSTEMS. 1988 PAST-PRESIDENTS' AWARD. Liu, CC. Institute of Transportation Engineers. ITE Journal VOL. 58 NO. 12 Dec 1988 pp 21-26 1 Fig. Tabs. 16 Refs.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

BASIC CONCEPTS IN THE IMAURO SYSTEM FOR DYNAMIC SIMULATION OF TRAFFIC FLOWS: SOME COMMENTS. Goodwin, PB. Oxford University, England Transport Studies Unit, 11 Bevington Road Oxford OX2 6NB England. Jun 1989 20p. REPORT NO: TSU-REF-467. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

BENCHMARK STUDY OF THE I-DYNEV EVACUATION TIME ESTIMATE COMPUTER CODE. Urbanik, T; Moeller, MP; Barnes, K. Battelle Memorial Institute/Pacific Northwest Labs Battelle Boulevard, P.O. Box 999 Richland Washington 99352. Jun 1988 52p. REPORT NO: PNL-6171. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

BENEFIT-COST EVALUATION OF LEFT-TURN LANES ON UNCONTROLLED APPROACHES OF RURAL INTERSECTIONS (ABRIDGMENT). McCoy, PT; Hoppe, WJ; Dvorak, DV. Transportation Research Board. Transportation Research Record N1026 1985 pp 40-43 2 Tab. 26 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

BTS (VERSION 1.0): BOTTLENECK TRAFFIC SIMULATOR USER'S MANUAL. LIN, WH; HALL, RW. INSTITUTE OF TRANSPORTATION STUDIES UNIVERSITY OF. PATH WORKING PAPER, NUCB- 1991 24 PP ENGLISH. REPORT NO: ITS-PWP-91-1

BUS-STOPS, CONGESTION AND CONGESTED BUS-STOPS. Gibson, J; Baeza, I; Willumsen, L. Printerhall Limited. Traffic Engineering and Control VOL. 30 NO. 6 Jun 1989 7p Figs. Tabs. Refs.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London England

CALIBRATING SIDRA. RESEARCH REPORT. Akcelik, R. Australian Road Research Board 500 Burwood Highway Vermont South Victoria 3133 Australia 0518-0758 0-86910-433-0. Mar 1990 115p. REPORT NO: ARR180

CALIBRATION OF TRANSYT PLATOON DISPERSION MODEL FOR PASSENGER CARS UNDER LOW-FRICTION FLOW CONDITIONS (ABRIDGMENT). McCoy, PT; Balderson, EA; Hsueh, RT; Mohaddes, AK (Nebraska University, Lincoln). Transportation Research Board. Transportation Research Record N905 1983 pp 48-52 1 Fig. 5 Tab. 8 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

CAN YOU AFFORD NOT TO USE TRAFFIC MODELS?. Liu, C; Kanaan, A; AEPCO Inc., Rockville, Md. and Santiago, A; and Lieu, H.; Federal Highway Administration, McLean, Va. Paper presented at the Engineering Foundation Conference on Traffic Management: Issues and Techniques, April, 1991

CAPACITY AND LEVEL OF SERVICE BY SIMULATION--A CASE STUDY OF TRAF-NETSIM. HIGHWAY CAPACITY AND LEVEL OF SERVICE. PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON HIGHWAY CAPACITY, KARLSRUHE, GERMANY, 24-27 JULY 1991. Wong, S-Y. Balkema (AA) P.O. Box 1675 3000 BR Rotterdam Netherlands 90 5410 011 7. 1991 pp 467-483 12 Fig. 7 Tab. 10 Ref.. AVAILABLE FROM: Balkema (AA) Publishers Old Post Road Brookfield Vermont 05036

CAPACITY FACTOR OR CYCLE TIME OPTIMIZATION FOR SIGNALIZED JUNCTIONS: A GRAPH THEORY APPROACH. Cantarella, GE; Improta, G. Pergamon Press Limited. Transportation Research. Part B: Methodological VOL. 22B NO. 1 Feb 1988 pp 1-23 25 Ref.. AVAILABLE FROM: Pergamon Press Limited Headington Hill Hall Oxford OX3 0BW England

CAR TRAFFIC FORECASTING - BACKSIGHTS, INSIGHTS AND FORESIGHTS. Duffell, JR (Hatfield Polytechnic). Kinslea Press Limited. Municipal Engineer VOL. 109 NO. 6 Jun 1982 pp 132-139 13 Fig. 12 Ref.

CARSIM: CAR-FOLLOWING MODEL FOR SIMULATION OF TRAFFIC IN NORMAL AND STOP-AND-GO CONDITIONS. Benekohal, RF; Treiterer, J. Transportation Research Board. Transportation Research Record N1194 1988 pp 99-111 7 Fig. 4 Tab. 26 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

CASE STUDY EVALUATION OF ALTERNATIVE SIGNAL TIMING PLANS FOR AN OVERSATURATED STREET NETWORK. Berg, WD; Lau, KY; Dettmann, DC; Rylander, G. F. (Wisconsin University, Madison). Institute of Transportation Engineers. ITE Journal VOL. 52 NO. 4 Apr 1982 pp 23-27 5 Ref.. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

CASE STUDY EVALUATION OF THE SAFETY AND OPERATIONAL BENEFITS OF TRAFFIC SIGNAL COORDINATION. Berg, WD; Kaub, AR; Belscamper, BW. Transportation Research Board. Transportation Research Record N1057 1986 pp 58-64 9 Fig. 4 Tab. 4 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

CHARACTERIZING THE QUALITY OF TRAFFIC SERVICE IN URBAN STREET NETWORKS. Herman, R; Ardekani, S. Texas University, Austin Center for Transportation Research Austin Texas 78712; Texas State Department of Highways & Public Transp Transportation Planning Division, P.O. Box 5051 Austin Texas 78763; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Nov 1984 Final Rpt. 202p Figs. Tabs. 70 Ref. 2 App.. REPORT NO: FHWA-TX-85-44+304-2F. AVAILABLE FROM: Texas University, Austin Center for Transportation Research Austin Texas 78712

COMMENTS ON THE APPLICATION OF QUEUING THEORY TO DELAYS AT SIGNALS. Akcelik, R. Australian Road Research Board. Australian Road Research VOL. 20 NO. 3 Sep 1990 pp 53-61 19 Ref.. AVAILABLE FROM: Australian Road Research Board Executive Director, P.O. Box 156 Nunawading Victoria 3131 Australia

COMPARATIVE ANALYSIS OF LEFT-TURN PHASE SEQUENCING (ABRIDGMENT). Machemehl, RB; Mechler, AM (Texas University, Austin). Transportation Research Board. Transportation Research Record N956 1984 pp 37-40 6 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

COMPARATIVE ANALYSIS OF MODELS FOR ESTIMATING DELAY FOR OVERSATURATED CONDITIONS AT FIXED-TIME TRAFFIC SIGNALS. Cronje, WB. Transportation Research Board. Transportation Research Record N1091 1986 p 48-59 9 Fig. 8 Tab. 4 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

PARATIVE ANALYSIS OF TWO LOGIC FOR ADAPTIVE CONTROL OF ISOLATED INTERSECTIONS. Lin, F-B. portation Research Board. Transportation Research Record N1194 1988 pp 6-14 7 Fig. 11 Ref.. AVAILABLE FROM: portation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

PARATIVE ASSESSMENT OF 1985 HCM DELAY MODEL. Sadegh, A; Radwan, AE. American Society of Civil neers. Journal of Transportation Engineering VOL 114 NO. 2 Mar 1988 pp 194-208 Figs. Tabs. Refs. Apps.. REPORT ASCE Paper 22278. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 17

PARING CAPACITIES AND DELAY ESTIMATES BY HIGHWAY CAPACITY SOFTWARE AND TRAF-NETSIM TO LD STUDIES. Wong, S. (Federal Highway Administration, Washington, D.C.). Institute of Transportation Engineers, ITE 0 Compendium of Technical Papers, pp. 224-227.

MPARISON OF FIXED TIME AND FLEXIBLE PROGRESSIVE TRAFFIC CONTROL IN SLOUGH. Lines, CJ; Lucas, CF. RL Supplementary Report 1984 Monograph 8p 2 Fig. 2 Tab. 7 Ref.. REPORT NO: SR 837

MPARISON OF MACROSCOPIC MODELS FOR SIGNALIZED INTERSECTION ANALYSIS. Hagen, LT; Courage, KG. nsportation Research Board. Transportation Research Record N1225 1989 pp 33-44 14 Fig. 10 Ref.. AVAILABLE FROM: nsportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

OMPARISON OF SOAP AND NETSIM: PRETIMED AND ACTUATED SIGNAL CONTROLS. Nemeth, ZA (Ohio State niversity). Transportation Research Board. Transportation Research Record N905 1983 pp 84-89 13 Fig. 2 Tab. 3 Ref.. VAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 0418

OMPUTER APPLICATIONS IN TRAFFIC SIGNAL MANAGEMENT. SESSION 4. Skabardonis, A; May, AD (California University, Berkeley). Institute of Transportation Engineers. Compendium of Technical Papers, 1984 pp 1-5 4 Fig. 8 Tab. 13 Ref.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

COMPUTER USER MANUAL FOR PROGRAM "LATM"--A PROGRAM PACKAGE FOR LOCAL AREA TRAFFIC MODELLING. Taylor, MAP. Commonwealth Scientific & Indus Res Org, Australia Division of Building Research, P.O. Box 56 Highett Victoria Australia 0 643 02818 8. 1982 Monograph 45p 5 Fig.

CONCURRENT USE OF MAXBAND AND TRANSYT SIGNAL TIMING PROGRAMS FOR ARTERIAL SIGNAL OPTIMIZATION. Cohen, SL (Federal Highway Administration). Transportation Research Board. Transportation Research Record N906 1983 pp 81-84 2 Tab. 7 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

CONGESTION-BASED CONTROL SCHEME FOR CLOSELY SPACED, HIGH TRAFFIC DENSITY NETWORKS. Lieberman, EB; Rathi, AK; King, GF; Schwartz, SI. Transportation Research Board. Transportation Research Record N1057 1986 pp 49-57 2 Fig. 5 Tab. 10 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

CONGESTION, FLOW AND CAPACITY. HIGHWAY CAPACITY AND LEVEL OF SERVICE. PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON HIGHWAY CAPACITY, KARLSRUHE, GERMANY, 24-27 JULY 1991. Liu, G-Q. Balkema (AA) P.O. Box 1675 3000 BR Rotterdam Netherlands 90 5410 011 7. 1991 pp 245-251 10 Fig. Refs.. AVAILABLE FROM: Balkema (AA) Publishers Old Post Road Brookfield Vermont 05036

CONSEQUENCES FOR TRAFFIC FLOW DURING A TEMPORARY ROAD-BLOCK (II). Botma, H; Stembord, HL (Delft University Of Technology). Royal Dutch Touring Club ANWB. Verkeerskunde VOL 36 NO. 7 Jul 1985 pp 314-316 2 Fig. 2 Tab. Dutch

CONSIDERATIONS IN THE LENGTH OF THE YELLOW INTERVAL. Shanteau, RM. Purdue University. Engineering Bulletin of Purdue University N154 Mar 1983 pp 115-120 2 Fig. 1 Tab. 8 Ref.. AVAILABLE FROM: Purdue University West Lafayette Indiana 47907

CONTROL OF FREEWAY TRAFFIC FLOW. Smulders, SA. S.Smulders Kervelgaarde 7 Nieuwegein Netherlands. 1990 162p 104 Ref. Dutch. AVAILABLE FROM: S. Smulders Kervelgaarde 7 Nieuwegein Netherlands

CONTROL STRATEGIES AND DETECTOR PLACEMENT GUIDELINES FOR A 1.5 GENERATION TRAFFIC CONTROL SYSTEM. Kessmann, RW; Ku, CS; Cooper, DL. Kessmann and Associates, Incorporated 18333 Egret Bay Boulevard Houston Texas 77058. Feb 1985 116p. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

CONTROL SYSTEM DESIGN FOR AN INDIVIDUAL SIGNALIZED JUNCTION. Improta, G; Cantarella, GE (Naples University, Italy). Pergamon Press Limited. Transportation Research. Part B: Methodological VOL. 18B NO. 2 Apr 1984 pp 147-167 17 Fig. 5 Tab. Refs.

COORDINATION OF ACTUATED ARTERIAL TRAFFIC SIGNAL SYSTEMS. Jovanis, PP; Gregor, JA. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 112 NO. 4 Jul 1986 pp 416-432 6 Fig. 6 Tab. 24 Ref.. REPORT NO: ASCE Paper 20775. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017

CURRENT KNOWLEDGE OF RURAL TRAFFIC BEHAVIOR. McLean, JR. Australian Road Research Board 500 Burwood Road Vermont South Victoria 3133 Australia 0 86910 127 7. 1983 pp 13-36 8 Fig. 6 Tab. 33 Ref.

DELAY ALLEVIATED BY LEFT-TURN BYPASS LANES. Bruce, EL; Hummer, JE. Transportation Research Board. Transportation Research Record N1299 1991 pp 1-8 3 Fig. 3 Tab. 10 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

DELAY ANALYSIS FOR FREEWAY CORRIDOR SURVEILLANCE, COMMUNICATION, AND CONTROL SYSTEMS. Derr, BR. Transportation Research Board. Transportation Research Record N1132 1987 pp 77-81 4 Fig. 1 Tab. 4 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

DELAY AT LIGHT RAIL TRANSIT GRADE CROSSINGS. Research rept. Sep 83-Sep 87. Cline-J.C.; Urbanik-T.; Rymer-B. Texas Transportation Inst., College Station. Federal Highway Administration, Austin, TX. Texas Div. Texas State Dept. of Highways and Public Transportation, Austin. TTI2108433910, FHWATX8733910. Mar 86. 67p.

DELAY MODELS FOR MIXED PLATOON AND SECONDARY FLOWS. Rouphail, NM. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 114 NO. 3 Mar 1988 pp 131-152 Figs. Tabs. Refs. Apps.. REPORT NO: ASCE Paper 22254. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017

DELAY MODELS OF TRAFFIC-ACTUATED SIGNAL CONTROLS. Lin, FB; Mazdeyasna, F (Clarkson College of Technology, New York). Transportation Research Board. Transportation Research Record N905 1983 pp 33-38 7 Fig. 8 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

DEMAND-RESPONSE DECENTRALIZED URBAN TRAFFIC CONTROL. PART 2. NETWORK EXTENSIONS. Gartner, NH; Kaltenbach, MH; Miyamoto, MM. Lowell University, Massachusetts Lowell Massachusetts 01854. Jul 1983 159p. REPORT NO: ULRF-05-2998-2; DOT/OST/P34-85/009. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

DEMONSTRATION OF THE EFFECTS OF HARMONIZED SPEED ON EFFICIENCY AND TRAFFIC SAFETY - A TRAFFIC SIMULATION STUDY OF TRAFFIC INTERACTION EFFECTS. REPORT SUMMARY. Carlsson, A; Nilsson, G. National Swedish Road & Traffic Research Institute. Nordic Road and Transport Research VOL. 1 NO. 1 1989 pp 20-21 1 Fig. 3 Tab.. AVAILABLE FROM: National Swedish Road & Traffic Research Institute Editor-in-chief S-581 01 Linkoeping Sweden

DEMONSTRATION OF TRAF-NETSIM FOR TRAFFIC OPERATIONS MANAGEMENT. FINAL REPORT. Sulzberg, JD; Demetsky, MJ. Virginia Transportation Research Council P.O. Box 3817, University Station Charlottesville Virginia 22903; Virginia Department of Transportation 1221 East Broad Street Richmond Virginia 23219; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Aug 1991 73p 6 Fig. 11 Tab. 34 Ref. 6 App.. REPORT NO: FHWA/VA-92-R3; VTRC 92-R3. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

VATION OF EQUATIONS FOR QUEUE LENGTH, STOPS, AND DELAY FOR FIXED-TIME TRAFFIC SIGNALS. , WB (Stellenbosch University, South Africa). Transportation Research Board. Transportation Research Record N905 pp 93-95 5 Fig.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, Washington D.C. 20418

IGN LENGTHS OF LEFT- OR RIGHT-TURN LANES WITH SEPARATE SIGNAL PHASES. Oppenlander, JC; nlander, JE. Institute of Transportation Engineers. ITE Journal VOL. 59 NO. 7 Jul 1989 pp 23-26 Figs. 3 Ref.. LABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024-2729

IGN, PERFORMANCE AND PLANNING OF SIGNALIZED ARTERIAL TRAFFIC NETWORKS. Final rept. Rao-T.S.C.S. ornia Univ., Berkeley. Dept. of Civil Engineering. RAOTRAFFIC871, Dec 87. 398p.

TERMINING PARAMETERS OF THE CONGESTED PART OF THE FUNDAMENTAL DIAGRAM. Botma, H; Detma, H, (Delft University Of Technology; Studiecentrum Verkeerstechniek). Werkdagcommissie. Bijdragen Verkeerskundige rkdagen 1983 Apr 1983 pp 799-814 6 Fig. 3 Tab. 5 Ref. Dutch. AVAILABLE FROM: Werkdagcommissie P.O. Box 163 ebergen-rijsenbur Netherlands

EVELOPMENT AND APPLICATION OF A MODEL TO INVESTIGATE THE TECHNICAL REQUIREMENTS FOR SIGNALS O DESIGN INTERSECTIONS. Myrrhe, R; Schnuell, R. Bundesminister fuer Verkehr, Abteilung Strassenbau Lennestrasse D-5300 Bonn West Germany. Mar 1986 56p German. AVAILABLE FROM: National Technical Information Service 5285 ort Royal Road Springfield Virginia 22161

DEVELOPMENT AND APPLICATION OF THE SSTOP TRAFFIC SIGNAL OPTIMIZATION PROGRAM. Lam, JK; Ugge, AJ; Allen, BL (Delcan Limited; Ontario Ministry of Transportation & Communic, Can; McMaster University, Canada). Wyllie and Ufnal Limited 1 Greensboro Drive, Suite 300 Rexdale Ontario Canada. 1982 pp 495-513 2 Fig. 3 Tab. 5 Ref.

DEVELOPMENT AND APPLICATIONS OF TRAFFIC SIMULATION MODELS AT THE KARLSRUHE INSTITUT FUR VERKEHRWESEN. LEUTZBACH, W; WIEDEMANN, R. TRAFFIC ENGINEERING & CONTROL VOL. 27 NO. 5 May 1986 PP 270-278 ENGLISH

DEVELOPMENT OF A FREEWAY CORRIDOR EVALUATION SYSTEM - PASSER IV. FINAL REPORT. Cunagin, WD; Borchardt, D; Chang, ECP. Texas Transportation Institute Texas A&M University College Station Texas 77843; Texas State Department of Highways & Public Transp Transportation Planning Division, P.O. Box 5051 Austin Texas 78763; Federal Highway Administration Office of Research and Development, 400 7th Street, SW Washington D.C. 20590. Aug 1986 85p. REPORT NO: FHWA/TX-86/63+281-2F. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

DEVELOPMENT OF A NEW HIGHWAY TRAFFIC NOISE PREDICTION MODEL. VOLUME 3: INDOOR VALIDATION TEST RESULTS. Lawther, JM. Pennsylvania State University Applied Research Laboratory, P.O. Box 30 State College Pennsylvania 16804; Federal Highway Administration Turner Fairbank Hwy Res Cntr, 6300 Georgetown Pike McLean Virginia 22101. Mar 1985 141p. REPORT NO: FHWA-TS-85-203; FCP 3322-418. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

DEVELOPMENT OF A NEW HIGHWAY TRAFFIC NOISE PREDICTION MODEL. VOLUME 4: HIGHWAY TRAFFIC TESTING OF PSUHTRAN VALIDITY. Lawther, JM. Pennsylvania State University Applied Research Laboratory, P.O. Box 30 State College Pennsylvania 16804; Federal Highway Administration Turner Fairbank Hwy Res Cntr, 6300 Georgetown Pike McLean Virginia 22101. Mar 1985 188p. REPORT NO: FHWA-TS-85-204; FCP 3322-418. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

DEVELOPMENT OF A NEW HIGHWAY TRAFFIC NOISE PREDICTION MODEL. VOLUME 5: BASIS FOR PSUHTRAN HIGHWAY TRAFFIC NOISE PREDICTION MODEL. Lawther, JM. Pennsylvania State University Applied Research Laboratory, P.O. Box 30 State College Pennsylvania 16804; Federal Highway Administration Turner Fairbank Hwy Res Cntr, 6300 Georgetown Pike McLean Virginia 22101. Mar 1985 140p. REPORT NO: FHWA-TS-85-205; FCP 3322-418. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

DEVELOPMENT OF A NEW HIGHWAY TRAFFIC NOISE PREDICTION MODEL. VOLUME 1: EXECUTIVE SUMMARY. Lawther, JM. Pennsylvania State University Applied Research Laboratory, P.O. Box 30 State College Pennsylvania 16804; Federal Highway Administration Turner Fairbank Hwy Res Cntr, 6300 Georgetown Pike McLean Virginia 22101. Mar 1985 5p. REPORT NO: FHWA-TS-85-201; FCP 3322-418. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

DEVELOPMENT OF A NEW HIGHWAY TRAFFIC NOISE PREDICTION MODEL. VOLUME 2: FINAL REPORT. Lawther, JM. Pennsylvania State University Applied Research Laboratory, P.O. Box 30 State College Pennsylvania 16804; Federal Highway Administration Turner Fairbank Hwy Res Cntr, 6300 Georgetown Pike McLean Virginia 22101. Mar 1985 106p. REPORT NO: FHWA-TS-85-202; FCP 3322-418. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

DEVELOPMENT OF A NEW HIGHWAY TRAFFIC NOISE PREDICTION MODEL. VOLUME 6: PSUHTRAN/INDATA USER'S MANUAL. Welz, JP. Pennsylvania State University Applied Research Laboratory, P.O. Box 30 State College Pennsylvania 16804; Federal Highway Administration Turner Fairbank Hwy Res Cntr, 6300 Georgetown Pike McLean Virginia 22101. Mar 1985 188p. REPORT NO: FHWA-TS-85-206; FCP 3322-418. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

DEVELOPMENT OF COMPACT MICROSIMULATION FOR ANALYZING FREEWAY OPERATIONS AND DESIGN. Bullen, AGR (Pittsburgh University, Pittsburgh). Transportation Research Board. Transportation Research Record N841 1982 pp 15-18 4 Fig. 6 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

DEVELOPMENT OF GRAPHICS DISPLAYS FOR THE INTEGRATED TRAFFIC DATA SYSTEM. Santiago, AJ; Chin, S-M. Transportation Research Board. Transportation Research Record N1112 1987 pp 140-143 1 Fig.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

DEVELOPMENTAL STUDY OF IMPLEMENTATION GUIDELINES FOR LEFT-TURN TREATMENTS. Lin, H-J; Machemehl, RB (Texas University, Austin). Transportation Research Board. Transportation Research Record N905 1983 pp 96-105 13 Fig. 8 Tab. 10 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

DIRECTIONAL WEIGHTING FOR MAXIMAL BANDWIDTH ARTERIAL SIGNAL OPTIMIZATION PROGRAMS. VOLUME 1. TECHNICAL REPORT. FINAL REPORT. Chang, ECP; Messer, CJ. Texas Transportation Institute Texas A&M University College Station Texas 77843; Federal Highway Administration Turner Fairbank Hwy Res Cntr, 6300 Georgetown Pike McLean Virginia 22101. Jul 1985 86p. REPORT NO: FHWA/RD-86/20. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

DIRECTIONAL WEIGHTING FOR MAXIMAL BANDWIDTH ARTERIAL SIGNAL OPTIMIZATION PROGRAMS. Chang, EC-P; Messer, CJ; Cohen, SL. Transportation Research Board. Transportation Research Record N1057 1986 pp 10-19 8 Fig. 6 Tab. 20 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

DYNAMIC ANALYSIS OF LANE CLOSURE STRATEGIES. Mahmassani, HS; Jayakrishnan, R. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 114 NO. 4 Jul 1988 pp 476-496 Figs. Tabs. Refs. Apps.. REPORT NO: ASCE Paper 22622. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017

DYNAMIC MODEL OF PEAK PERIOD CONGESTION. Ben-Akiva, M; Cyna, M; De Palma, A (Massachusetts Institute of Technolog Ministry of Transport, France; McMaster University, Canada). Pergamon Press Limited. Transportation Research. Part B: Methodological VOL. 18B NO. 4/5 1984 pp 339-355 17 Fig. 14 Ref.

DYNAMIC MODELS OF COMMUTER BEHAVIOR : EXPERIMENTAL INVESTIGATION AND APPLICATION TO THE ANALYSIS OF PLANNED TRAFFIC DISRUPTIONS. MAHMASSANI, HS (UNIVERSITY OF TEXAS AT AUSTIN). TRANSPORTATION RESEARCH PART A NV199N6 Nov 1990 PP 465-484 ENGLISH

DYNAMIC TRAFFIC CONTROL SYSTEM SCOOT - FURTHER DEVELOPMENTS. Bretherton, RD. ENGINEERING FOUNDATION. TRAFFIC CONTROL METHODS. PROCEEDINGS OF THE FIFTH 1990 337-9

NEMO: A MODEL FOR THE SIMULATION OF TRAFFIC FLOW IN MOTORWAY NETWORKS. Schwerdtfeger, T (Technical University of Karlsruhe, West Germany). VNU Science Press Bv P.O. Box 2073 Utrecht Netherlands 0-6764-008-5. 1984 pp 65-87 12 Fig. 18 Ref.

EFFECT OF BUS TURNOUTS ON TRAFFIC CONGESTION AND FUEL CONSUMPTION. Cohen, SL (Federal Highway Administration). Transportation Research Board. Transportation Research Record N901 1983 pp 33-38 4 Fig. 3 Tab. 13 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

EFFECT OF CLEARANCE INTERVAL TIMING ON TRAFFIC FLOW AND CRASHES AT SIGNALIZED INTERSECTIONS. Zador, P; Stein, H; Shapiro, S; Tarnoff, P. Institute of Transportation Engineers. ITE Journal VOL. 55 NO. 11 Nov 1985 pp 36-39 9 Ref.. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

EFFECT OF LEFT-TURN BAYS ON FUEL CONSUMPTION ON UNCONTROLLED APPROACHES TO STOP-SIGN-CONTROLLED INTERSECTIONS. Dvorak, DV; McCoy, PT (Nebraska University, Lincoln). Transportation Research Board. Transportation Research Record N901 1983 pp 50-53 4 Fig. 7 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

EFFECTIVENESS OF RELEASE TIME MODIFICATION IN ROAD NETWORKS WITH LIGHT SIGNAL SYSTEMS. PT. C. APPENDICES. Schlabbach, K. Technische Hochschule Darmstadt Germany. Jan 1990 202p German. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

EFFECTS OF ARTERIAL PLATOON PROGRESSION ON CAPACITY. Todd, K. Printerhall Limited. Traffic Engineering and Control VOL. 29 NO. 9 Sep 1988 pp 468-470 Figs. Refs.

EFFECTS OF DESIGN ELEMENTS ON MERGING CAPACITY. Skabardonis, A; McDonald, M. Institution of Highways and Transportation. Highways and Transportation VOL. 32 NO. 11 Nov 1985 pp 14-18 11 Fig. 4 Tab. 11 Ref.. AVAILABLE FROM: Institution of Highways and Transportation 3 Lygon Place, Ebury Street London SW1 England

EFFECTS OF PROGRESSION QUALITY AND TRAFFIC FLOW NON-STATIONARITY IN DELAYS MODELS AT SIGNALIZED INTERSECTIONS. HIGHWAY CAPACITY AND LEVEL OF SERVICE. PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON HIGHWAY CAPACITY, KARLSRUHE, GERMANY, 24-27 JULY 1991. Chodur, J; Tracz, M. Balkema (AA) P.O. Box 1675 3000 BR Rotterdam Netherlands 90 5410 011 7. 1991 pp 91-97 3 Fig. 5 Tab. Refs.. AVAILABLE FROM: Balkema (AA) Publishers Old Post Road Brookfield Vermont 05036

EFFECTS OF PROHIBITING LEFT-TURNS AT SIGNALIZED INTERSECTIONS. FINAL REPORT. Habib, P; Thornhill, W; Kaplan, W. Polytechnic Institute of New York 333 Jay Street Brooklyn New York 11201 Federal Highway Administration Turner Fairbank Hwy Res Cntr, 6300 Georgetown Pike McLean Virginia 22101. Jul 1984 54p. REPORT NO: FHWA/RD-84/083; FCP 31A2-022. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

EMERGING TECHNOLOGICAL TOOLS FOR DETAILED FREEWAY DESIGN AND OPERATIONAL ANALYSIS: TRAF-FRESIM, FSMTUTOR, AND FEDIT. Mekemson, J. and Kanaan, A. (VICOR Associates, Manassas, Va.). Proceedings of the 1991 Annual Meeting of the Institute of Transportation Engineers, Washington, D.C.

EMPIRICAL STUDY OF ON-THE-STREET OPERATION OF LRT AND BUSES IN CALGARY. Babalola, A; Morrall, JF (Calgary University, Canada). Institute of Transportation Engineers 9803 102A Avenue, 12th Floor Edmonton Alberta Canada. 1983 20p 7 Fig. 4 Tab. 6 Ref.

ENERGY AND EMISSION CONSEQUENCES OF IMPROVED TRAFFIC SIGNAL SYSTEMS. Kahng, SJ; May, AD (California University, Berkeley). Transportation Research Board. Transportation Research Record N881 1982 pp 34-41 11 Fig. 3 Tab. 23 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

ENERGY SAVINGS THROUGH SIGNAL TIMING OPTIMIZATION AND COORDINATION. McGill, JA; Degroot, P; Ugge, A (Ontario Ministry of Transportation & Communic, Can; Delcan Canada Limited). Wyllie and Ufnal Limited 1 Greensboro Drive, Suite 300 Rexdale Ontario Canada. 1982 pp 236-256 4 Fig. 4 Tab. 8 Ref.

ENGINEERING STRATEGIES FOR MAJOR RECONSTRUCTION OF URBAN HIGHWAYS. VOLUME 2. APPLI[illegible] TO THE I-5 RECONSTRUCTION PROJECT. FINAL REPORT. Recker, WW; Waters, CD; Leonard, JD. California Un[illegible] Irvine Institute of Transportation Studies Irvine California 92717; Federal Highway Administration 400 7th Stre[illegible] Washington D.C. 20590; California Department of Transportation 1120 N Street Sacramento California 95814. De[illegible] 291p. REPORT NO: FHWA/CA/UCI/ITS/RR-1. AVAILABLE FROM: National Technical Information Service 5285 Port [illegible] Road Springfield Virginia 22161

ENHANCED FREFLO: MODELING OF CONGESTED ENVIRONMENTS. Rathi, AK; Lieberman, EB; Yedlin, [illegible] Transportation Research Board. Transportation Research Record N1112 1987 pp 61-71 5 Fig. 9 Tab. 7 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

ENTERING HEADWAY AT SIGNALIZED INTERSECTIONS IN A SMALL METROPOLITAN AREA. Lee, J; Chen, [illegible] Transportation Research Board. Transportation Research Record N1091 1986 p 117-126 1 Fig. 13 Tab. 7 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

ESTIMATING TIME-DEPENDENT TRIP MATRICES FROM TRAFFIC COUNTS. Willumsen, LG (University College, London). VNU Science Press Bv P.O. Box 2073 Utrecht Netherlands 90-6764-008-5. 1984 pp 397-411 1 Tab. 15 Ref.

ESTIMATION OF LEFT-TURN TRAFFIC PARAMETERS. Lin, FB; Nadratowski, TT (Clarkson College of Technology). American Society of Civil Engineers. ASCE Journal of Transportation Engineering VOL. 109 NO. 3 May 1983 pp 347-362 11 Ref.. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

ESTIMATION OF ROAD USER COST FACTORS BY ROAD TRAFFIC SIMULATION. GYNNERSTEDT, G. PRESSES DE L'ECOLE NATIONALE DES PONTS ET. COLLOQUE INTERNATIONAL SUR LES ROUTES ET LE VOL. 1 1984 PP 349-353 ENGLISH

EVALUATING TRAFFIC CAPACITY AND IMPROVEMENTS TO ROAD GEOMETRY. Hoban, CJ. International Bank for Reconstruction & Development 1818 H Street, NW Washington D.C. 20433 0-8213-0965-X. 1987 157p. REPORT NO: TP-74. AVAILABLE FROM: International Bank for Reconstruction & Development 1818 H Street, NW Washington D.C. 20433

EVALUATION OF 1984 LOS ANGELES SUMMER OLYMPICS TRAFFIC MANAGEMENT. FINAL REPORT. Giuliana, G; Haboian, K; Rutherford, K; Prashker, J; Recker, W. California University, Irvine Institute of Transportation Studies Irvine California 92717. Apr 1987 156p Figs. Tabs. Refs. 1 App.. AVAILABLE FROM: California University, Irvine Institute of Transportation Studies Irvine California 92717

EVALUATION OF BUS LANES. Hounsell, NB; McDonald, M. TRANSPORT AND ROAD RESEARCH LABORATORY. TRRL CONTRACTOR REPORT NCR 8 1988 216P. REPORT NO: 7

EVALUATION OF COMPUTER PROGRAMS FOR PREDICTING THE PERFORMANCE OF SIGNALIZED INTERSECTIONS. Rao, TSCS. California University, Berkeley Department of Civil Engineering Berkeley California 94720. Jan 1988 193p. REPORT NO: RAO/TRAFFIC-88/02. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

EVALUATION OF CONTROL STRATEGIES FOR BUS PREEMPTION OF TRAFFIC SIGNALS. Smith, MJ. New Jersey Department of Transportation Bureau of Transportation Systems Research, 1035 Parkway Ave Trenton New Jersey 08625; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Mar 1985 Final Rpt. 53p 5 Fig. 2 Tab. 3 App.. REPORT NO: FHWA-NJ-RD-85-003. AVAILABLE FROM: New Jersey Department of Transportation Bureau of Transportation Systems Research, 1035 Parkway Ave Trenton New Jersey 08625

EVALUATION OF DYNAMIC FREEWAY FLOW MODEL BY USING FIELD DATA (DISCUSSION). Derzko, NA; Ugge, AJ; Case, ER; Payne, HJ (Ontario Ministry of Transportation & Communic, Can). Transportation Research Board. Transportation Research Record N905 1983 pp 52-60 12 Fig. 1 Tab. 14 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

EVALUATION OF FREEWAY IMPROVEMENT ALTERNATIVES USING CORFLO. Liu, C. (AEPCO, Rockville, Md.) and Kanaan, A. (VIGGEN Corporation, Reston, Va.). Proceedings of the American Society of Civil Engineers Microcomputers in Transportation Conference, 1992.

UATION OF ROADWAY SITES FOR QUEUE MANAGEMENT. Final rept. Miller-H.J.; Demetsky-M.J. Virginia portation Research Council, Charlottesville. Federal Highway Administration, Richmond, VA. Virginia Div. Virginia of Transportation, Richmond. VTRC92R5, FHWAVA92R5. Dec 91. 126p.

UATION OF SIGNAL TIMING AND COORDINATION PROCEDURES: VOLUME II: FIELD MANUAL. Arnold, ED, Jr. nia Highway & Transportation Research Council P.O. Box 3817, University Station Charlottesville Virginia 22903; nia Department of Highways and Transportation 1221 East Broad Street Richmond Virginia 23219 Federal Highway inistration 400 7th Street, SW Washington D.C. 20590. Sep 1985 62p 19 Fig. 6 Tab. 13 Ref.. REPORT NO: A-VA-86-08-09; VHTRC 86-R9. AVAILABLE FROM: Virginia Highway & Transportation Research Council P.O. Box 17, University Station Charlottesville Virginia 22903

ALUATION OF SIGNAL TIMING VARIABLES BY USING A SIGNAL TIMING OPTIMIZATION PROGRAM. Mao, ACM; sser, CJ; Rogness, RO (Texas State Department of Highways & Public Transp; Texas Transportation Institute; North kota State University). Transportation Research Board. Transportation Research Record N881 1982 pp 48-52 12 Fig. Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington .C. 20418

VALUATION OF THE DYNAMIC ARTERIAL-RESPONSIVE TRAFFIC SYSTEM (DARTS). Lee, CE. Texas University, stin Center for Transportation Research Austin Texas 78712 243-1F; Texas State Department of Highways & Public ansp Transportation Planning Division, P.O. Box 5051 Austin Texas 78701. Aug 1982 Final Rpt. 67p. REPORT NO: HWA/TX-82/25+243-1F. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield irginia 22161

EVALUATION OF THE OPTIMIZED POLICIES FOR ADAPTIVE CONTROL STRATEGY. FINAL REPORT. Farradyne Systems, Incorporated 3206 Tower Oaks Boulevard Rockville Maryland 20852; Federal Highway Administration Turner Fairbank Hwy Res Cntr, 6300 Georgetown Pike McLean Virginia 22101. May 1989 130p. REPORT NO: FHWA-RD-89-135; NCP 3B1e 1022. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

EVALUATION OF VEHICLE ACTUATED SIGNAL CONTROL IN URBAN STREET NETWORK. Joubert, HS; Lockwood, DN. National Institute for Transport & Rd Res, S Af P.O. Box 395 Pretoria 0001 Transvaal South Africa. Aug 1986 18p. REPORT NO: CSIR-RR-468. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

EVALUATION TOOLS OF URBAN INTERCHANGE DESIGN AND OPERATION. Radwan, AE; Hatton, RL. Transportation Research Board. Transportation Research Record N1280 1990 pp 148-155 6 Fig. 5 Tab. 11 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

EVIPAS: A COMPUTER MODEL FOR THE OPTIMAL DESIGN OF A VEHICLE-ACTUATED TRAFFIC SIGNAL. Bullen, AGR; Hummon, N; Bryer, T; Nekmat, R. Transportation Research Board. Transportation Research Record N1114 1987 pp 103-110 8 Tab. 11 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

EXPERT SYSTEM FOR TRAFFIC SIGNAL SETTING ASSISTANCE. Zozaya-Gorostiza, C; Hendrickson, C. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 113 NO. 2 Mar 1987 pp 108-126 4 Fig. 12 Ref. 4 App.. REPORT NO: ASCE Paper 20590. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017

FEDIT USER INTERFACE FOR FHWA'S TRAF-FRESIM MODEL. Mekemson, J. (VICOR Associates, Inc., Manassas, Va.). Proceedings of the 1992 American Society of Civil Engineers Microcomputers in Transportation Conference.

FHWA-SPONSORED PROJECT PROVES COST EFFECTIVENESS OF SIGNAL TIMING OPTIMIZATION. Euler, GW; Schoene, GW (Federal Highway Administration). Transportation Research Board. Transportation Research News N103 Nov 1982 pp 2-4 2 Tab. 1 Phot.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

FIRST-GENERATION UTCS SIMULATION. Eiger, A; Chin, S-M (Rensselaer Polytechnic Institute). Transportation Research Board. Transportation Research Record N906 1983 pp 57-60 5 Fig. 5 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

FLASHING SIGNALS IN PEAK PERIODS. DEMETSKY, MJ; MORENO, LE (VIRGINIA HIGHWAY AND TRANSPORTATION RESEARCH; COUNCIL). TRANSPORTATION QUARTERLY VOL. 39 JAN19 1985 ENGLISH. REPORT NO: 85

FLOW AT ROUNDABOUT ENTRIES. Chin, HC; McDonald, M (Universities Of Singapore And Southampton; Southampton University, England). PTRC Education and Research Services Limited. Planning & Transport Res & Comp, Sum Ann Mtg. Proc 1984 pp1-11 3 Fig. 2 Tab. 10 Ref.

FLOW PROFILE COMPARISON OF A MICROSCOPIC CAR-FOLLOWING MODEL AND A MACROSCOPIC PLATOON DISPERSION MODEL FOR TRAFFIC SIMULATION. Mekemson, J., VICOR Associates, Manassas, Va. and Gantz, D. George Mason University, Fairfax, Va. 1990 Winter Simulation Conference Proceedings.

FRESIM - A FREEWAY SIMULATION MODEL FOR ANALYZING OPERATIONAL AND GEOMETRIC ALTERNATIVES. Halati, A; Torres, J; JFT & Associates, Pacific Palisades, Ca. and Cohen, S; Federal Highway Administration, McLean, Va. Paper submitted to Transportation Research Board for 1991 Annual Meeting.

FREESIM: A MICROSCOPIC SIMULATION MODEL OF FREEWAY LANE CLOSURES (ABRIDGMENT). Rathi, AK; Nemeth, ZA. Transportation Research Board. Transportation Research Record N1091 1986 p 21-24 1 Tab. 12 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

FREEWAY CAPACITY AND FLOW RELATIONSHIPS. HIGHWAY CAPACITY AND LEVEL OF SERVICE. PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON HIGHWAY CAPACITY, KARLSRUHE, GERMANY, 24-27 JULY 1991. Wemple, EA; Morris, AM; May, AD. Balkema (AA) P.O. Box 1675 3000 BR Rotterdam Netherlands 90 5410 011 7. 1991 pp 439-455 14 Fig. 3 Tab. Refs.. AVAILABLE FROM: Balkema (AA) Publishers Old Post Road Brookfield Vermont 05036

FREEWAY SIMULATION AND CONTROL. Babcock, PS, IV; May, AD; Auslander, DM; Tomizuka, M. California University, Berkeley Institute of Transportation Studies Berkeley California 94720; California Department of Transportation 1120 N Street Sacramento California 95814; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Dec 1982 Final Rpt. 469p. REPORT NO: UCB-ITS-RR-82-13. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

FREEWAY SIMULATION MODELS REVISITED. May, AD. Transportation Research Board. Transportation Research Record N1132 1987 pp 94-99 89 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

FREEWAY SPEED-FLOW-CONCENTRATION RELATIONSHIPS: MORE EVIDENCE AND INTERPRETATIONS (WITH DISCUSSION AND CLOSURE). Banks, JH; Furth, PG. Transportation Research Board. Transportation Research Record N1225 1989 pp 53-60 5 Fig. 11 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

FREEWAY SURVEILLANCE AND CONTROL SYSTEM USING SIMULATION MODEL. Ju, R-S; Maze, TH. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 115 NO. 4 Jul 1989 pp 425-437 Figs. Tabs. Refs. 1 App. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017-2398

FUEL AND TIME IMPLICATIONS OF MERGING TRAFFIC AT FREEWAY ENTRANCES. Lyons, TJ; Rainford, H; Kenworthy, JR; Newman, PWG. Murdoch University South Street Murdoch Western Australia Australia. N8/84 1984 Monograph 52p 19 Fig. 4 Tab. 14 Ref.

FUEL CONSUMPTION ANALYSES FOR URBAN TRAFFIC MANAGEMENT. Bowyer, DP; Akcelik, R; Biggs, DC. Institute of Transportation Engineers. ITE Journal VOL. 56 NO. 12 Dec 1986 pp 31-34 Figs. Tabs. 9 Ref.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

EL CONSUMPTION AND EMISSION VALUES FOR TRAFFIC MODELS. FINAL REPORT. McGill, R. Oak Ridge National boratory Post Office Box X Oak Ridge Tennessee 37830. May 1985 93p. AVAILABLE FROM: National Technical rmation Service 5285 Port Royal Road Springfield Virginia 22161

EL CONSUMPTION AND EMISSION VALUES FOR TRAFFIC MODELS. McGill, R. Oak Ridge National Laboratory Post fice Box X Oak Ridge Tennessee 37830 ; Federal Highway Administration Turner Fairbank Hwy Res Cntr, 6300 orgetown Pike McLean Virginia 22101. May 1985 Final Rpt. 90p 20 Fig. 18 Tab. 7 Ref. 5 App.. REPORT NO: WA/RD-85/053. AVAILABLE FROM: Federal Highway Administration Turner Fairbank Hwy Res Cntr, 6300 Georgetown e Washington D.C. 20590

UEL CONSUMPTION MODELS: AN EVALUATION BASED ON A STUDY OF PERTH'S TRAFFIC PATTERNS. Pitt, DR; ons, TJ; Newman, PWG; Kenworthy, JR. Murdoch University South Street Murdoch Western Australia. 1984 40p 9 Fig. 2 Tab. 26 Ref.. REPORT NO: 3/84

UEL EFFICIENT TRAFFIC SIGNAL OPERATION AND EVALUATION: GARDEN GROVE DEMONSTRATION PROJECT. Wagner-McGee Associates 4660 Kenmore Avenue, Suite 825 Alexandria Virginia 22304; California Energy Commission 1516-19th Street Sacramento California 95814. Feb 1983 76p. REPORT NO: P-400-83-004

FUEL EFFICIENT TRAFFIC SIGNAL TIMING PROGRAM. CITY OF LOS ANGELES DEPT OF TRANSPORTATION LOS ANGELES. Feb 1984 ENGLISH

FUEL SAVING POTENTIALS OF ISOLATED TRAFFIC SIGNAL INSTALLATIONS. Edholm, S; Buren, H. Royal Institute of Technology, Sweden. Rapport 1982 Monograph 40p 16 Fig. 14 Tab. 18 Ref. Swedish. REPORT NO: TRITA-TRL-82-05-17

GAP ACCEPTANCE AND TRAFFIC CONFLICT SIMULATION AS A MEASURE OF RISK. McDowell, MRC; Wennell, J; Storr, PA; Darzentas, J (Royal Holloway College). Transport and Road Research Laboratory Old Wokingham Road Crowthorne RG11 6AU Berkshire England 0305-1315. N776 1983 Monograph 19p 4 Fig. 16 Tab. 17 Ref. Apps.

GENERAL APPROACH TO RELATIVE OFFSET SETTINGS OF TRAFFIC SIGNALS. Al-Khalili, AJ. Institute of Electrical & Electronics Engrs, Inc. IEEE Transactions on Systems, Man and Cybernetics 1985 pp 587-594 15 Ref.. REPORT NO: VSMC-N4. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

GENERATION AND ASSESSMENT OF INCIDENT MANAGEMENT STRATEGIES. SUMMARY REPORT. Mannering, F; Jones, B; Garrison, DH; Sebranke, B; Janssen, L. Washington University, Seattle 4507 University Way, NE, Corbet Bldg, Suite 204 Seattle Washington 98105; Washington State Department of Transportation Building, KF-10 Olympia Washington 98504-5201 ; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Jan 1990 25p 1 Fig.. REPORT NO: WA-RD 204.1. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

GENERATION AND ASSESSMENT OF INCIDENT MANAGEMENT STRATEGIES. VOLUME I: MANAGEMENT, SURVEILLANCE, CONTROL, AND EVALUATION OF FREEWAY INCIDENTS--A REVIEW OF EXISTING LITERATURE. Mannering, F; Jones, B; Garrison, DH; Sebranke, B; Janssen, L. Washington University, Seattle 4507 University Way, NE, Corbet Bldg, Suite 204 Seattle Washington 98105; Washington State Department of Transportation Building, KF-10 Olympia Washington 98504-5201 ; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Jan 1990 45p 4 Tab. Refs.. REPORT NO: WA-RD 204.2. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

GENERATION AND ASSESSMENT OF INCIDENT MANAGEMENT STRATEGIES. VOLUME II: ANALYSIS OF FREEWAY INCIDENTS IN THE SEATTLE AREA. Mannering, F; Jones, B; Garrison, DH; Sebranke, B; Janssen, L. Washington University, Seattle 4507 University Way, NE, Corbet Bldg, Suite 204 Seattle Washington 98105; Washington State Department of Transportation Building, KF-10 Olympia Washington 98504-5201 ; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Jan 1990 85p 1 Fig.. REPORT NO: WA-RD 204.3. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

GENERATION AND ASSESSMENT OF INCIDENT MANAGEMENT STRATEGIES. VOLUME III: SEATTLE-AREA INCIDENT IMPACT ANALYSIS--MICROCOMPUTER TRAFFIC SIMULATION RESULTS. Mannering, F; Jones, B; Garrison, DH; Sebranke, B; Janssen, L. Washington University, Seattle 4507 University Way, NE, Corbet Bldg, Suite 204 Seattle Washington 98105; Washington State Department of Transportation Building, KF-10 Olympia Washington 98504-5201 ; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Jan 1990 145p 28 Fig. 13 Tab. Refs. 4 App.. REPORT NO: WA-RD 204.4. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

GENERATION AND ASSESSMENT OF INCIDENT MANAGEMENT STRATEGIES. VOLUME IV: SEATTLE-AREA INCIDENT MANAGEMENT--ASSESSMENT AND RECOMMENDATIONS. Mannering, F; Jones, B; Garrison, DH; Sebranke, B; Janssen, L. Washington University, Seattle 4507 University Way, NE, Corbet Bldg, Suite 204 Seattle Washington 98105; Washington State Department of Transportation Transportation Building, KF-10 Olympia Washington 98504-5201 ; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Jan 1990 25p 4 Fig. 2 Tab.. REPORT NO: WA-RD 204.5. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

GENERATION AND ASSESSMENT OF INCIDENT MANAGEMENT STRATEGIES. VOLUME 4: SEATTLE-AREA INCIDENT IMPACT ANALYSIS: MICROCOMPUTER TRAFFIC SIMULATION RESULTS. Mannering, FL; Garrison, DH; Sebrenke, B. TransNow, Transportation Northwest Washington Univ, Civil Engineering Dept, 135 More Hall FX-10 Seattle Washington 98195. Feb 1990 v.p. Figs. Tabs. Refs. Apps.. REPORT NO: TNW90-13.4. AVAILABLE FROM: TransNow, Transportation Northwest Washington Univ, Civil Engineering Dept, 135 More Hall FX-10 Seattle Washington 98195

GETTING TRAFFIC SYSTEM SOLUTIONS WITH TRAF-FAMILY MODELS. Byun, J., Wong, S., and Stephens, B., (Federal Highway Administration). Institute of Transportation Engineers, ITE 1991 Compendium of Technical Papers, pp 485-491.

GETTING STARTED: SELECTING AND USING COMPUTERIZED TRAFFIC MODELS. MORALES, JM. PUBLIC ROADS VOL. 53 NO. 1 Jun 1989 PP 6-11 ENGLISH

GRAPHICAL REPRESENTATION OF THE EFFECT OF SIGNAL TIMINGS ON DELAY AT 2-STAGE JUNCTIONS USING COMPUTER GRAPHICS. Saavedra, A (Comision De Transporte Urbano). PTRC Education and Research Services Limited. Planning & Transport Res & Comp, Sum Ann Mtg, Proc 1984 pp217-237 7 Fig. 9 Ref.

GUIDE TO FUEL CONSUMPTION ANALYSES FOR URBAN TRAFFIC MANAGEMENT. Bowyer, DP; Akcelik, R; Biggs, DC. Australian Road Research Board. Australian Road Research Report N32 Oct 1985 98p 33 Fig. 25 Tab. 29 Ref.. AVAILABLE FROM: Australian Road Research Board P.O. Box 156, Bag 4 Nunawading Victoria 3131 Australia

GUIDEBOOK FOR IMPROVING TRAFFIC SIGNAL TIMING. SKABARDONIS, A. INSTITUTE OF TRANSPORTATION STUDIES UNIVERSITY OF. RESEARCH REPORT INSTITUTE OF TRANSPORTATION N---8 Nov 1986 ENGLISH. REPORT NO: 6-10

GUIDELINES FOR LEFT-TURN TREATMENTS AT SIGNAL CONTROLLED INTERSECTIONS. Nemeth, ZA; Mekemson. Ohio State University Engineering Experiment Station, 2070 Neil Avenue Columbus Ohio 43210; Ohio Department of Transportation P.O. Box 899 Columbus Ohio 43216-0899; Federal Highway Administration Washington D.C. 20590. Jun 1983 Final Rpt. 284p Figs. Tabs. Refs. 4 App.. REPORT NO: FHWA-OH-83-003

HEURISTIC PROGRAMMING APPROACH TO ARTERIAL SIGNAL TIMING. Rogness, RO; Messer, CJ. Transportation Research Board. Transportation Research Record N906 1983 pp 67-75 3 Fig. 6 Tab. 25 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

IDENTICAL TRAFFIC STREAMS IN THE TRAF-NETSIM SIMULATION PROGRAM. Rathi, AK; Santiago, AJ. Printerhall Limited. Traffic Engineering and Control VOL. 31 NO. 6 Jun 1990 pp 351-355 3 Fig. 1 Tab. 6 Ref.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London W1P 3PE England

IMPACT OF ARTERIAL LANE OBSTRUCTIONS. VOLUME 2: RESEARCH REPORT. FINAL REPORT. Torres, JF; Halati, A; Danesh, M. JFT Associates 5555 Inglewood Boulevard, Suite 102 Culver City California 90230; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Feb 1986 119p. REPORT NO: FHWA/RD-86/139. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

ACT OF ARTERIAL LANE OBSTRUCTIONS. VOLUME 3: LANE BLOCKAGE LOGIC CHANGES IN NETSIM. FINAL ORT. Danesh, M; Halati, A; Torres, JF. JFT Associates 5555 Inglewood Boulevard, Suite 102 Culver City California 30; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Feb 1986 25p. REPORT NO: WA/RD-86/140. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 161

PACT OF PASSING-CLIMBING LANES ON TRAFFIC FLOW ON UPGRADES. Polus, A; Reshetnik, I. Pergamon Press ited. Transportation Research. Part A: General VOL. 21A NO. 6 Nov 1987 14 Ref.. AVAILABLE FROM: Pergamon Press ited Headington Hill Hall Oxford OX3 0BW England

PLEMENTATION OF THE AUSTRALIAN ROUNDABOUT ANALYSIS METHOD IN SIDRA. HIGHWAY CAPACITY AND EVEL OF SERVICE. PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON HIGHWAY CAPACITY, KARLSRUHE, ERMANY, 24-27 JULY 1991. Akcelik, R; Troutbeck, R. Balkema (AA) P.O. Box 1675 3000 BR Rotterdam Netherlands 5410 011 7. 1991 pp 17-34 9 Fig. 3 Tab. Refs.. AVAILABLE FROM: Balkema (AA) Publishers Old Post Road Brookfield ermont 05036

PLEMENTATION OF TRAFFIC SIGNAL TIMING PLANS IN COORDINATED ARTERIAL SYSTEMS. Courage, KG. orida University, Gainesville Transportation Research Center Gainesville Florida 32611. Jan 1990 25p. REPORT NO: TC-UF-268-3. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

PLEMENTING TRANSYT TRAFFIC SIGNAL TIMING. Dock, FC. Roads and Transportation Association of Canada 1765 St Laurent Boulevard Ottawa Ontario K1G 3V4 Canada. Sep 1984 pp B3-B29 8 Fig. 5 Tab. 12 Ref.. AVAILABLE FROM: Roads and Transportation Association of Canada 1765 St Laurent Boulevard Ottawa Ontario K1G 3V4 Canada

IMPORTANCE OF SIMULATION IN TRAFFIC FLOW BEHAVIOR ANALYSIS, SURVEILLANCE AND TRAFFIC CONTROL. Stanojevic, M. Savez Inzenjera I Tehn Saobracaja I Veza Jugo. Zbornik III Jugo Savetovanje Tehn Regul Saobracaja Apr 1983 pp 173-188 14 Fig. 1 Tab. 23 Ref. Serbian

IMPROVED CONTINUUM MODELS OF FREEWAY FLOW. Michalopoulos, PG; Beskos, DE (Minnesota University, Minneapolis). VNU Science Press Bv P.O. Box 2073 Utrecht Netherlands 90-6764-008-5. 1984 pp 89-111 6 Fig. 1 Tab. 15 Ref.

IMPROVED GRAPHIC TECHNIQUES IN SIGNAL PROGRESSION. Wallace, CE; Courage, KG (Florida University, Gainesville). Transportation Research Board. Transportation Research Record N957 1984 pp 47-55 11 Fig. 12 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

IMPROVED SIGNAL TIMING PLAN SELECTION. Kessmann, RW; Ku, CS. Kessmann and Associates, Incorporated Houston Texas. Aug 1985 22p. REPORT NO: REPT-1502.02. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

IMPROVING SIGNAL TIMING, VOLUME 1. ISOLATED INTERSECTIONS. Imada, T; May, AD. California University, Berkeley Institute of Transportation Studies, 109 McLaughlin Hall Berkeley California 94720. May 1984 103p. REPORT NO: UCB-ITS-RR-84-3; FHWA-CA-TO-84-3-1. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

IMPROVING SIGNAL TIMING. VOLUME 2. PRETIMED ARTERIAL ROADWAYS. Vermeulen, MJ; Lermat, NP; May, AD. California University, Berkeley Institute of Transportation Studies, 109 McLaughlin Hall Berkeley California 94720. May 1984 204p. REPORT NO: UCB-ITS-RR-84-4; FHWA-CA-TO-83-3-2. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

INCORPORATING FUEL CONSUMPTION MODELS INTO URBAN TRAFFIC ANALYSIS TECHNIQUES. NATIONAL ENERGY RESEARCH, DEVELOPMENT AND DEMONSTRATION PROGRAM; END OF GRANT REPORT. Bowyer, DP. Australian Dept of Primary Industries and Energy GPO Box 858 Canberra A.C.T. 2601 Australia 0811-9570 0-642-12708-5. Oct 1988 9p. REPORT NO: NERDDP Report 814

INDO-SWEDISH TRAFFIC SIMULATION MODEL: A PROGRAM FOR THE MONTE CARLO SIMULATION OF HETEROGENEOUS VEHICLE TRAFFIC ALONG SINGLE LANE, INTERMEDIATE LANE AND NARROW TWO LANE ROADS. Brodin, A; Palaniswamy, SP. National Swedish Road & Traffic Research Institute Fack S-581 01 Linkoeping Sweden. 1985 124p. REPORT NO: VTI/MEDDELANDE-439A. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

INSECT WITH TRAFFIC SIGNALS: VALIDATION REPORT. RJ NAIRN AND PARTNERS PTY LTD 7 CENTENNIAL AVENUE Randwick New South Wales Australia. Jun 1986 61p

INTEGRATED MODELING OF FREEWAY FLOW AND APPLICATION TO MICROCOMPUTERS (ABRIDGMENT). Michalopoulos, PG; Lin, J. Transportation Research Board. Transportation Research Record N1091 1986 p 25-28 1 Fig. 6 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

INTERSECTION, DIAMOND, AND THREE-LEVEL DIAMOND GRADE SEPARATION BENEFIT-COST ANALYSIS BASED ON DELAY SAVINGS. Rymer, B; Urbanik, T, II. Transportation Research Board. Transportation Research Record N1239 1989 pp 23-29 8 Fig. 2 Tab. 4 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

INTERSECTION SIMULATION MODEL: INSECT. Cotterill, PJ; Moore, SE; Tudge, R (Rj Nairn and Partners Proprietary Limited; New South Wales Department of Main Roads,Australia). Australian Road Research Board 500 Burwood Road Vermont South Victoria 3133 Australia 0572-1431. VOL. 12 NO. 4 1984 pp 171-182 9 Fig. 18 Ref.

INTERSECTIONS. PROCEEDINGS: INSTITUTE OF TRANSPORTATION ENGINEERS DISTRICT 7 - CANADA - TWELFTH ANNUAL MEETING. Gillett, R; Teply, S; Babey, GM; Hunt, JD; Stephenson, B; Solomon, HL; Mah, M. Institute of Transportation Engineers RTAC, 1765 St Laurent Boulevard Ottawa Ontario K1G 3V4 Canada. 1987 pp 8.1-102 31 Fig. 16 Tab. 22 Ref.. AVAILABLE FROM: Institute of Transportation Engineers RTAC, 1765 St Laurent Boulevard Ottawa Ontario K1G 3V4 Canada

INTRODUCTION TO RURAL TRAFFIC SIMULATION. Hoban, CJ. Australian Road Research Board 500 Burwood Road Vermont South Victoria 3133 Australia 0 86910 127 7. 1983 pp 37-48 4 Fig. 11 Ref.

INVESTIGATION OF OPTIMAL TIME TO CHANGE ARTERIAL TRAFFIC SIGNAL-TIMING PLAN. Jrew, BK; Parsonson, PS; Chang, EC-P. Transportation Research Board. Transportation Research Record N1057 1986 pp 20-29 6 Fig. 10 Tab. 6 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

ITDS: A DATA BASE DRIVEN INTERFACE TO TRAFFIC MODELS USING A MICROCOMPUTER. Santiago, AJ. Federal Highway Administration, Office of R&D. Public Roads VOL. 49 NO. 4 Mar 1986 pp 122-126. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

ITDS: PAST, PRESENT, AND FUTURE. Rathi, AJ; Santiago, AJ; Valentine, DE; Chin, SM. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 116 NO. 6 Nov 1990 pp 799-808 Figs. Refs. 1 App. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017-2398

KNOWLEDGE BASE ON SEMI-ACTUATED TRAFFIC-SIGNAL CONTROL. Lin, F-B. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 117 NO. 4 Jul 1991 pp 398-417 Figs. Tabs. Refs. 2 App.. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017-2398

LABOR SAVING METHODS FOR IMPROVED OPERATION OF COMPUTER-CONTROLLED TRAFFIC SIGNAL SYSTEMS: 1.5 GENERATION SYSTEM FUNCTIONAL DESCRIPTION AND SOFTWARE DEVELOPMENT GUIDELINES. Kessmann, RW; Ku, CS; Cooper, DL. Kessmann and Associates, Incorporated 18333 Egret Bay Boulevard Houston Texas 77058. Mar 1985 106p. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

LABOR SAVING METHODS FOR IMPROVED OPERATION OF COMPUTER-CONTROLLED TRAFFIC SIGNAL SYSTEMS: EXECUTIVE SUMMARY. Kessmann, RW; Ku, CS; Cooper, DL. Kessmann and Associates, Incorporated 18333 Egret Bay Boulevard Houston Texas 77058. Mar 1985 38p. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

OF SERVICE CONSIDERATIONS AT SIGNALIZED INTERCHANGES. HIGHWAY CAPACITY AND LEVEL OF CE. PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON HIGHWAY CAPACITY, KARLSRUHE, ANY, 24-27 JULY 1991. Urbanik, T, II; Fambro, DB. Balkema (AA) P.O. Box 1675 3000 BR Rotterdam Netherlands 10 011 7. 1991 pp 407-411 1 Fig. 1 Tab. Refs.. AVAILABLE FROM: Balkema (AA) Publishers Old Post Road ield Vermont 05036

ATIONS ON THE OBJECTIVE OF ENERGY EFFICIENCY IN URBAN TRAFFIC MANAGEMENT. Akcelik, R. Society motive Engineers (Australasia) 191 Royal Parade Parkville Victoria 3052 Australia. Nov 1982 p 81.1 3 Fig. 3 Tab. REPORT NO: SAEA 82081

G: A COMPUTER PROGRAM TO AID TRAFFIC SIGNAL DESIGN AND ASSESSMENT. Simmonite, BF. Printerhall d. Traffic Engineering and Control VOL. 26 NO. 6 Jun 1985 pp 310-315 9 Fig. 3 Ref.

RO VS MICRO FREEWAY SIMULATION: A CASE STUDY. Liu, C. and Kanaan, A. (AEPCO, Inc., Rockville, Md.), ago, A. (Federal Highway Administration, Mclean, Va.), and Holt, G. (City of Columbus, Columbus, Oh.). Proceedings American Society of Civil Engineers Microcomputers in Transportation Conference, 1992.

CROSCOPIC FREEWAY MODEL FOR DENSE TRAFFIC - STOP-START WAVES AND INCIDENT DETECTION. hne, RD (Aeg-Telefunken Forschungsinstitut, W Germany). VNU Science Press Bv P.O. Box 2073 Utrecht Netherlands 764-008-5. 1984 pp 21-42 13 Fig. 1 Phot. 19 Ref.

CROSCOPIC MODELS FOR OVERTAKING AND ONCOMING BICYCLE TRAFFIC. Van Laarhoven, AJM. Royal Dutch uring Club ANWB. Verkeerskunde VOL. 33 NO. 7 Jul 1982 pp 388-392 2 Fig. 3 Phot. 10 Ref. Dutch

ACROSCOPIC SIMULATION FOR URBAN TRAFFIC MANAGEMENT. VOLUME 1: EXECUTIVE SUMMARY. Lieberman, KLD Associates Incorporated 300 Broadway Huntington Station New York 11746 TR-94; Federal Highway Administration 00 7th Street, SW Washington D.C. 20590. Jan 1982 Final Rpt. 25p. REPORT NO: FHWA-RD-80-113. AVAILABLE FROM: tional Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

MACROSCOPIC SIMULATION FOR URBAN TRAFFIC MANAGEMENT: VOLUME 2: TRAFLO USER'S GUIDE. Lieberman, E; Andrews, B; Davila, M; Yedlin, M. KLD Associates Incorporated 300 Broadway Huntington Station New York 11746 TR-92; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Jan 1982 Final Rpt. 214p. REPORT NO: FHWA-RD-80-114. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

MACROSCOPIC SIMULATION MODEL FOR FAST ROAD NETWORKS TAKING INDIVIDUAL VEHICLES INTO ACCOUNT (DYNEMO). Schwerdtfeger, T. Technical University of Karlsruhe, West Germany Fakultaet fuer Bauingenieur- und Vermessungswesen D-7500 Karlsruhe West Germany. Jul 1986 199p German. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

MACROSCOPIC TRAFFIC DELAY MODEL OF BUS SIGNAL PREEMPTION. Radwan, AE; Hurley, JW, Jr (Virginia Polytechnic Institute & State University; Memphis State University). Transportation Research Board. Transportation Research Record N881 1982 pp 59-65 4 Fig. 2 Tab. 17 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

MAKING TRANSYT USAGE EASY WITH MICROS: A CASE STUDY. SESSION 4. Strong, DW; Eckols, RH (Barton-Aschman Associates, Incorporated). Institute of Transportation Engineers. Compendium of Technical Papers, 1984 pp 9-13 4 Fig. 8 Ref.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

MAXBAND-86: PROGRAM FOR OPTIMIZING LEFT-TURN PHASE SEQUENCE IN MULTIARTERIAL CLOSED NETWORKS. Chang, EC-P; Cohen, SL; Liu, C; Chaudhary, NA; Messer, C. Transportation Research Board. Transportation Research Record N1181 1988 pp 61-67 1 Fig. 3 Tab. 16 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

MAXBAND PROGRAM FOR ARTERIAL SIGNAL TIMING PLANS. Cohen, SL; Little, JDC. Federal Highway Administration, Office of R&D. Public Roads VOL. 46 NO. 2 Sep 1982 pp 61-65 9 Ref.. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

MEASURES OF QUEUEING PERFORMANCE FOR A TRAFFIC NETWORK. Bell-M.C.. Newcastle upon Tyne Univ. (England). Transport Operations Research Group. TORGRR33. Oct 80. 29p. UNITED-KINGDOM.

MEASURING AND ANALYZING CYCLIC FLOW PROFILES WITH A PORTABLE MICROCOMPUTER. Robertson, DI; Wood, K (Transport and Road Research Laboratory). Printerhall Limited. Traffic Engineering and Control VOL. 25 NO. 1 Jan 1984 pp 27-28 2 Fig. 4 Ref.

MEASURING LEVEL OF SERVICE OF TWO-LANE HIGHWAYS BY OVERTAKINGS. Morrall, JF; Werner, A. Transportation Research Board. Transportation Research Record N1287 1990 pp 62-69 7 Fig. 3 Tab. 9 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

MEASURING SATURATION FLOW AT TRAFFIC SIGNALS USING A HANDHELD MICROCOMPUTER. Wood, K. Printerhall Limited. Traffic Engineering and Control VOL. 27 NO. 4 Apr 1986 pp 174-175 2 Fig. 6 Ref.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London England

MEASURING SIGNAL PLATOON FLOW. VIRKLER, MR; MADSEN, RW; SUTTON, JH. JOURNAL OF URBAN PLANNING AND DEVELOPMENT VOL. 117 NO. 5 Oct 1991 PP 513-528 ENGLISH

MELBOURNE ON-ROAD, HALF SECOND SPEED AND FUEL CONSUMPTION, PEAK DATA (1978), COLD-START DATA (1982) AND FUELS DATA (1982). Lansell, SR; Chittleborough, CC; Watson, HC. Melbourne University, Australia Department of Mechanical Engineering, Grattan Street Parkville Victoria 3053 Australia. 1984 Monograph 29p 1 Fig. 7 Tab. 5 Ref.. REPORT NO: TG1/84

METHODS OF EVALUATION USED IN ARRB SIMULATION STUDIES. Hoban, CJ. Australian Road Research Board 500 Burwood Road Vermont South Victoria 3133 Australia 0 86910 127 7. 1983 pp 133-154 5 Fig. 7 Tab. 25 Ref.

MICROCOMPUTER-BASED INTEGRATED TRAFFIC SYSTEM: MARKET STUDY AND CONCEPTUAL DESIGN. Stewart, S; Sims, D; Quinn, M; Jang, K. Transport Canada Complexe Guy Favreau, 601 - 200 Dorchester Boulevard West Montreal Quebec Canada. Jul 1985 81p 13 Fig. 3 Tab. French. REPORT NO: E 6747. AVAILABLE FROM: Transport Canada Complexe Guy Favreau, 601 - 200 Dorchester Boulevard West Montreal Quebec Canada

MICROSCOPIC SIMULATION OF TRAFFIC IN NETWORKS: SUPERCOMPUTER EXPERIENCE. Mahmassani, HS; Jayakrishnan, R; Herman, R. American Society of Civil Engineers. Journal of Computing in Civil Engineering VOL. 4 NO. 1 Jan 1990 pp 1-19 Figs. Tabs. Refs. 2 App.. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Stre[illegible] New York New York 10017-2398

MICROPROCESSOR AIDS TO OPTIMIZING UTC SIGNAL PERFORMANCE. Robertson, GD (West Yorkshire Metropolitan County Council). Printerhall Limited. Traffic Engineering and Control VOL. 26 NO. 1 Jan 1985 pp 4-8 6 Fig. 4 Ref.

MICROSCOPIC SIMULATION OF ENERGY CONSUMPTION AND EXHAUST AS EMISSION IN ROAD TRAFFIC. Benz, T. Karlsruhe University, West Germany Kaiserstrasse 12 7500 Karlsruhe West Germany. Dec 1984 127p German. REPORT NO: NP-7770068. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

MICROSCOPIC SIMULATION OF FUEL CONSUMPTION AND EXHAUST EMISSIONS OF ROAD TRAFFIC (MISEVA). Benz, T. Karlsruhe University, West Germany Institut fuer Verkehrswesen Karlsruhe West Germany. 1985 128p German. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

MICROSCOPIC SIMULATION OF VEHICLES IN AN URBAN NETWORK. ADVANTAGES AND DISADVANTAGES OF THE EVENT-SCANNING METHOD. Aron, M (Institute for Rapid Transit). PTRC Education and Research Services Limited. Planning & Transport Res & Comp, Sum Ann Mtg, Proc 1984 pp13-24 6 Fig. 4 Ref.

MODELING AND FILTERING OF FREEWAY TRAFFIC FLOW. Smulders, SA. Mathematisch Centrum Amsterdam Netherlands. 1987 22p. REPORT NO: CWI-OS-R8706. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

DELING OF QUEUE DISSIPATION FOR SIGNAL CONTROL. Lin, F-B; Cooke, D. American Society of Civil Engineers. nal of Transportation Engineering VOL. 112 NO. 6 Nov 1986 pp 593-608 11 Fig. 3 Tab. 6 Ref. 2 App.. REPORT NO: CE Paper 21040. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 017

DELING OF SHARED LANE USE IN TRANSYT-7F. Wallace, CE; White, FJ. Transportation Research Board. nsportation Research Record N1194 1988 pp 160-166 2 Fig. 13 Ref.. AVAILABLE FROM: Transportation Research ard Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

DELING THE BURLINGTON SKYWAY FTMS DURING RECURRING AND NON-RECURRING TRAFFIC NGESTION. Van Aerde, M; Voss, J; Blum, Y. Printerhall Limited. Traffic Engineering and Control VOL. 30 NO. 5 May 89 pp 228-241 Figs. Tabs. Refs.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London England

ODELLING THE DRIVING BEHAVIOR INFLUENCED BY INFORMATION TECHNOLOGIES. HIGHWAY CAPACITY AND EVEL OF SERVICE. PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON HIGHWAY CAPACITY, KARLSRUHE, ERMANY, 24-27 JULY 1991. Reiter, U. Balkema (AA) P.O. Box 1675 3000 BR Rotterdam Netherlands 90 5410 011 7. 991 pp 309-320 12 Fig. Refs.. AVAILABLE FROM: Balkema (AA) Publishers Old Post Road Brookfield Vermont 05036

ODELLING THE MOVEMENT OF VEHICLES IN PARKING FACILITIES. Young, W (Karlsruhe University, West Germany). onash University, Australia Department of Civil Engineering, Wellington Road Clayton Victoria 3168 Australia 0156-2126. pr 1985 Monograph 4p 1 Fig. 11 Ref.. REPORT NO: 85/9

MODELLING THE TRAFFIC BEHAVIOR AT GRADE-SEPARATED INTERCHANGES. Skabardonis, A. Printerhall Limited. Traffic Engineering and Control VOL. 26 NO. 9 Sep 1985 pp 410-415 7 Fig. 16 Ref.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London England

MODELLING URBAN FUEL CONSUMPTION: SOME EMPIRICAL EVIDENCE. Ferreira, L (Australian National Railway, Keswick). Pergamon Press Limited. Transportation Research. Part A: General VOL. 19A NO. 3 May 1985 pp 253-268 17 Tab. 12 Ref.

MULTAM AND THE SEMARL PROJECT. 1. MODEL ESTIMATION AND VALIDATION. Taylor, MAP. Printerhall Limited. Traffic Engineering and Control VOL. 29 NO. 2 Feb 1988 pp 64-71 Figs. Tabs. 21 Refs.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London England

MULTIBAND--A VARIABLE-BANDWIDTH ARTERIAL PROGRESSION SCHEME. Gartner, NH; Assmann, SF; Lasaga, F; Hou, DL. Transportation Research Board. Transportation Research Record N1287 1990 pp 212-222 16 Fig. 3 Tab. 23 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

MULTILANE TRAFFIC FLOW DYNAMICS. SOME MACROSCOPIC CONSIDERATIONS. Michalopoulos, PG; Beskos, DE; Yamauchi, Y (Minnesota University, Minneapolis; Patras University, Greece). Pergamon Press Limited. Transportation Research. Part B: Methodological VOL. 18B NO. 4/5 1984 pp 377-395 8 Fig. 1 Tab. 15 Ref.

MULTPLAN: A COMPUTER SIMULATION MODEL OF A MULTI-LANE SIGNAL CONTROLLED ROAD DURING THE TRANSITION BETWEEN TWO FIXED-TIME SIGNAL-PLANS. Gault, HE; Taylor, IG. Newcastle upon Tyne University, England Transport Operations Research Group, Claremont Road Newcastle NE1 7RU Tyne and Wear England 0306-3402. Jan 1982 Monograph 37p 9 Fig. 4 Tab. 16 Ref.. REPORT NO: No. 41

NATIONAL SIGNAL TIMING OPTIMIZATION PROJECT. Institute of Transportation Engineers. ITE Journal VOL. 52 NO. 10 Oct 1982 pp 12-14. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

NETSIM FOR MICROCOMPUTERS. Sibley, SW. Federal Highway Administration, Office of R&D. Public Roads VOL. 49 NO. 2 Sep 1985 pp 54-59 3 Ref.. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

NETWORK OPTIMIZATION WITH CONTINUOUS CONTROL PARAMETERS. Marcotte, P (Montreal University, Canada). Operations Research Society of America. Transportation Science VOL. 17 NO. 2 May 1983 pp 181-197 17 Ref. 2 App.. AVAILABLE FROM: Operations Research Society of America 428 East Preston Street Baltimore Maryland 21202

NEW ALGORITHM FOR SOLVING THE MAXIMUM PROGRESSION BANDWIDTH (WITH DISCUSSION AND CLOSURE). Tsay, H-S; Lin, L-T; Chang, EC-P. Transportation Research Board. Transportation Research Record N1194 1988 pp 15-30 9 Fig. 3 Tab. 14 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

NEW DIRECTIONS FOR INTER-URBAN TRAFFIC MODELS?. KIRBY, HR. HIGHWAYS AND TRANSPORTATION VOL. 36 NO. 7 Jul 1989 PP 6-11 ENGLISH

NORTH CAROLINA'S COMPREHENSIVE TRAFFIC SIGNAL TIMING OPTIMIZATION PROGRAM. MARTIN, RL. OHIO TRANSPORTATION ENGINEERING CONFERENCE 1988 PP 106-112 ENGLISH

NORTH CAROLINA'S TRAFFIC SIGNAL MANAGEMENT PROGRAM FOR ENERGY CONSERVATION. 1987 TRANSPORTATION ENERGY CONSERVATION AWARD IN MEMORY OF FREDRICK A. WAGNER. Institute of Transportation Engineers. ITE Journal VOL. 57 NO. 12 Dec 1987 pp 35-38. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

OBJECT-ORIENTED PROGRAMMING IN TRAFFIC SIMULATION. Rodriguez-moscoso, JJ; Shin-miao CHIN; Santiago, A; Roland, R. ENGINEERING FOUNDATION. TRAFFIC CONTROL METHODS. PROCEEDINGS OF THE FIFTH 1990 177-90

OIL OVERCHARGE PROGRAM PROVIDES FUNDING FOR SIGNAL TIMING IMPROVEMENTS. Euler, GW; Wilbur, A. Institute of Transportation Engineers. ITE Journal VOL. 56 NO. 10 Oct 1986 pp 19-22 15 Ref.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

ON-LINE CALCULATION OF SIGNAL INTERSECTION PERFORMANCE. FINAL REPORT. Pandya, SM; May, AD; Auslander, DM. California University, Berkeley Institute of Transportation Studies Berkeley California 94720; California Department of Transportation 1120 N Street Sacramento California 95814; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Jul 1987 68p Figs. Tabs. 17 Ref.. REPORT NO: FHWA-CA-UCB-ITS-WP-8. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

ON-LINE OPTIMIZATION OF SIGNAL COORDINATION - THE SCOOT METHOD. Robertson, DI; Hunt, PB; Bretherton, RD; Bowen, GT. Council for Scientific & Industrial Res S Africa P.O. Box 395 Pretoria South Africa 0-7988-2505-7. 1982 12p 2 Fig. 2 Tab. 3 Ref.

ON THE KINEMATICS AND QUANTUM DYNAMICS OF TRAFFIC FLOW. Baker, RGV (New South Wales University, Australia). Pergamon Press Limited. Transportation Research. Part B: Methodological VOL. 17B NO. 1 Feb 1983 pp 55-66 13 Ref.

ON THE MODELLING OF FLOWS IN TRANSPORT SYSTEMS. Taylor, MAP; Gipps, PG (Commonwealth Scientific & Indus Res Org, Australia). Society of Automotive Engineers (Australasia) 191 Royal Parade Parkville Victoria 3052 Australia. May 1982 pp 1-23 15 Fig. 4 Tab. Refs.. REPORT NO: Paper 23

"ONE AND ONE-HALF GENERATION" TRAFFIC CONTROL SYSTEMS. Kessmann, RW; Ross, P (Kessmann & Associates, Houston). Institute of Transportation Engineers. ITE Journal VOL. 54 NO. 6 Jun 1984 pp 35-37 1 Ref.. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

OPAC: A DEMAND-RESPONSIVE STRATEGY FOR TRAFFIC SIGNAL CONTROL. Gartner, NH (Lowell University). Transportation Research Board. Transportation Research Record N906 1983 pp 75-81 7 Fig. 1 Tab. 25 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

OPERATIONAL EFFECTIVENESS OF PASSING LANES ON TWO-LANE HIGHWAYS. PHASE II - TECHNICAL REPORT. Harwood, DW; St. John, AD. Midwest Research Institute 425 Volker Boulevard Kansas City Missouri 64110; Federal Highway Administration Turner Fairbank Hwy Res Cntr, 6300 Georgetown Pike McLean Virginia 22101. Jun 1986 42p. REPORT NO: FHWA/RD-86/195. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

OPTIMAL SIGNAL SETTINGS OVER TRANSPORTATION NETWORKS. Sheffi, Y; Powell, WB. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 109 NO. 6 Nov 1983 pp 824-839 16 Ref.. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

OPTIMAL TIMING SETTINGS AND DETECTOR LENGTHS OF PRESENCE MODE FULL-ACTUATED CONTROL. Lin, (Clarkson University, New York). Transportation Research Board. Transportation Research Record N1010 1985 pp 37-45 2 Fig. 9 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

OPTIMIZATION MODEL FOR ISOLATED SIGNALIZED TRAFFIC INTERSECTIONS. Cronje, WB (Stellenbosch University, South Africa). Transportation Research Board. Transportation Research Record N905 1983 pp 80-83 6 Fig. 5 Tab. 1 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

OPTIMIZATION OF LEFT TURN PHASE SEQUENCE IN SIGNALIZED NETWORKS USING MAXBAND 86. FINAL REPORT. VOLUME 1: SUMMARY REPORT. Messer, CJ; Hogg, GL; Chaudhary, NA; Chang, ECP. Texas Transportation Institute Texas A&M University College Station Texas 77843; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Aug 1987 102p. REPORT NO: FHWA/RD-87/109. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

OPTIMIZATION OF LEFT TURN PHASE SEQUENCE IN SIGNALIZED NETWORKS USING MAXBAND 86. FINAL REPORT. VOLUME 3: MAXBAND PROGRAMMER'S MANUAL. Messer, CJ; Hogg, GL; Chaudhary, NA; Chang, ECP. Texas Transportation Institute Texas A&M University College Station Texas 77843; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Aug 1987 297p. REPORT NO: FHWA/RD-87/111. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

OPTIMIZATION OF LEFT-TURN PHASE SEQUENCE IN SIGNALIZED CLOSED NETWORKS. Final rept. Cohen-S.L. Federal Highway Administration, McLean, VA. Traffic Systems Div. FHWARD88157, May 88. 38p.

OPTIMIZATION OF LEFT TURN PHASE SEQUENCE IN SIGNALIZED NETWORKS USING MAXBAND 86. FINAL REPORT. VOLUME 2: MAXBAND USER'S MANUAL. Messer, CJ; Hogg, GL; Chaudhary, NA; Chang, ECP. Texas Transportation Institute Texas A&M University College Station Texas 77843; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Aug 1987 304p. REPORT NO: FHWA/RD-87/110. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

OPTIMIZATION OF THE OFFSET PATTERNS OF ROAD NETWORKS THROUGH THE DECOMPOSITION PRINCIPLE. Hisai, M. Japan Society of Civil Engineers. Japan Society of Civil Engineers, Proceedings N347 Jul 1984 pp 69-76 12 Ref. Japanese. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

OPTIMIZATION OF TRAFFIC SIGNAL CHANGE INTERVALS. FINAL REPORT. Wortman, RH; Fox, TC. Arizona University Transportation and Traffic Institute Tucson Arizona 85721; Arizona Department of Transportation 206 South 17th Avenue Phoenix Arizona 85007; Federal Highway Administration Office of Research and Development, 400 7th Street, SW Washington D.C. 20590. Jun 1986 69p. REPORT NO: FHWA/AZ-86/191. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

OPTIMIZING TRAFFIC DIVERSION AROUND BOTTLENECKS. Hu, Y; Schonfeld, P (Taiwan National University, Taipei; Maryland University, College Park). Transportation Research Board. Transportation Research Record N957 1984 pp 22-27 10 Fig. 6 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

OSCADY: A COMPUTER PROGRAM TO MODEL CAPACITIES, QUEUES AND DELAYS AT ISOLATED TRAFFIC SIGNAL JUNCTIONS. Burrow, IJ. Transport and Road Research Laboratory. TRRL Research Report 1987 23p 15 Ref.. REPORT NO: RR 105. AVAILABLE FROM: Transport and Road Research Laboratory Old Wokingham Road Crowthorne RG11 6AU Berkshire England

OVERFLOW DELAY IN SIGNALIZED NETWORKS. Van As, SC. Pergamon Press plc. Transportation Research. Part A: General VOL. 25A NO. 1 Jan 1991 pp 1-7 Figs. Refs.. AVAILABLE FROM: Pergamon Press, Incorporated Maxwell House, Fairview Park Elmsford New York 10523

OVERSATURATION DELAY ESTIMATES WITH CONSIDERATION OF PEAKING. Rouphail, N., University
Chicago and Akcelik, R., Australian Road Research Board, Victoria, Australia. Transportation Research Board
71st Annual Meeting, Washington, D.C.

PARAMETER ESTIMATION FOR THE PEAK TRAFFIC MODEL. Alfa, AS (Ahmadu Bello University, Nigeria).
Breach Science Publishers Limited. Transportation Planning and Technology VOL. 7 NO. 4 1982 pp 281-287 2

PASSER II-84 MICROCOMPUTER ENVIRONMENT SYSTEM--PRACTICAL SIGNAL-TIMING TOOL. Chang,
Marsden, BG; Derr, BR. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 113 NO.
1987 pp 625-641 Figs. Tabs. Refs.. REPORT NO: ASCE Paper 21941. AVAILABLE FROM: American Society
Engineers 345 East 47th Street New York New York 10017

PASSER IV QUICK RESPONSE PROCEDURES. Research rept. Cunagin-W.D.; Lee-J.Y. Texas Transportation
College Station. Federal Highway Administration, Austin, TX. Texas Div. Texas State Dept. of Highways and
Transportation, Austin. TTI218802811, FHWATX85192811. May 85. 81p.

PICADY2: AN ENHANCED PROGRAM TO MODEL CAPACITIES, QUEUES AND DELAYS AT MAJOR/MINOR PRIORITY
JUNCTIONS. RESEARCH REPORT. Semmens, MC. Transport and Road Research Laboratory Old Wokingham Road
Crowthorne RG11 6AU Berkshire England 0266-5247. 1985 32p Figs. Tabs. Refs.. REPORT NO: RR 36. AVAILABLE
FROM: Transport and Road Research Laboratory Old Wokingham Road Crowthorne RG11 6AU Berkshire England

PLAN-CHANGE ALGORITHMS FOR AREA TRAFFIC CONTROL SYSTEMS. Bell-M.C.; Gault-H.E.; Taylor-I.G. Newcastle
upon Tyne Univ. (England). Transport Operations Research Group. RR51, Apr 83. 49p. UNITED-KINGDOM.

PLATOON DISPERSION FACTOR IN TRANSYT FOR SWEDISH TRAFFIC CONDITIONS. Hammarstroem, U. National
Swedish Road & Traffic Research Institute Fack S-581 01 Linkoeping Sweden. 1988 26p. REPORT NO:
VTI/MEDDELANDE-569A. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield
Virginia 22161

POSSIBLE PASSER II ENHANCEMENTS. Rogness, RO (North Dakota State University). Transportation Research Board.
Transportation Research Record N881 1982 pp 42-48 5 Fig. 6 Tab. 8 Ref.. AVAILABLE FROM: Transportation Research
Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

POTENTIAL IMPACT OF SPEED REDUCTION AT FREEWAY LANE CLOSURES: A SIMULATION STUDY (ABRIDGMENT). Nemeth, ZA; Rathi, AK. Transportation Research Board. Transportation Research Record N1035 1985 pp 82-84 3 Tab. 3 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

PREDICTING AREA TRAFFIC CONTROL PERFORMANCE WITH TRANSYT/8 AND AN ELEMENTAL MODEL OF FUEL CONSUMPTION. Luk, JYK; Akcelik, R. Australian Road Research Board 500 Burwood Road Vermont South Victoria 3133 Australia 0572-1431. VOL. 12 NO. 4 1984 pp 87-101 2 Fig. 7 Tab. 10 Ref.

PREDICTION OF TRAFFIC FLOW BY AN ADAPTIVE PREDICTION SYSTEM. Lu, J. Transportation Research Board. Transportation Research Record N1287 1990 pp 54-61 10 Fig. 17 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

PREFERENTIAL CONTROL WARRANTS OF LIGHT RAIL TRANSIT MOVEMENTS. Radwan, AE; Hwang, K (Arizona State University, Tempe; Virginia Polytechnic Institute & State University). Transportation Research Board. Transportation Research Record N1010 1985 pp 69-75 9 Fig. 1 Tab. 1 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

PRELIMINARY TESTING AND EVALUATION OF NEW COMPUTER PROGRAMS FOR TRAFFIC ANALYSIS, TASK: EVALUATION OF SUPERCOMPUTER POTENTIAL. Parker-L.E.G. Ontario. Ministry of Transportation. Research and Development Branch, Regina. c1990. 135p. CANADA.

PROGRESS WITH RURAL TRAFFIC SIMULATION. Hoban, CJ; McLean, JR (Arrb). Australian Road Research Board 500 Burwood Road Vermont South Victoria 3133 Australia 0572-1431. 1982 pp 23-33 1 Fig. 4 Tab. 29 Ref.

OGRESSION ADJUSTMENT FACTORS AT SIGNALIZED INTERSECTIONS. Rouphail, NM. Transportation Research ard. Transportation Research Record N1225 1989 pp 8-17 12 Fig. 3 Tab. 10 Ref.. AVAILABLE FROM: Transportation earch Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

OGRESSION THROUGH A SERIES OF INTERSECTIONS WITH TRAFFIC ACTUATED CONTROLLERS. VOLUME TECHNICAL REPORT. FINAL REPORT. Skabardonis, A. Deakin, Harvey, Skabardonis, Incorporated P.O. Box 9156 rkeley California 94709; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Oct 1988 141p 22 . 29 Tab. 31 Ref. 1 App.. REPORT NO: FHWA-RD-89-132. AVAILABLE FROM: National Technical Information Service 85 Port Royal Road Springfield Virginia 22161

ROGRESSION THROUGH A SERIES OF INTERSECTIONS WITH TRAFFIC ACTUATED CONTROLLERS. VOLUME : USER'S GUIDE. FINAL REPORT. Skabardonis, A. Deakin, Harvey, Skabardonis, Incorporated P.O. Box 9156 Berkeley California 94709; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Oct 1988 30p 7 Fig. 2 Tab. Ref.. REPORT NO: FHWA-RD-89-133. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

PROPOSALS FOR A SINGLE-LANE TRAFFIC SIMULATION MODEL. Gynnerstedt, G; Palaniswamy, SP. National Swedish Road & Traffic Research Institute Fack S-581 01 Linkoeping Sweden 0347-6049. N398A 1984 Monograph 8p 1 Ref.

QUALITY OF TRAFFIC SERVICE. Ardekani, S; Herman, R. Texas University, Austin Center for Transportation Research Austin Texas 78712 Res Rpt. 304-1; Texas State Department of Highways & Public Transp Transportation Planning Division, P.O. Box 5051 Austin Texas 78763; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Jun 1982 Intrm Rpt. 110p. REPORT NO: FHWA/TX-82/17+304-1. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

QUEUEING MODEL FOR TRANSYT 7. Bell-M.C.. Newcastle upon Tyne Univ. (England). Transport Operations Research Group. Science Research Council, Swindon (England). TORGRR34. Oct 80. 30p. UNITED-KINGDOM.

REDUCING TRAFFIC CONGESTION IN HERALD SQUARE. Rathi, AK; Lieberman, EB. Institute of Transportation Engineers. ITE Journal VOL. 56 NO. 9 Sep 1986 pp 27-31 Figs. Tabs. 1 Ref.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

REPRESENTING TRAFFIC FLOW PROFILES FROM SAMPLE DATA. Mathews, DH; Phillips, JG (Transport and Road Research Laboratory; Advisa Research & Consultancy Services). PTRC Education and Research Services Limited. Planning & Transport Res & Comp, Sum Ann Mtg, Proc 1984 pp 121-133 6 Fig. 3 Tab. 9 Ref.

RESEARCH INITIATIVES FOR TRAFFIC SIGNAL CONTROL SYSTEMS. Transportation Research Board. Transportation Research Circular N380 Oct 1991 15p. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

REVIEW OF FREEWAY CORRIDOR TRAFFIC MODELS. FINAL REPORT. Van Aerde, M; Yagar, S. Ontario Ministry of Transportation & Communic, Can 1201 Wilson Avenue Downsview Ontario M3M 1J8 Canada. Jun 1985 62p Tabs. Refs.. AVAILABLE FROM: Ontario Ministry of Transportation & Communic, Can 1201 Wilson Avenue Downsview Ontario M3M 1J8 Canada

REVIEW OF TRAFFIC MODELLING TECHNIQUES. Pretty, RL (Queensland University, Australia). Society of Automotive Engineers (Australasia) 191 Royal Parade Parkville Victoria 3052 Australia. May 1982 pp 1-9 21 Ref.. REPORT NO: Paper 22

REVIEW OF TRAFFIC SIMULATIONS FOR INTELLIGENT VEHICLE-HIGHWAY SYSTEM EVALUATION. UNDERWOOD, SE. UNIVERSITY OF MICHIGAN TRANSPORTATION RESEARCH. IVHS TECHNICAL REPORT ; N90-1 Jan 1990 ENGLISH. REPORT NO: 0

ROUNDABOUT CONTROL IS SIGNAL SUCCESS. Belcher, M (West Midland County Council). Specialist and Professional Press. Surveyor VOL. 163 NO. 4780 Feb 1984 pp 13-14 1 Fig. 1 Phot.

SATURN - A BRIGHT STAR. Carlisle, JS; Tudge, RT. Institution of Engineers, Australia 11 National Circuit Barton A.C.T. 2600 Australia. 1985 pp 42-46 2 Fig. 11 Ref.. REPORT NO: No. 85/11. AVAILABLE FROM: Institution of Engineers, Australia 11 National Circuit Barton A.C.T. 2600 Australia

SCENE 1: A MODEL OF PARKING-LOT ENTRANCE AND EXIT CONDITIONS. Poon, WF; Young, W. Printerhall Limited. Traffic Engineering and Control VOL. 30 NO. 6 Jun 1989 pp 304-310 Figs. Tabs. Refs.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London England

SCOOT DATA AND ROUTE GUIDANCE. SECOND INTERNATIONAL CONFERENCE ON ROAD TRAFFIC MONITORING. Hounsell, NB; McDonald, M. Institution of Electrical Engineers Savoy Place London WC2R OBL England 0-85296373-4. 1989 pp 191-194 9 Ref.. AVAILABLE FROM: Institution of Electrical Engineers Savoy Place London WC2R OBL England

SECOND CONFERENCE ON TRAFFIC, ENERGY AND EMISSIONS, MELBOURNE, MAY 1982. PROGRAM AND PAPERS. Society of Automotive Engineers (Australasia) 191 Royal Parade Parkville Victoria 3052 Australia. May 1982 Monograph n.p. Figs. Tabs. Refs.

SEGMENTWIDE TRAFFIC RESPONSIVE FREEWAY ENTRY CONTROL: FREEWAY CORRIDOR MODELING, CONTROL STRATEGY, AND IMPLEMENTATION PLAN. Kahng, SJ; Jeng, C-Y; Campbell, JF; May, AD. California University, Berkeley Institute of Transportation Studies, 109 McLaughlin Hall Berkeley California 94720; California Department of Transportation 1120 N Street Sacramento California 95814; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Aug 1984 Final Rpt. 171p Figs. Tabs. 24 Ref. 6 App.. REPORT NO: FHWA-CA-TO-84-5. AVAILABLE FROM: California University, Berkeley Institute of Transportation Studies, 109 McLaughlin Hall Berkeley California 94720

SEGMENTWIDE TRAFFIC RESPONSIVE FREEWAY ENTRY CONTROL: FREEWAY CORRIDOR MODELING, CONTROL STRATEGY, AND IMPLEMENTATION PLAN. Kahng, SJ; Jeng, CY; Campbell, JF; May, AD. California University, Berkeley Institute of Transportation Studies, 109 McLaughlin Hall Berkeley California 94720. Aug 1984 186p. REPORT NO: UCB-ITS-RR-84-5; FHWA/CA/TO-84/5. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

SETTING CHANGE INTERVALS AT SIGNALIZED INTERSECTIONS. Chan, Y; Liao, T. Institute of Transportation Engineers. ITE Journal VOL. 57 NO. 2 Feb 1987 pp 45-50 Figs. 22 Ref.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

SIDRA-2 DOES IT LANE BY LANE. Akcelik, R. Australian Road Research Board 500 Burwood Road Vermont South Victoria 3133 Australia 0572-1431. VOL. 12 NO. 4 1984 pp 137-149 3 Fig. 1 Tab. 19 Ref.

SIDRA-2 FOR TRAFFIC SIGNAL DESIGN. Akcelik, R (Australian Road Research Board). Printerhall Limited. Traffic Engineering and Control VOL. 26 NO. 5 May 1985 pp 256-261 6 Fig. 8 Ref.

SIGNAL-CONTROLLED ROUNDABOUTS. Flanagan, TB; Salter, RJ (Bradford University, England). PTRC Education and Research Services Limited. Planning & Transport Res & Comp, Sum Ann Mtg, Proc 1983 pp 181-192 5 Fig. 4 Tab. 9 Ref.. AVAILABLE FROM: PTRC Education and Research Services Limited 110 Strand London WC2 England

SIGNAL IMPROVEMENTS SAVE TIME AND FUEL. Brohard, T. Public Works Journal Corporation. Public Works VOL. 117 NO. 2 Feb 1986 pp 52-53. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

SIGNAL SYSTEMS: METHODOLOGY FOR PROJECT SELECTION. VOLUME 2. FINAL REPORT. Carter-E.C. Maryland Univ., College Park. Dept. of Civil Engineering. Federal Highway Administration, Baltimore, MD. Maryland Div. Maryland State Highway Administration, Baltimore. AW085285046 VOL2, FHWAMD8820. Feb 88. 155p.

SIGNAL SYSTEMS: METHODOLOGY FOR PROJECT SELECTION. VOLUME 1. SUMMARY REPORT. Carter-E.C. Maryland Univ., College Park. Dept. of Civil Engineering. Federal Highway Administration, Baltimore, MD. Maryland Div. Maryland State Highway Administration, Baltimore. AW085285046 VOL1, FHWAMD8819. Feb 88. 33p.

SIGNAL TIMING BASED ON TRANSYT-7F. Davis, SW (City of Fort Wayne, Indiana). Purdue University. Engineering Bulletin of Purdue University N153 1982 pp 131-133. AVAILABLE FROM: Purdue University West Lafayette Indiana 47907

...III. USER'S MANUAL. Lieberman; Lai, J; Ellington, RE. Federal Highway Administration Research, Development ...nology, 6300 Georgetown Pike McLean Virginia 22101. Jul 1983 Final Rpt. 135p 36 Fig. 2 App.. REPORT NO: ...IP-82-19. AVAILABLE FROM: Federal Highway Administration Office of Implementation McLean Virginia 22101

...GN: A PHASE-BASED OPTIMIZATION PROGRAM FOR INDIVIDUAL SIGNAL-CONTROLLED JUNCTIONS. Silcock, ...ng, A. Printerhall Limited. Traffic Engineering and Control VOL. 31 NO. 5 May 1990 pp 291-98 8 Fig. 2 Tab. 15 Ref.. ...ABLE FROM: Printerhall Limited 29 Newman Street London W1P 3PE England

...UT AND META, TWO MOTORWAY TRAFFIC SIMULATION MODELS : CONCEPTUALIZATION, CALIBRATION AND ...DATION. COHEN, S. INSTITUT NATIONAL DE RECHERCHE SUR LES TRANSPORTS. RAPPORT INRETS, NN108 ...1989 70 PP FRENCH

...A2 - A MICROSCOPIC SIMULATION MODEL OF TRAFFIC FLOW ON TWO-LANE RURAL ROADS. Brannolte, U ...sruhe Universitaet, West Germany). Australian Road Research Board 500 Burwood Road Vermont South Victoria 3133 ...tralia 0572-1431. VOL. 12 NO. 5 1984 pp 88-92 4 Fig. 5 Ref.

...ULATION AND OPTIMIZATION OF TRAFFIC FLOW ON INTERCITY NETWORKS. Hu, YC; Schonfeld, P. Maryland ...versity, College Park Transportation Studies Center College Park Maryland 20742. Jul 1983 288p. REPORT NO: ...WA/MD-83/05. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia ...161

...MULATION MODEL APPLIED TO JAPANESE EXPRESSWAY. Makigami, Y; Nakanishi, T; Seill, K (Ritsumeikan ...niversity). American Society of Civil Engineers. Journal of Transportation Engineering VOL. 110 NO. 1 Jan 1984 pp 94-111 ... Ref.. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

...IMULATION MODEL FOR THE ANALYSIS OF COMPLEX TRAFFIC WEAVING PROBLEMS. O'Leary, TJ (Arizona State ...niversity). Transportation Planning and Technology VOL. 8 NO. 2 1983 pp 101-115 7 Fig. 4 Tab. 11 Ref.

SIMULATION OF DELAYS AND QUEUE LENGTHS AT OVER-SATURATED PRIORITY HIGHWAY JUNCTIONS. Salter, RJ (Bradford University, England). Australian Road Research Board. Australian Road Research VOL. 12 NO. 4 Dec 1982 pp 239-246 8 Fig. 7 Ref.

SIMULATION OF TRAFFIC FLOW AT SIGNAL-CONTROLLED ROUNDABOUTS. Salter, RJ; Okezue, OG. Printerhall Limited. Traffic Engineering and Control VOL. 29 NO. 3 Mar 1988 pp 142-147 Figs. Tabs. 1 Ref.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London England

SIMULATION OF TRAFFIC FLOW PARAMETERS ON A SERIES OF SIGNALIZED INTERSECTIONS. Savic, D. Savez Inzenjera I Tehn Saobracaja I Veza Jugo. Zbornik III Jugo Savetovanje Tehn Regul Saobracaja Apr 1983 pp 189-199 4 Fig. 5 Tab. Serbian

SIMULATION OF VEHICLE EMISSIONS AT INTERSECTIONS. Lee, F-P; Lee, CE; Machemehl, RB; Copeland, CR, Jr. Texas University, Austin Center for Transportation Research Austin Texas 78712; Texas State Department of Highways & Public Transp Transportation Planning Division, P.O. Box 5051 Austin Texas 78763; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Aug 1983 Intrm Rpt. n.p.. REPORT NO: FHWA/TX-84/17+250-1

SIMULTANEOUS ANALYSIS OF A SIGNALIZED INTERSECTION. HIGHWAY CAPACITY AND LEVEL OF SERVICE. PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON HIGHWAY CAPACITY, KARLSRUHE, GERMANY, 24-27 JULY 1991. Ozaki, H. Balkema (AA) P.O. Box 1675 3000 BR Rotterdam Netherlands 90 5410 011 7. 1991 pp 271-282 9 Fig. 3 Tab. Refs.. AVAILABLE FROM: Balkema (AA) Publishers Old Post Road Brookfield Vermont 05036

SIMULTANEOUS OPTIMIZATION OF SIGNAL SETTINGS AND LEFT-TURN TREATMENTS. Rouphail, NM; Radwan, AE. Transportation Research Board. Transportation Research Record N1287 1990 pp 1-10 6 Fig. 4 Tab. 28 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

SINGLE-ARTERIAL VERSUS NETWORKWIDE OPTIMIZATION IN SIGNAL NETWORK OPTIMIZATION PROGRAMS (DISCUSSION AND CLOSURE). Johnson, V; Cohen, SL; Chang, ECP. Transportation Research Board. Transportation Research Record N1142 1987 pp 6-15 7 Fig. 11 Tab. 3 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

SOME EXPERIENCE WITH THREE URBAN NETWORK MODELS: SATURN, TRANSYT/8 AND NETSIM. Luk, JYK; Stewart, RW (Waterloo University). Australian Road Research Board. Australian Road Research VOL. 14 NO. 2 Jun 1984 pp 82-87 2 Fig. 4 Tab. 18 Ref.

SOME MEASUREMENTS OF ROBERTSON'S PLATOON DISPERSION FACTOR. Axhausen, KW; Korling, H-G. Transportation Research Board. Transportation Research Record N1112 1987 pp 71-77 5 Fig. 9 Tab. 17 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

SOME MICROCOMPUTER APPLICATIONS IN TRAFFIC ENGINEERING IN CHILE. Ortuzar, J, de D. PTRC Education and Research Services Limited. Planning & Transport Res & Comp, Sum Ann Mtg, Proc VOL. P249 1984 pp 73-75 4 Ref.. AVAILABLE FROM: PTRC Education and Research Services Limited 110 Strand London WC2 England

SOME PROPERTIES OF MACROSCOPIC TRAFFIC MODELS. Ross, P. Transportation Research Board. Transportation Research Record N1194 1988 pp 129-134 2 Fig. 12 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

SSTOP - A SIGNAL SYSTEM OPTIMIZATION PROGRAM. McGill, J (Ontario Ministry of Transportation & Communic, Can). Institute of Transportation Engineers. ITE Journal VOL. 54 NO. 3 Mar 1984 pp 38-40. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

STATE OF THE ART REPORT. TRAFFIC MANAGEMENT. TRAFFIC CONTROL. Kinslea Press Limited. Municipal Engineer VOL. 1 NO. 3 Oct 1984 pp 255-274 11 Fig. 11 Phot. 120 Ref.. AVAILABLE FROM: Kinslea Press Limited Central Buildings, 24 Southwark Street, London Bridge London England

STATE SIGNAL TIMING OPTIMIZATION PROGRAMS. Arnold, ED. Institute of Transportation Engineers. ITE Journal VOL. 59 NO. 2 Feb 1989 pp 33-35 1 Tab. 1 Ref.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

STATISTICAL ANALYSIS OF OUTPUT RATIOS IN TRAFFIC SIMULATION. Gafarian, AV; Halati, A. Transportation Research Board. Transportation Research Record N1091 1986 p 29-36 2 Fig. 4 Tab. 5 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

STOP PROBABILITY AND DELAY ESTIMATIONS AT LOW VOLUMES FOR SEMI-ACTUATED TRAFFIC SIGNALS. Luh, JZ; Lee, CY. Operations Research Society of America. Transportation Science VOL. 25 NO. 1 Feb 1991 pp 65-82 Figs. Tabs. Refs.. AVAILABLE FROM: Operations Research Society of America Mount Royal and Guilford Avenue Baltimore Maryland 21202

STREET-WISE SCOOT MOVES TRAFFIC THAT OTHER SYSTEMS CAN'T REACH. Bowen, GT; Vincent, RA. Business Press International Limited. Surveyor Public Authority Technology VOL. 165 NO. 4875 Dec 1985 pp 8-9 2 Fig. 1 Phot.. AVAILABLE FROM: Business Press International Limited Throwley Way Sutton Surrey United Kingdom

STUDY AND NUMERICAL MODELLING OF NON-STATIONARY TRAFFIC FLOW DEMANDS AT SIGNALIZED INTERSECTIONS. Chodur, J; Tracz, M (Cracow Technical University). VNU Science Press Bv P.O. Box 2073 Utrecht Netherlands 90-6764-008-5. 1984 pp 134-154 13 Fig. 1 Tab. 12 Ref.

TESTING DELAY MODELS WITH FIELD DATA FOR FOUR-WAY, STOP SIGN-CONTROLLED INTERSECTIONS. Zion, M; List, GF; Manning, C. Transportation Research Board. Transportation Research Record N1225 1989 pp 83-90 10 Fig. 6 Tab. 8 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

TESTING OF DYNAMIC MODELS FOR SIGNAL CONTROLLED INTERSECTIONS. Beskos, DE; Okutani, I; Michalopoulos, P (Minnesota University, Minneapolis; Shinshu University Japan). Pergamon Press Limited. Transportation Research. Part B: Methodological VOL. 18B NO. 4/5 1984 pp 397-408 3 Fig. 3 Tab. 10 Ref.

THE ARTERIAL ANALYSIS PACKAGE. Gibson, DRP; Williams, L. Federal Highway Administration, Office of R&D. Public Roads VOL. 50 NO. 3 Dec 1986 pp 91-96 Figs. 3 Ref.. AVAILABLE FROM: Government Printing Office Superintendent of Documents Washington D.C. 20402

BANDWIDTH-CONSTRAINED TRANSYT SIGNAL-OPTIMIZATION PROGRAM (DISCUSSION AND CLOSURE). n, SL; Liu, CC; Chang, EC-P. Transportation Research Board. Transportation Research Record N1057 1986 pp 1-9 g. 5 Tab. 13 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, Washington D.C. 20418

CALCULATION OF THE ORIGIN DESTINATION MATRIX FROM THE MEASUREMENT OF TRAFFIC FLOWS BASED THE HYPOTHESIS OF PROPORTIONAL ASSIGNMENT. Cascetta, E (Naples University, Italy). Casa Editrice la cola. Vie e Trasporti VOL. 51 NO. 486 Jan 1982 pp 25-35 3 Fig. 3 Tab. 5 Ref. Italian

E DEVELOPMENT OF TRANSIM - A DISPLAY ORIENTED TRAFFIC SIMULATION MODEL. Foster, D; Smare, AD est Yorkshire Metropolitan County Council). Echo Press Limited. Municipal Engineer VOL. 110 NO. 6 Jun 1983 pp 1-205 5 Fig.

E DEVELOPMENT OF UTCS/NETSIM/ICG: AN INTEGRATED URBAN TRAFFIC CONTROL SYSTEM - NETWORK MULATION - INTERACTIVE COMPUTER GRAPHICS PROGRAM. Eiger, A; Chin, S-M. Rensselaer Polytechnic Institute epartment of Civil Engineering Troy New York 12181; Department of Transportation Office of University Research, 400 h Street, SW Troy New York 12181. 1982 Final Rpt 50p. REPORT NO: DOT-RSPA-DMA-50/83/5. AVAILABLE FROM: nsselaer Polytechnic Institute Department of Civil Engineering Troy New York 12181

HE EFFECTS OF PELICAN CROSSING FACILITIES IN A LINKED SIGNAL SYSTEM: A SIMULATION STUDY. Taylor, G. Newcastle upon Tyne University, England Transport Operations Research Group, Claremont Road Newcastle NE1 7RU Tyne and Wear England. May 1984 42p 15 Fig. 2 Tab. 14 Ref.. REPORT NO: 55

THE EFFECTS OF TRAFFIC CONTROL OPERATION SYSTEMS WITH SPECIAL REGARD TO THE NOISE SITUATION IN THE VICINITY OF INTERSECTIONS. Teichgraeber, W; Elsner, A; Gudehus, V. Bundesminister fuer Verkehr, Abteilung Strassenbau Lennestrasse 30 D-5300 Bonn West Germany. 1985 40p German. REPORT NO: 443. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

THE FUEL-EFFICIENT TRAFFIC SIGNAL MANAGEMENT PROGRAM: EVALUATION OF THE FOURTH AND FIFTH FUNDING CYCLES. Skabardonis, A; Singh, R; Deakin, EA. California University, Berkeley Institute of Transportation Studies Berkeley California 94720 0192-4095; California Department of Transportation 1120 N Street Sacramento California 95814. Apr 1988 30p 6 Tab. 9 Ref.. REPORT NO: UCB-ITS-RR-88-8. AVAILABLE FROM: California University, Berkeley Institute of Transportation Studies Berkeley California 94720

THE NETSIM GRAPHICS SYSTEM. Andrews, B; Lieberman, EB; Santiago, AJ. Transportation Research Board. Transportation Research Record N1112 1987 pp 124-131 14 Fig. 6 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

THE NEW NETSIM SIMULATION PROGRAM. Rathi, AK; Santiago, AJ. Printerhall Limited. Traffic Engineering and Control VOL. 31 NO. 5 May 1990 pp 317-320 14 Ref.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London W1P 3PE England

THE PASSER II-84 SYSTEM: A PRACTICAL SIGNAL TIMING TOOL. Marsden, BG; Chang, CP; Derr, BR. Institute of Transportation Engineers. ITE Journal VOL. 57 NO. 3 Mar 1987 pp 31-36 Figs. 1 Tab. 13 Ref.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

THE PASSER II-87 MICROCOMPUTER PROGRAM. Chang, EC-P. Printerhall Limited. Traffic Engineering and Control VOL. 29 NO. 11 Nov 1988 pp 574-578 Figs. Tabs.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London England

THE POTENTIAL FOR ROUTE GUIDANCE IN ON-LINE COMPUTER CONTROLLED UTC (URBAN TRAFFIC CONTROL) NETWORKS. TRAFFIC OPERATION AND MANAGEMENT. PROCEEDINGS OF SEMINAR M HELD AT THE PTRC SUMMER ANNUAL MEETING, UNIVERSITY OF SUSSEX, ENGLAND, 15-18 JULY 1985, VOLUME P269. McDonald, M; Hounsell, NB. PTRC Education and Research Services Limited 110 Strand London WC2 England 0266-4593 086050-154-X. 1985 pp 33-43 3 Fig. 1 Tab. 21 Ref.. AVAILABLE FROM: PTRC Education and Research Services Limited 110 Strand London WC2 England

THE PROBLEM OF PERFORMANCE EVALUATION AT SIGNALIZED INTERSECTIONS WITH VARIOUS TRAFFIC CONTROL STRATEGIES. HIGHWAY CAPACITY AND LEVEL OF SERVICE. PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON HIGHWAY CAPACITY, KARLSRUHE, GERMANY, 24-27 JULY 1991. Hsu, T-P. Balkema (AA) P.O. Box 1675 3000 BR Rotterdam Netherlands 90 5410 011 7. 1991 pp 173-180 9 Fig. 3 Tab. Refs.. AVAILABLE FROM: Balkema (AA) Publishers Old Post Road Brookfield Vermont 05036

THE SCOOT ON-LINE TRAFFIC SIGNAL OPTIMIZATION TECHNIQUE. Hunt, PB; Robertson, DI; Bretherton, RD; Royle, MC. Printerhall Limited. Traffic Engineering and Control VOL. 23 NO. 4 Apr 1982 pp 190-192 2 Fig. 2 Tab. 3 Ref.

THE TEXAS MODEL FOR INTERSECTION TRAFFIC--A USER-FRIENDLY MICROCOMPUTER VERSION WITH ANIMATED GRAPHICS SCREEN DISPLAY. Lee, CE; Machemehl, RB. Transportation Research Board. Transportation Research Record N1142 1987 pp 1-5 2 Fig. 1 Tab. 4 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

THE TWO AND A HALF LANE RURAL ROAD. Hoban, CJ. Australian Road Research Board 500 Burwood Road Vermont South Victoria 3133 Australia 0572-1431. 1982 pp 59-70 4 Fig. 5 Tab. 29 Ref.

THE USE OF BINARY CHOICE DECISION PROCESS FOR ADAPTIVE SIGNAL CONTROL. Lin, F-B. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 115 NO. 3 May 1989 pp 270-282 Figs. Tabs. Refs. 2 App.. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017

THE USE OF MICRO SIMULATION FOR THE DESIGN OF WEAVING SECTIONS. HIGHWAY CAPACITY AND LEVEL OF SERVICE. PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON HIGHWAY CAPACITY, KARLSRUHE, GERMANY, 24-27 JULY 1991. Vermijs, RGMM. Balkema (AA) P.O. Box 1675 3000 BR Rotterdam Netherlands 90 5410 011 7. 1991 pp 419-427 6 Fig. 4 Tab. Refs.. AVAILABLE FROM: Balkema (AA) Publishers Old Post Road Brookfield Vermont 05036

THE USE OF SIMULATION AS AN AID TO TRAFFIC ACCIDENT RESEARCH. Corner, JPA (Queensland Institute of Technology). Australian Road Research Board 500 Burwood Road Vermont South Victoria 3133 Australia 0 86910 127 7. 1983 pp 171-178

THE USE OF SIMULATION IN THE ROAD DESIGN PROCESS. Golding, S (Queensland Main Roads Department, Australia). Australian Road Research Board 500 Burwood Road Vermont South Victoria 3133 Australia 0 86910 127 7. 1983 pp 105-118 5 Fig. 7 Ref.

THE USE OF THE QDELAY SURVEY METHOD IN THE ESTIMATION OF FUEL CONSUMPTION AT SIGNALIZED INTERSECTIONS. Richardson, AJ (Monash University, Australia). Society of Automotive Engineers (Australasia) 191 Royal Parade Parkville Victoria 3052 Australia. May 1982 pp 1-11 1 Fig. 20 Ref.. REPORT NO: Paper 24

THE USE OF TRANSYT AT SIGNALIZED ROUNDABOUTS. Lines, CJ; Crabtree, MR. Printerhall Limited. Traffic Engineering and Control VOL. 29 NO. 6 Jun 1988 pp 332-337 Figs. 9 Ref.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London England

THE VALUE OF FIXED-TIME SIGNAL CO-ORDINATION IN DEVELOPING COUNTRIES. II. IMPROVED BUS MODELING AND RESULTS. Willumsen, LG; Coeymans, JE. Printerhall Limited. Traffic Engineering and Control VOL. 30 NO. 3 Mar 1989 pp 126-134 Figs. Tabs. Refs.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London England

THE VTI TRAFFIC SIMULATION MODEL. A DESCRIPTION OF THE MODEL AND PROGRAM SYSTEM. Brodin, A; Carlsson, A; Bolling, A. National Swedish Road & Traffic Research Institute. VTI Meddelanden N321 1982 Monograph 193p Figs. Tabs. 11 Ref. Swedish

THE VTI TRAFFIC SIMULATION MODEL: DESCRIPTION AND SOME APPLICATIONS. CARLSSON, A. NEW ZEALAND ROADING SYMPOSIUM NEW ZEALAND ROADING VOL 3 1987 PP 451-463 ENGLISH

THREE-DIMENSIONAL RELATIONSHIPS AMONG TRAFFIC FLOW THEORY VARIABLES. Gilchrist, RS; Hall, FL. Transportation Research Board. Transportation Research Record N1225 1989 pp 99-108 9 Fig. 13 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

DESIGN OF TRAFFIC SIGNALS. Sakita, M. Transportation Research Board. Transportation Research Record 1986 pp 83-87 4 Fig. 1 Tab. 5 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 ...tion Avenue, NW Washington D.C. 20418

...G OF INTERGREEN PERIODS AT SIGNALIZED INTERSECTIONS: THE GERMAN METHOD. Retzko, HG; Boltze, ...itute of Transportation Engineers. ITE Journal VOL. 57 NO. 9 Sep 1987 pp 23-26 Figs. Refs.. AVAILABLE FROM: ...e of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

...G PLAN SENSITIVITY TO CHANGES IN PLATOON DISPERSION SETTINGS. Guebert, AA; Sparks, G. ...NEERING FOUNDATION. TRAFFIC CONTROL METHODS. PROCEEDINGS OF THE FIFTH 1990 131-45

...ARD INTELLIGENT TRAFFIC SIGNAL DESIGN SYSTEM. Pattnaik, SB; Rajeev, S; Mukundan, A. American Society ...vil Engineers. Journal of Transportation Engineering VOL. 117 NO. 5 Sep 1991 pp 524-539 Figs. Refs. 1 App.. ...ILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017-2398

...WARDS A REVIEW OF THE CONCEPT OF LEVEL OF SERVICE FOR TWO- LANE RURAL ROADS. Hoban, CJ. ...tralian Road Research Board. Australian Road Research VOL. 13 NO. 3 Sep 1983 pp 216-218 2 Fig. 2 Tab. 9 Ref.

...AF II NETSIM USER GUIDE. FINAL REPORT. Hagerty, BR. Michigan Department of Transportation State Highways ...lding, 425 West Ottawa, P.O. Box 30050 Lansing Michigan 48909; Federal Highway Administration 400 7th Street, SW ...ashington D.C. 20590. Mar 1987 v.p. 1 App.. REPORT NO: FHWA-MI-RD-87-01. AVAILABLE FROM: National Technical ...ormation Service 5285 Port Royal Road Springfield Virginia 22161

...RAF SYSTEM - TECHNICAL SUMMARY. Final rept. Lieberman-E.; Yedlin-M.; Andrews-B.; Sheridan-K. KLD Associates, ...c., Huntington, NY. Federal Highway Administration, Washington, DC. KLDTR135, FHWARD83084. Apr 85. 34p.

TRAFFIC MANAGEMENT. RTS ENGLISH ISSUE NUMBER 6. A COMPARISON OF TWO MOTORWAY TRAFFIC SIMULATION MODELS. Cohen, S; Aron, M; Pierrelee, J-C. Institut National Recherche sur Transp et Securite. Recherche Transports Securite N6 Feb 1991 pp 113-118 Figs. Tabs.. AVAILABLE FROM: Institut National Recherche sur Transp et Securite 2, Avenue du General Malleret-Joinville, BP 34 94114 Arcueil Cedex France

TRAFFIC MODELING TO EVALUATE POTENTIAL BENEFITS OF ADVANCED TRAFFIC MANAGEMENT AND IN-VEHICLE INFORMATION SYSTEMS IN A FREEWAY ARTERIAL CORRIDOR. GARDES, Y; MAY, AD. INSTITUTE OF TRANSPORTATION STUDIES UNIVERSITY OF BERKELEY CALIF. Jun 1990 15 PP ENGLISH

TRAFFIC MODELLING AND SIMULATION. Heydecker, BG. ENGINEERING FOUNDATION. TRAFFIC CONTROL METHODS. PROCEEDINGS OF THE FIFTH 1990 345-51

TRAFFIC MODELLING IN KUWAIT.: 1., DEVELOPMENT OF A SATURN NETWORK DATABASE. MCSHEEN, JR; HALE, RC. TRAFFIC ENGINEERING & CONTROL VOL. 30 NO. 10 1989 PP 466-473 ENGLISH

TRAFFIC MODELLING IN KUWAIT.: 2, DEVELOPMENT OF A MULTI-MODAL TRAFFIC MODEL FOR THE KUWAIT METROPOLITAN AREA. HALE, RC; MCSHEEN, JR. TRAFFIC ENGINEERING & CONTROL VOL. 30 NO. 10 Nov 1989 PP 534-544 ENGLISH

TRAFFIC MODELLING TECHNIQUES FOR THE DEVELOPING WORLD. TIMBERLAKE, RS. NATIONAL RESEARCH COUNCIL TRANSPORTATION RESEARCH WASHINGTON DC. 1988 ENGLISH

TRAFFIC MODELLING: 1969-1989. Gipps, PG. Australian Road Research Board. Australian Road Research VOL. 20 NO. 1 Mar 1990 pp 22-29. AVAILABLE FROM: Australian Road Research Board Executive Director, P.O. Box 156 Nunawading Victoria 3131 Australia

TRAFFIC MODELLING: A REVIEW OF NEEDS AND CAPABILITIES. TAYLOR, MAP; OGDEN, KW; SZWED, N. AUSTRALIAN ROAD RESEARCH BOARD PROCEEDINGS 1986 PP 84-95 ENGLISH

TRAFFIC MODELS AND ROAD TRANSPORT INFORMATICS (RTI) SYSTEMS. STERGIOU, B; STATHOPOULOS, A. TRAFFIC ENGINEERING & CONTROL VOL. 30 NO. 12 1989 PP 580-586 ENGLISH

TRAFFIC OPERATION ON BUSY TWO-LANE RURAL ROADS IN THE NETHERLANDS. Botma, H. Transportation Research Board. Transportation Research Record N1091 1986 p 127-131 2 Fig. 3 Tab. 7 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

TRAFFIC OPERATIONS OF BASIC ACTUATED TRAFFIC CONTROL SYSTEMS AT DIAMOND INTERCHANGES. Messer, CJ; Chang-M-S. Texas Transportation Institute Texas A&M University College Station Texas 77843; Texas State Department of Highways & Public Transp Transportation Planning Division, P.O. Box 5051 Austin Texas 78763; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Aug 1985 Final Rpt. 76p 30 Fig. 8 Tab. 8 Ref.. REPORT NO: FHWATX-85/75+344-2F; Res Rpt. 344-2F. AVAILABLE FROM: Texas Transportation Institute Texas A&M University College Station Texas 77843

TRAFFIC PATTERNS IN UNSTABLE TRAFFIC FLOW ON FREEWAYS. HIGHWAY CAPACITY AND LEVEL OF SERVICE. PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON HIGHWAY CAPACITY, KARLSRUHE, GERMANY, 24-27 JULY 1991. Kuhne, R. Balkema (AA) P.O. Box 1675 3000 BR Rotterdam Netherlands 90 5410 011 7. 1991 pp 211-223 14 Fig. Refs.. AVAILABLE FROM: Balkema (AA) Publishers Old Post Road Brookfield Vermont 05036

TRAFFIC PLATOON DISPERSION MODELING. Denney, RW, Jr. American Society of Civil Engineers. Journal of Transportation Engineering VOL 115 NO. 2 Mar 1989 pp 193-207 Figs. Refs. 1 App.. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017

TRAFFIC-RESPONSIVE SIGNAL CONTROL AT ISOLATED JUNCTIONS. Bell, MGH; Cowell, MPH; Heydecker, BG. ENGINEERING FOUNDATION. TRAFFIC CONTROL METHODS. PROCEEDINGS OF THE FIFTH 1990 273-94

TRAFFIC SIGNAL TIMING AS A TRANSPORTATION SYSTEM MANAGEMENT MEASURE: THE CALIFORNIA EXPERIENCE. Deakin, EA; Skabardonis, A; May, AD. Transportation Research Board. Transportation Research Record N1081 1986 pp 59-65 1 Fig. 4 Tab. 12 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

TRAFFIC SIGNAL TIMING MODELS FOR OVERSATURATED SIGNALIZED INTERCHANGES. (Interim Report March 1989-January 1992). Kim-Y.; Messer-C.J. Texas Transportation Inst., College Station. Federal Highway Administration, Austin, TX. Texas Div. Texas Dept. of Transportation, Austin. Transportation Planning Div. TTI218881148, RR11482, FHWATX9211482. Jan 92. 123p.

TRAFFIC SIGNAL TIMING OPTIMIZATION IN LARGE NETWORKS. VLAHOS, NJ; JOVANIS, PP. Aug 1987 ENGLISH. SUBMITTED FOR PRESENTATION AT THE JANUARY, 1988 ANNUAL MEETING OF THE TRANSPORTATION RESEARCH BOARD AUGUST, 1987

TRAFFIC SIGNAL TIMING OPTIMIZATION STUDY FOR THE CITY OF SAN DIEGO. PRC VOORHEES SAN DIEGO CALIF. Feb 1984 ENGLISH

TRAFFIC SIGNAL TIMING PROGRAM PASSER II - 84. Chang, E C-P; Messer, CJ. Texas Transportation Institute. Texas Transportation Researcher VOL. 20 NO. 2 Apr 1984 pp 7-9. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

TRAFFIC SIMULATION STUDIES: A REVIEW. KATTI, BK; CHARI, SR. INDIAN HIGHWAYS VOL. 13 NO. 4 Apr 1985 PP 5-13 ENGLISH

TRAFFIC SIMULATION STUDY FOR TWO-LANE RURAL HIGHWAY OVERTAKING IMPROVEMENTS. OKURA, I; MATSUMOTO, K. AUSTRALIAN ROAD RESEARCH BOARD PROCEEDINGS 1990 PP 43-56 ENGLISH

TRAFFIC SIMULATION: COURSE NOTES. Young, W; Allsop, R; Cornwell, RR; Gipps, PG; Hoban, CJ; Vandebona, U; Johnston, DK; Luk, JYK; Taylor, MAP; Richardson, AJ (University College, London; Road Traffic Authority). Monash University, Australia Department of Civil Engineering, Wellington Road Clayton Victoria 3168 Australia 0-86746-337-6. 1984 Monograph n.p. Figs. Tabs. Phots. Refs.

TRAFFIC SOFTWARE INTEGRATED SYSTEM (TSIS). Santiago, AJ; Rathi, AK. ENGINEERING FOUNDATION. TRAFFIC CONTROL METHODS. PROCEEDINGS OF THE FIFTH 1990 307-13

LO-M MACROSCOPIC TRAFFIC SIMULATION MODEL USER'S MANUAL. Goldblatt, R; Hagerty, B; Laban, T. KLD ates Incorporated 300 Broadway Huntington Station New York 11746; Michigan Department of Transportation State ays Building, 425 West Ottawa, P.O. Box 30050 Lansing Michigan 48909; Federal Highway Administration 400 7th , SW Washington D.C. 20590. Oct 1984 Final Rpt. v.p. Figs. Tabs. Refs. 7 App.. REPORT NO: FHWA-MI-RD-85-01. ABLE FROM: KLD Associates Incorporated 300 Broadway Huntington Station New York 11746

FLO-M MACROSCOPIC TRAFFIC SIMULATION MODEL. USER'S MANUAL FOR (OBJ)P/Q/444/11 ON OBJECTS, P/Q/444/13 ON OBJECTS. Hagerty, BR. KLD Associates Incorporated 300 Broadway Huntington Station New York 46. Oct 1984 450p. REPORT NO: FHWA/MI/RD-85/01. AVAILABLE FROM: National Technical Information Service 5285 Royal Road Springfield Virginia 22161

F-NETSIM: HOW IT WORKS, WHAT IT DOES. Wong, S. (Federal Highway Administration, Washington, D.C.). Institute Transportation Engineers, ITE Journal, Vol. 60. No. 4, Apr 1990, pp 22-27.

AF SYSTEM - TECHNICAL SUMMARY. Final rept. Lieberman-E.; Yedlin-M.; Andrews-B.; Sheridan-K. KLD Associates, ., Huntington, NY. Federal Highway Administration, Washington, DC. KLDTR135, FHWARD83084. Apr 85. 34p.

RAFSIG: A COMPUTER PROGRAM FOR SIGNAL SETTINGS AT AN ISOLATED UNDER- OR OVERSATURATED, XED-TIME CONTROLLED INTERSECTION. Relic, S. Printerhall Limited. Traffic Engineering and Control VOL 29 NO. Nov 1988 pp 562-566 Figs. Tabs. Refs.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London England

RANSPORTATION AND TRAFFIC THEORY. PROCEEDINGS OF THE TENTH INTERNATIONAL SYMPOSIUM ON RANSPORTATION AND TRAFFIC THEORY, HELD JULY 8-10, 1987, AT THE MASSACHUSETTS INSTITUTE OF ECHNOLOGY, CAMBRIDGE, MASSACHUSETTS. CONTINUED FROM TRIS ACCESSION NO 24XXXX. Gartner, NH; Wilson, NHM. Massachusetts Institute of Technology Center for Transportation Studies Cambridge Massachusetts 02139 0-444-01227-3. 1987 506p Figs. Tabs. Refs.. AVAILABLE FROM: Elsevier North-Holland Incorporated 52 Vanderbilt Avenue New York New York 10017

TRANSYT-7F AND NETSIM, COMPARISON OF ESTIMATED AND SIMULATED PERFORMANCE DATA. Dudek, G; Goode, L; Poole, M. Institute of Transportation Engineers, ITE Journal, Vol 53., No. 8, Aug 1983, pp 32-34.

TRANSYT-7F OR PASSER II, WHICH IS BETTER - A COMPARISON THROUGH FIELD STUDIES. Shui-Ying Wong, Federal Highway Administration Office of Traffic Operations Washington D.C. 20590. Transportation Research Board. Transportation Research Record N1324, 1991, pp 83-97. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418.

TRANSYT-7F USER'S MANUAL. Wallace, CE; Courage, KG; Reaves, DP; Schoene, GW; Euler, GW. Florida University, Gainesville Transportation Research Center Gainesville Florida 32611; Federal Highway Administration Office of Traffic Operations Washington D.C. 20590. Jun 1984 510p. REPORT NO: UF-TRC-U32 FP-06/07. AVAILABLE FROM: Florida University, Gainesville Transportation Research Center Gainesville Florida 32611

TWO-LANE TRAFFIC SIMULATION: A FIELD EVALUATION OF ROADSIM. Morales, JM; Paniati, JF. Transportation Research Board. Transportation Research Record N1100 1986 pp 29-39 11 Fig. 4 Tab. 6 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

TWO-PHASE TRAFFIC SIGNAL TIMING WITH 'CONFLICT POINT METHOD. YANG, P. AUSTRALIAN ROAD RESEARCH VOL. 19 NO. 2 Jun 1989 PP 155-163 ENGLISH

TWO TRAFFIC-RESPONSIVE AREA TRAFFIC CONTROL METHODS: SCAT AND SCOOT. Luk, JYK (Australian Road Research Board). Printerhall Limited. Traffic Engineering and Control VOL 25 NO. 1 Jan 1984 p 14 3 Tab. 17 Ref.

UNDERSTANDING THE CUMULATIVE STATISTICS FROM TRAF-NETSIM. Chen, H. and Thor, C. PC-TRANSmission Vol 4., No. 2, October 1989.

UNSIGNALISED ISOLATED INTERSECTION SIMULATION MODEL. Stanojevic, M. Savez Inzenjera I Tehn Saobracaja I Veza Jugo. Zbornik III Jugo Savetovanje Tehn Regul Saobracaja Apr 1983 pp 201-209 7 Fig. 7 Ref. Serbian

URBAN NETWORK TRAFFIC SIMULATION: TRAF-NETSIM PROGRAM. Rathi, AK; Santiago, AJ. American Society of Civil Engineers. Journal of Transportation Engineering VOL 116 NO. 6 Nov 1990 pp 734-743 Refs. 1 App.. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017-2398

URBAN ROAD TRAFFIC MODELS FOR ECONOMIC APPRAISAL: STAGES I AND II. FISK, CS; DUNN, RCM. DEPT OF CIVIL ENGINEERING UNIVERSITY OF AUCKLAND. SCHOOL OF ENGINEERING REPORT, NO 428 , N428 Nov 1986 175 PP ENGLISH

URBAN TRAFFIC MODELS FOR OPERATIONAL ANALYSES AND ECONOMIC APPRAISALS. NEW ZEALAND ROADING SYMPOSIUM 1987. VOLUME 3. Fisk, CS; Dunn, RCM. National Roads Board, New Zealand P.O. Box 12-041 Wellington New Zealand 0-477-07156-2. 1987 pp 475-481 2 Ref.. AVAILABLE FROM: National Roads Board, New Zealand P.O. Box 12-041 Wellington New Zealand

URBAN TRAFFIC NETWORK FLOW MODELS. Williams, JC; Mahmassani, HS; Herman, R. Transportation Research Board. Transportation Research Record N1112 1987 pp 78-88 14 Fig. 1 Tab. 11 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

USE AND EFFECTIVENESS OF SYNTHETIC ORIGIN-DESTINATION DATA IN A MACROSCOPIC FREEWAY SIMULATION MODEL. Stokes, RW; Morris, DE. Institute of Transportation Engineers. ITE Journal VOL 56 NO. 4 Apr 1986 pp 43-47 14 Ref.. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

USE OF PREDICTED VEHICLE ARRIVAL INFORMATION FOR ADAPTIVE SIGNAL CONTROL--AN ASSESSMENT. Lin, F-B; Cooke, D; Vijayakumar, S. Transportation Research Board. Transportation Research Record N1112 1987 pp 89-98 12 Fig. 1 Tab. 14 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

USE OF THREE-DIMENSIONAL CONJUGATE DIRECTIONS SEARCH METHOD TO IMPROVE TRANSYT-7F COMPUTATIONAL EFFICIENCY. Tsay, H-S; Wang, K-T. Transportation Research Board. Transportation Research Record N1225 1989 pp 116-129 7 Fig. 3 Tab. 11 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

USE OF TRAFFIC SIMULATION TO EVALUATE RURAL ROAD IMPROVEMENT ALTERNATIVES. Hoban, CJ. Roads and Transportation Association of Canada 1765 St Laurent Boulevard Ottawa Ontario K1G 3V4 Canada. 1985 pp 3-20 6 Fig. 3 Tab. 10 Ref.. AVAILABLE FROM: Roads and Transportation Association of Canada 1765 St Laurent Boulevard Ottawa Ontario K1G 3V4 Canada

USER-FRIENDLY TEXAS MODEL--GUIDE TO DATA ENTRY. FINAL REPORT. Lee, CE; Machemehl, RB; Inman, RF; Copeland, CR, Jr; Sanders, WM. Texas University, Austin Center for Transportation Research Austin Texas 78712; Texas State Department of Highways & Public Transp Transportation Planning Division, P.O. Box 5051 Austin Texas 78763; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Nov 1985 210p 11 Fig. 6 Tab. 3 Ref. 3 App.. REPORT NO: FHWA/TX-86/54+361-1F; Res Rept 361-1F. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

USER GUIDE TO CONTRAM VERSION 4. Leonard, DR; Gower, P. Transport and Road Research Laboratory Old Wokingham Road Crowthorne RG11 6AU Berkshire England 0305-1315 GRATIS. 1982 Monograph 68p 4 Fig. 6 Ref.. REPORT NO: SR 735

USER'S GUIDE FOR TRAF II NETSIM (OBJ)P Q 444 14 ON OBJECTS: SURFACE STREET TRAFFIC SIMULATION MODEL. HAGERTY, BR. MICHIGAN DEPT OF TRANSPORTATION LANSING MICH. 1987 ENGLISH

USER'S MANUAL FOR OBJP Q 444 11 ON OBJECTS AND OBJP Q 444 13 ON OBJECTS : TRAFLO-M MACROSCOPIC TRAFFIC SIMULATION MODEL. HAGERTY, BR. MICHIGAN DEPT OF TRANSPORTATION LANSING MICH. 1985 FINAL REPO ENGLISH. REPORT NO: FHWA/MI/RD-85/01

USING SIMULATION TO INVESTIGATE MATHEMATICAL TRAFFIC FLOW RELATIONSHIPS. McLean, JR. Australian Road Research Board 500 Burwood Road Vermont South Victoria 3133 Australia 0 86910 127 7. 1983 pp 179-193 5 Fig. 1 Tab. 13 Ref.

TRAF-NETSIM TO EVALUATE THE EFFECTS OF DRAWBRIDGE OPENINGS ON ADJACENT SIGNALIZED SECTIONS. Yauch, P; Gray, J; Lewis, W. Institute of Transportation Engineers, ITE Journal, Vol. 58, No. 5, May pp 35-39.

TRANSYT FOR TRAFFIC SIGNAL OPTIMIZATION IN PARRAMATTA. Luk, JYK; Lowrie, PR; Sims, AG (New Wales Department of Main Roads,Australia). Australian Road Research Board 500 Burwood Road Vermont South 3133 Australia 0572-1431. 1982 pp 12-22 7 Fig. 5 Tab. 21 Ref.

G VOLUME-TO-CAPACITY RATIOS TO SUPPLEMENT DELAY AS CRITERIA FOR LEVELS OF SERVICE AT FFIC SIGNALS. Berry, DS. Transportation Research Board. Transportation Research Record N1112 1987 pp 23-28 7 Tab. 8 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW hington D.C. 20418

IDATION OF A TRAFFIC MODEL. Cronje, WB. Transportation Research Board. Transportation Research Record N1069 6 pp 73-79 6 Fig. 11 Tab. 6 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 nstitution Avenue, NW Washington D.C. 20418

RIABILITY ASSESSMENT FOR TRAF-NETSIM. Chang, G-L; Kanaan, A. American Society of Civil Engineers. Journal Transportation Engineering VOL. 116 NO. 5 Sep 1990 pp 636-657 Figs. Tabs. Refs. 3 App.. AVAILABLE FROM: merican Society of Civil Engineers 345 East 47th Street New York New York 10017-2398

ARIANCE REDUCTION APPLIED TO URBAN NETWORK TRAFFIC SIMULATION. Rathi-A.K.; Venigalla-M.M. Oak idge National Lab., TN. Department of Energy, Washington, DC. Sep 91. 31p.

EHICLES, PCUS AND TCUS IN TRAFFIC SIGNAL CALCULATIONS. Heydecker, BG (University College, London). Printerhall Limited. Traffic Engineering and Control VOL. 24 NO. 3 Mar 1983 pp 111-114 13 Ref.

VEHICULAR FUEL-CONSUMPTION MAPS AND PASSENGER VEHICLE FLEET PROJECTIONS. Santiago, AJ (Federal Highway Administration). Transportation Research Board. Transportation Research Record N901 1983 pp 5-11 7 Fig. 1 Tab. 8 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

VOLUME-DELAY RELATIONSHIP AT FOUR-WAY-STOP CONTROLLED INTERSECTIONS: A RESPONSE-SURFACE MODEL. Chan, Y; Flynn, LJ; Stocker, KJ. Institute of Transportation Engineers. ITE Journal VOL. 59 NO. 3 Mar 1989 pp 27-34 Figs. Tabs. 16 Ref.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

VTI TRAFFIC SIMULATION MODEL - A USER GUIDE. Bolling, A; Junghard, O. National Swedish Road & Traffic Research Institute Fack S-581 01 Linkoeping Sweden. 1987 48p Swedish. REPORT NO: VTI/MEDDELANDE-542. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

VTI TRAFFIC SIMULATION MODEL-REVISED USER GUIDE. Bolling, A; Junghard, O; Soerensen, G. National Swedish Road & Traffic Research Institute Fack S-581 01 Linkoeping Sweden. 1988 56p Swedish. REPORT NO: VTI/MEDDELANDE-580. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

VTI TRAFFIC SIMULATION MODEL. A PROGRAM FOR THE MONTE CARLO SIMULATION OF VEHICLE TRAFFIC ALONG TWO-LANE RURAL ROADS. AN APPLICATION OF JSP AND SIMULA -67 LANGUAGE. REVISED EDITION. Brodin, A. National Swedish Road & Traffic Research Institute. VTI Topics N322A 1983 Monograph 81p 1 Fig. 6 Ref.

WAITING TO CROSS A MAJOR STREAM AT AN UNCONTROLLED ROAD JUNCTION. Hurdle, VF; Hauser, E; Steuart, GN; Golias, JC. Toronto University Press Toronto Ontario Canada 0 8020 2461 0. 1983 pp 292-230 3 Fig. 16 Ref.

WARRANTS FOR INTERCONNECTION OF ISOLATED TRAFFIC SIGNALS. Chang-E.C.; Messer-C.J. Texas Transportation Inst., College Station. Texas State Dept. of Highways and Public Transportation, Austin. Transportation Planning Div. Federal Highway Administration, Austin, TX. Texas Div. TTI21880293, FHWATX86672931F. Aug 86. 77p.

WHAT'S NEW IN SIGNAL TIMING OPTIMIZATION MODELS?. Wilbur, AD. Institute of Transportation Engineers, ITE Journal VOL. 61 NO. 4 Apr 1991 pp 41-45 Figs. 1 Tab. Refs.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024-2729

WORK ZONE ANALYSIS MODEL FOR THE SIGNALIZED ARTERIAL. Joseph, CT; Radwan, E; Rouphail, NM. Transportation Research Board. Transportation Research Record N1194 1988 pp 112-119 4 Fig. 2 Tab. 4 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

APPENDIX V

REFERENCES AND ABSTRACTS

References and Abstracts of Traffic Models for Simulation, Operational Analysis, Signal Timing, Traffic Flow Theory, Capacity, System Control, Case Applications, Fuel Consumption, and Vehicle Emissions (Jan 1982 - Nov 1991 plus additional references for 1992)

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ferences and Abstracts of Traffic Models for Simulation, Operational alysis, Signal Timing, Traffic Flow Theory, Capacity, System Control, Case pplications, Fuel Consumption, and Vehicle Emissions (Jan 1982 - Nov 1991 us additional references for 1992)

BEHAVIORAL APPROACH TO RISK ESTIMATION OF REAR-END COLLISIONS AT SIGNALIZED INTERSECTIONS. hale!, D; Prashker, JN. Transportation Research Board. Transportation Research Record N1114 1987 pp 96-102. VAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 0418

A conceptual approach to estimating the risk of rear-end collisions at a signalized intersection is presented. It is argued that the creation of a large option zone increases the range of the indecision zone, the direction implication of which is an increase in the risk of rear-end collisions. With the aid of field data collected for two warning intervals (3 and 6 sec) before the red light, a large option zone is shown to increase the variance underlying the stopping probability curve, and thus to determine a larger range for the indecision zone. Data from urban intersections support the basic argument that a long warning period causes a significant increase in the number of rear-end collisions. This paper appeared in Transportation Research Record No. 1114, Traffic Control Devices and Rail-Highway Grade Crossings.

A COMPARISON OF ARTERIAL AND NETWORK SOFTWARE PROGRAMS. Sadegh, A; Radwan, AE; Mathias, JS. Institute of Transportation Engineers. ITE Journal VOL 57 NO. 8 Aug 1987 pp 35-39 Tabs. 2 Ref.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

An attempt is reported to identify available computer software pertinent to traffic signal timing of arterial and network systems and to conduct a comparative assessment of a selected group of programs. Currently available software was inventoried, and 18 software packages were chosen to be evaluated. Five preprocessors were evaluated and the results tabulated. The results of 12 network software programs are tabulated. Four popular and widely used software programs were thoroughly assessed and the results were compared with the NETSIM model. A comparative assessment was conducted on 6 programs to estimate the execution time on three types of computers (micro, mini, and mainframe). It is noted that the selection of one software program over another depends primarily on the user's specific needs.

A COMPARISON OF OBSERVED, ESTIMATED AND SIMULATED QUEUE LENGTHS AND DELAYS AT OVERSATURATED SIGNALIZED JUNCTIONS. Shawaly, EAA; Ashworth, R; Laurence, CJD. Printerhall Limited. Traffic Engineering and Control VOL. 29 NO. 12 Dec 1988 pp 637-642 Figs. Tabs.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London England

In this study, data collection at two selected approaches to signalized junctions has been performed in the urban area of the City of Sheffield, England, so as to check the validity of Catling's formulae and examine the limitation of their use. A video system has been used to collect the required data. The results showed a considerable variation in the departure patterns of vehicles crossing the stop-line during the peak hours not only during a particular peak period, but also on different dates. For this reason, a simulation technique has been used in order to supplement the collected data.

A COMPARISON OF TWO FREEWAY TRAFFIC SIMULATION MODELS. COHEN, S; ARON, M; PIERRELEE, J. RECHERCHE-TRANSPORTS-SECURITE N28 Dec 1990 PP 113-118 FRENCH

SIMON COHEN, MAURICE ARON, JEAN-CLAUDE PIERRELEE ILLUSTRATED INCLUDES BIBLIOGRAPHICAL REFERENCES

A COMPROMISED APPROACH TO OPTIMIZE TRAFFIC SIGNAL COORDINATION PROBLEMS DURING UNSATURATED CONDITIONS. Lan, C; Messer, C; Chaudhary, N; Chang, E., Texas Transportation Institute, Texas A&M University, College Station, Tx. Paper submitted for presentation at the 71st Annual Meeting of The Transportation Research Board, Washington, D.C.

In this paper, we present a methodology to optimize the traffic signal coordination problem on an arterial network simultaneously considering delay minimization and progression bandwidth maximization criteria. This approach generates a compromised solution to these two conflicting criteria and, sometimes, produces less-delay and less-bandwidth timing solutions compared to conventional MAXBAND solutions and sometimes the outcome is the reverse. In general, there is usually a trade-off between delay and bandwidth under the well-timed traffic signal system.

A CRITIQUE OF CURRENT URBAN ROAD APPRAISAL TECHNIQUES. CITIES AND ROADS. PAPERS FROM TRANSPORT 2000 SEMINAR, UNIVERSITY OF LONDON, 26 NOVEMBER 1985. Mogridge, MJH. Transport 2000 Limited Walkden House, 10 Melton Street London England. 1986 pp 39-40. AVAILABLE FROM: Transport 2000 Limited Walkden House, 10 Melton Street London England

Traffic models are of three basic types: (a) models which track each vehicle through a network in real time; (B) models which treat "packets" of vehicles in small time periods; and (c) models which apply steady state equilibrium relationships between speed and flow, (or delay and flow at junctions). The two models critically reviewed here, coba (cost benefit analysis) and stem (strategic transport evaluation model), are both of type c, which give different answers to types a and b for the same problem. (TRRL)

A DECENTRALIZED CONTROL STRATEGY FOR FREEWAY REGULATION. Goldstein, NB; Kumar, KSP (Minnesota University, Minneapolis). Pergamon Press Limited. Transportation Research. Part B: Methodological VOL. 16B NO. 4 1982 pp 279-290 8 Fig. 3 Tab. 19 Ref.

A multilevel decentralized control scheme, the cascading technique, with application to the regulation of traffic on an urban freeway is presented. Performance of the decentralized system is compared to the performance of a centralized and a fixed time control structure. It is shown that the decentralized structure performs better than the centralized structure when incidents (lane closures) occur on the freeway. The freeway is modeled in terms of the aggregate variables section density and section speed, and is considered as a system of interconnected subsystems. (Author/TRRL)

A DELAY MODEL FOR MULTIWAY STOP-SIGN INTERSECTIONS. Richardson, AJ. Transportation Research Board. Transportation Research Record N1112 1987 pp 107-114 8 Fig. 3 Tab. 11 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

A limited number of empirical studies have examined the capacity and delay characteristics of multiway stop signs, and some simulation studies have been reported, but no analytical models of delay at multiway stop signs are available in the published literature. The objective of the research reported in this paper, therefore, is the development of such an analytical model of delays experienced at multiway stop-sign intersections. The paper draws on previously reported empirical observations to provide values of critical input parameters, and uses these within the framework of an M/G/1 queuing model to predict delays. Delays at a multiway stop sign are shown to be the result of a set of complex interactions between the flows on all approaches to the intersection. It is shown that there are primary, secondary, and tertiary influences on the delays experienced on the approach; namely, the flow on that approach, the flows on conflicting approaches, and the flows on opposite approaches. In comparison with previously quoted results for multiway stop-sign intersections, the model shows good agreement in terms of capacities and levels of service for various demand splits. What the model adds, however, is the ability to predict levels of performance over a much wider range of operating conditions. This paper appeared in Transportation Research Record No. 1112, Highway Capacity and Flow Theory and Characteristics.

A MACROPARTICLE TRAFFIC SIMULATION MODEL TO INVESTIGATE PEAK-PERIOD COMMUTER DECISION DYNAMICS. CHANG, G; MAHMASSANI, HS; HERMAN, R. 1985 ENGLISH

BY GANG-LEN CHANG, HANI S. MAHMASSANI AND ROBERT HERMAN OTHER PHYS. DESCRIPTION: 42 LEAVES PAPER PRESENTED AT THE 1985 ANNUAL MEETING OF THE TRANSPORTATION RESEARCH BOARD, WASHINGTON, D.C INCLUDES BIBLIOGRAPHICAL REFERENCES

ACROSCOPIC MODEL FOR THE ANALYSIS OF TRAFFIC OPERATIONS ON RURAL HIGHWAYS. FINAL REPORT. nez, JC; Wingerd, L; May, AD. California University, Berkeley Institute of Transportation Studies, 109 McLaughlin Hall eley California 94720; California Department of Transportation P.O. Box 1499 Sacramento California 95807; Federal way Administration 400 7th Street, SW Washington D.C. 20590. Apr 1985 Final Rpt. 388p Figs. Tabs. Refs. 4 App.. PORT NO: FHWA-CA-TO-85-01. AVAILABLE FROM: California University, Berkeley Institute of Transportation Studies keley California 94720

This report presents the development of a macroscopic simulation model for the analysis of traffic operations over long sections of rural highways. The simulation model, RURAL2, is a deterministic model which calculates traffic performance on rural highways for a given supply (geometrics) and demand (traffic) information. Five types of subsections can be analyzed: freeway, divided and undivided multilane, two-lane, and passing lane sections. The model uses the procedures for capacity and level of service evaluation presented in the new Highway Capacity Manual. To perform the simulation, the roadway section must be divided into "homogeneous" subsection--i.e., subsections with uniform geometric and traffic characteristics. Subsection boundaries are established based upon changes in road geometrics and/or traffic demand characteristics. RURAL2 calculates traffic performance measures, such as average speed, travel time, vehicle delay, vehicle travel hours and vehicle travel miles. A subsection dependency logic has been incorporated to account for upstream dependency effects on downstream traffic performance. Data collected on several sites in California were used to calibrate and validate the simulation model. A cast-study using 40-mile section of California State Route 20 was conducted. The existing design configuration was evaluated and compared with three other design strategies. Conclusions were drawn regarding the location of highway improvements based on the simulation experiment results. Future areas of research have been identified. An appendix is included describing alternative methodologies to handle subsection dependency. A complete documentation of the simulation model is provided. (Author)

A MARTINGALE APPROACH TO ESTIMATION AND CONTROL OF TRAFFIC FLOW ON MOTORWAYS. Van Maarseveen, MFAM (Instituut Tno Voor Wiskunde, Informatieverwerking). Instituut TNO voor Wiskunde Informatieverwerking en Statistiek, Schoemakerstraat 97 Delft Netherlands. Oct 1982 Monograph 8p 5 Fig. 1 Tab. 11 Ref.

A stochastic continuous-time aggregate variable model which emphasizes the stochastic elements of traffic flow on motorways is presented. The model consists of a nonlinear dynamic system with a Martingale forcing term. The problem of estimating local traffic conditions from noisy disaggregate data (detector measurements) is discussed. Using results of abstract Martingale theory with respect to nonlinear optimal filtering for counting process observations a recursive estimation algorithm is obtained. The algorithm, which is very appropriate for use in automatic motorway control and surveillance systems, performs very well. Finally, the optimal control of traffic flow is discussed with an emphasis on speed control. (TRRL)

A METHODOLOGY FOR THE ASSESSMENT OF TRUCK LANE NEEDS IN THE TEXAS HIGHWAY NETWORK. FINAL REPORT. Mahmassani, HS; Walton, CM; Mouskos, K; Massimi, JJ; Levinton, I. Texas University, Austin Center for Transportation Research Austin Texas 78712; Texas State Department of Highways & Public Transp Transportation Planning Division, P.O. Box 5051 Austin Texas 78763; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Nov 1985 90p. REPORT NO: FHWA/TX-86/46+356-3F. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

Special truck lanes have been proposed as a measure for dealing with the increasing traffic of larger and heavier trucks on the Texas highway system. This report describes an integrated network modelling methodology for the study of truck lane needs in the Texas highway network. It consists of three major components: critical link programming, network traffic assignment, and optimal link selection/network design. The critical link programs allow the user to diagnose and assess the adequacy of the links in a highway network for handling excessive truck traffic under specified conditions. The traffic assignment model is essential for the prediction of link flow patterns and subsequent user costs calculation in response to particular changes in the network corresponding to truck-related link improvements. The assignment problem addressed here allows the asymmetric interaction between cars and trucks sharing the roadway in the determination of link travel times. The optimal link improvement selection problem is cast as a discrete network design problem with multiple improvement options per link. One of its main features is the definition of link improvement in terms of both lane addition (capacity expansion) and operating scheme (lane access restrictions to cars and trucks).

A MICROCOMPUTER-BASED SIMULATION PROGRAM FOR INTERSECTION SITES DURING RECONSTRUCTION. Michalopoulos, PG; Plum, R. Transportation Research Board. Transportation Research Record N1112 1987 pp 132-139 6 Fig. 1 Tab. 6 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

The problem of traffic control at intersections during reconstruction is addressed in this paper. This includes not only the appropriate type of control but also evaluation of the effects of geometrics on traffic operations. Evaluation of the alternatives is accomplished through microscopic simulation using an efficient microcomputer-based program specifically developed for this purpose. The program, which runs on the IBM PC, is interactive, menu driven, and has extensive graphic capabilities for easy data entry and better inspection and understanding of the results. It allows for simulation of four-way intersections or T-intersections controlled either by stop signs in all directions or by traffic signals. Because of the modeling used by the program, reliable results can be obtained in a short period of time. Input to the program is entered interactively and includes the number of lanes for each approach, the saturation flow rate for each lane, vehicle clearance times, and vehicle demands. In addition, when traffic signals are simulated, the phasing arrangement and signal timings are entered. Printed outputs for each lane include the number of vehicles serviced and statistics dealing with delays, stops, and queue sizes. In addition to the printed outputs, the program is capable of showing on a graphics screen the simulation of the intersection, including traffic signal indications, queue formation and dissipation, and vehicle arrivals and departures. Design tables and curves are developed for quick determination of the control policy and evaluation of is effectiveness. This paper appeared in Transportation Research Record No. 1112, Highway Capacity and Flow Theory and Characteristics.

A MICROCOMPUTER VERSION OF TRANSYT. Lines, CJ; Logie, M. PTRC Education and Research Services Limited. Planning & Transport Res & Comp, Sum Ann Mtg, Proc VOL. P249 1984 p 71. AVAILABLE FROM: PTRC Education and Research Services Limited 110 Strand London WC2 England

The TRANSYT method of coordinating traffic signals was conceived at TRRL in 1966 and has subsequently been extensively developed. Various versions of the program have been distributed to more than 300 users in over 40 countries. The method consists of a traffic model that predicts vehicle delay and stops, and an optimizer that systematically alters signal timings until a set are found that minimize a weighted sum of vehicle delay and stops. Until recently, the program has usually run on large mainframe computers. The past few years have seen a rapid growth in the numbers of microcomputers and now machines with 16 bit central processors have become available. These are sufficiently powerful to run large complex FORTRAN programs, so TRRL decided to place a contract with MVA Systematica to modify TRANSYT to run on a 16 bit microcomputer; the intention was to give more traffic engineers ready access to the program and, by making the program easier and more convenient to use, greatly encourage its use. The program was modified to run on an IBC personal computer with 256k bytes of memory and the additional IBM 8987 high speed arithmetic card. The modified TRANSYT program has all the features of the latest mainframe version 8 except that the maximum network that can be handled has been reduced to about 25 junctions and 100 links. Program running times have been kept as short as possible; a four junction 18 link network taking approximately nine minutes to optimize the signal timings. The program is available under license from TRRL. (TRRL) Microcomputer Applications in Developing Countries. Proceedings of Seminar F held at the 12th PTRC Summer Annual Meeting, University of Sussex, England, July 10-13, 1984. For the covering abstract of the seminar see IRRD 283731 (TRIS 458582).

A MODEL FOR SIMULATING TRAFFIC ON TWO- LANE RURAL ROADS: USER GUIDE AND MANUAL FOR TRARR VERSION 3.0. Hoban, CJ; Fawcett, GJ; Robinson, GK. Australian Road Research Board 500 Burwood Road Vermont South Victoria 3133 Australia 0313895X 0-86910-182-X. May 1985 Monograph 96p 23 Fig. 8 Tab. 23 Ref.. REPORT NO: ATM 10A

TRARR is a rural traffic simulation model developed at the Australian Road Research Board. The model can be used to investigate the effects on traffic operations of changes in either the road or traffic characteristics. TRARR has been used at ARRB on specific case studies requested by road authorities, and in general investigations of level of service and guidelines for rural road improvements. The model has also been provided to numerous organizations outside ARRB, many of them outside Australia. A new version, TRARR 3.0, has recently been released, with improved transportability and simplified user requirements. TRARR requires input data on the traffic stream, road characteristics, and what is to be observed and recorded. It then reviews the progress of each vehicle at frequent intervals as it moves along the simulated road. Decision rules for catching up, overtaking, merging and other aspects of behavior are largely determined by the vehicle/driver characteristics supplied in one of the input files. Many of these parameters have been derived from other ARRB research projects. Outputs include travel time, journey speed, bunching, overtaking and fuel consumption information, as well as plots and terminal graphics display. (Author/TRRL)

NATIONAL SURVEY OF SINGLE-POINT URBAN INTERCHANGES. INTERIM REPORT. Bonneson, JA; Messer, CJ. exas Transportation Institute Texas A&M University College Station Texas 77843; Texas State Department of Highways Public Transp Transportation Planning Division, P.O. Box 5051 Austin Texas 78763; Federal Highway Administration 400 h Street, SW Washington D.C. 20590. Mar 1989 62p 17 Fig. 3 Tab. 11 Ref. 1 App.. REPORT NO: FHWA/TX-88/1148-1; es Rept 1148-1. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 2161

Current trends in the design of diamond interchanges include several new configurations which are well suited to certain topographical and traffic demand constraints. Of these new types, it appears that the single-point urban interchange (SPUI) has generated the most interest. This interim report summarizes the research conducted during the first year of a three-year study. Specifically, the first year's research activity has focused on a field survey and evaluation of six SPUIs located in five states. The data collected during this field study were used to assess both the design and the operation of SPUIs. In this regard, selected design, operational, safety, structural, and economic issues have been presented and discussed in this report. Subsequent project reports will focus on an examination of SPUI capacity and delay based on analytic traffic models and field data. As a result of the survey and evaluation process, it appears that the SPUI is a viable alternative to other diamond interchange configurations in certain situations. It is adaptable to locations where right-of-way is limited and appears to operate efficiently under traditional NEMA 8-phase control. On the other hand, it does not appear to be well-suited to continuous frontage road situations because of capacity restrictions that result from an additional signal phase.

A NOTE ON THE NEGLECT OF THE DOPPLER EFFECT IN THE MODELLING OF TRAFFIC FLOW AS A LINE OF STATIONARY POINT SOURCES. Academic Press Incorporated, Limited. Journal of Sound and Vibration VOL. 85 NO. 3 Dec 1982 pp 442-444 4 Ref.

Many traffic noise prediction models consider that a line of stationary point sources emit the standard spectrum of a vehicle moving in a direction perpendicular to the line between observer and vehicle. In practice, however, most vehicles will have a velocity component towards the observer which will result in a changed noise spectrum because of the Doppler effect. A formula is derived to predict the influence of the steepness of the spectrum on the leg of a traffic flow. It is shown that the error caused by neglecting the Doppler effect is only 0.015db for a noise source with a speed of 100km/h. This error vanishes for a flat spectrum and for steep spectra with high levels. It appears that the Doppler effect can be neglected in traffic noise modelling. (TRRL)

A PERMITTED-MOVEMENT MODEL FOR TRANSYT-7F. Wallace, CE; White, FJ; Wilbur, AD. Transportation Research Board. Transportation Research Record N1112 1987 pp 45-51 2 Fig. 2 Tab. 18 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

The TRANSYT-7F program has become one of the most widely used tools for traffic flow analysis and traffic signal timing optimization in the United States and several other countries. Although the model is one of the most useful, it is currently limited to the modeling of protected or unopposed traffic movements. Permitted-only left-turn operations can be approximated by adjusting the maximum flow rate and delaying the start of the effective green phase, but it is the user's responsibility to determine the appropriate values of these parameters. Permitted plus protected operations cannot be modeled at all. A project to develop an algorithm that will allow the explicit modeling of opposed, permitted traffic movements is described. The model was calibrated with field data collected in the suburban areas in and around Washington, D.C., by personnel of the FHWA Office of Traffic Operations. The field data were analyzed using multiple regression to produce the model. In addition, explicit treatment of left-turn "sneakers" has also been developed. Development of both algorithms and their implementation in the TRANSYT-7F program is described. This paper appeared in Transportation Research Record No. 1112, Highway Capacity and Flow Theory and Characteristics.

A PROBABILISTIC APPROACH FOR DETERMINING THE CHANGE INTERVAL (DISCUSSION AND CLOSURE). Mahalel, D; Zaidel, D; Stein, H. Transportation Research Board. Transportation Research Record N1069 1986 pp 39-45 5 Fig. 27 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

> Determination of the change interval is a crucial step in signal timing. In the recommendations of the Institute of Traffic Engineers for determining the change interval, the length of the yellow light is so calculated that the "reasonable" driver can pass the stop line before the onset of the red light. Field data show that the normative, reasonable driver model fails empirically, particularly at low approach speeds. The common approach to determine the change interval fails to consider the possibility of rear-end accidents. It does not offer rational, empirical measures for evaluating the joint risk of right-angle and rear-end collisions for various durations of change intervals and for different combinations of yellow and red clearance intervals. A proposed alternative approach relies on the stopping probability function of traffic at the intersection approach. It is shown that the range of the indecision zone that can be inferred from the stopping probability function is related to the risk of rear-end accidents. Similarly, the stopping function and the speed distribution are related to the risk of right-angle collisions. Finally, it is demonstrated how the concepts of stopping probability function and indecision zone might be used in practice to determine the change interval. This paper appeared in Transportation Research Record N1069, Traffic Control Devices and Rail-Highway Crossings.

A PROGRESSION-BASED OPTIMIZATION MODEL IN TRANSYT-7F. Hadi, A. and Wallace, C.; Transportation Research Center, University of Florida, Gainesville, Fl. Transportation Research Board 71st Annual Meeting Preprint.

> The forward progression opportunities (PROS) concept has been developed as an alternative for design and evaluation of the arterial signal timing. The concept expands upon the maximal bandwidth approach by considering time-space progression opportunities that do not necessarily extend throughout the length of the route. This paper presents the implementation of the PROS concept for application on multiple arterials within networks, using TRANSYT-7F.

A PROPOSED ANALYTICAL TECHNIQUE FOR THE DESIGN AND ANALYSIS OF MAJOR FREEWAY WEAVING SECTIONS. FINAL REPORT. Cassidy, M; Chan, P; Robinson, B; May, AD. California University, Berkeley Institute of Transportation Studies, 109 McLaughlin Hall Berkeley California 94720; California Department of Transportation 1120 N Street Sacramento California 95814; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Jul 1990 316p Figs. Tabs. 37 Ref. 7 App.. REPORT NO: FHWACAUCBITSRR-90-16; UCB-ITS-RR-90-16. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

> Weaving occurs when merging traffic streams entering a freeway from an on-ramp cross over diverging traffic streams exiting the freeway via a nearby off-ramp. The intense lane-changing activity which typically occurs in weaving areas can create significant operational problems. Thus, weaving sections often represent bottleneck locations in urban freeway systems. The research documented in this report has sought to develop and calibrate a more reliable technique for evaluating weaving performance. Specifically, a procedure is proposed for the design and analysis of major weaving areas (a subset of all weaving configurations). Such weaving sections are often used at freeway to freeway interchanges. The proposed procedure predicts vehicle flow rates in critical regions within a weaving area as a function of prevailing traffic flow and geometric conditions. Predicted flows are then used to assess the capacity sufficiency and/or level of service of the subject weaving site. Such a methodology represents a more disaggregate approach to evaluating weaving operation than existing evaluation procedures. The proposed model was developed using large amounts of empirical and simulation data. Much of the research effort was directed toward identifying the traffic flow and geometric factors that influence the behavior of traffic streams operating at weaving locations. Results indicate that traffic behavior in weaving areas can generally be predicted.

A REASSESSMENT OF THE TRAFFIC SIGNAL CHANGE INTERVAL. Wortman, RH; Fox, TC. Transportation Research Board. Transportation Research Record N1069 1986 pp 62-68 7 Fig. 23 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

> Data from field studies of intersections in Arizona and information from the literature were used to make an in-depth examination of the traffic signal change interval. This examination included a review of the traditional concept and theory on which the determination of the change interval has been based and an evaluation of the applicability of this theory. The analysis of driver behavior and characteristics indicates that the majority of drivers do not conform to the model, which assumes a constant or uniform deceleration rate. In fact, the deceleration profile is related to

the approach speed. An analysis of the first vehicle to stop at an intersection and the last vehicle to clear the intersection was made based on the time from the intersection at the onset of the yellow interval. This analysis revealed that the time for the last vehicle to clear the intersection is more critical in the design of the yellow interval. It is concluded that a uniform 4-sec yellow interval would be acceptable. This paper appeared in Transportation Research Record N1069, Traffic Control Devices and Rail-Highway Crossings.

RELATIONSHIP BETWEEN VEHICLE DETECTOR OCCUPANCY AND DELAY AT SIGNAL-CONTROLLED JUNCTIONS. Young, CP. Printerhall Limited. Traffic Engineering and Control VOL. 29 NO. 3 Mar 1988 pp 131-134 Figs. 1 Tab. 2 Ref.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London England

A method is described of measuring system performance using vehicle occupancy data collected from inductive-loop vehicle detectors. It provides an effective replacement of the conventional numberplate survey. The factors involved are numerous and complex. The results presented here were obtained inter alia during the investigation of signal control strategies. It is believed that the conclusions lead to a useful and inexpensive method of comparing junction performance. At 3 junctions a linear relationship has been found between observed values of mean delay per vehicle and observed values of mean occupancy per vehicle per detector. This is subject to the proviso that there are enough vehicle detectors, appropriately placed in the traffic lanes approaching the junction. This conclusion is reinforced from a traffic simulation computer program. Proposals are given for detector layouts to enable comparisons to be made between various signal control strategies.

A REPORT ON THE USERS MANUAL FOR THE MICROCOMPUTER VERSION OF PASSER III-88. INTERIM REPORT. Fambro, DB; Chaudhary, NA; Messer, CJ; Garza, RU. Texas Transportation Institute Texas A&M University College Station Texas 77843; Texas State Department of Highways & Public Transp Transportation Planning Division, P.O. Box 5051 Austin Texas 78763; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Sep 1988 132p 22 Fig. 4 Tab. 8 Ref. 6 App.. REPORT NO: FHWA/TX-88/478-1; Res Rept 478-1. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

This report describes the User's Manual for the microcomputer version of PASSER III-88, a practical computer program designed to assist transportation engineering professionals in the analysis of pretimed or traffic-responsive, fixed-sequence signalized diamond interchanges. The program can evaluate existing or proposed signalization strategies, determine signalization strategies which minimize the average delay per vehicle, and calculate signal timing plans for interconnecting a series of interchanges along continuous one-way frontage roads. In addition, the program can evaluate the effectiveness of various geometric design alternatives, e.g., lane configurations, U-turn lanes, and channelization. The report describes procedures for installing the program on your microcomputer and use of the three interactive, user-friendly menus for data entry and editing, running the program, and managing input and output files. Coding instructions, output interpretation, and background information are described verbally and supplemented with examples from the program. Input and output from two example problems, an isolated interchange and a frontage road progressive system, are also included in the report. Several appendices provide additional information for advanced users of the program. Research study title: Operations and Design Applications Using PASSER III-85.

A REVIEW OF CANDIDATE FREEWAY-ARTERIAL CORRIDOR TRAFFIC MODELS. Van Aerde, M; Yagar, S; Ugge, A; Case, ER. Transportation Research Board. Transportation Research Record N1132 1987 pp 53-65 3 Tab. 45 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

In order to select a model for application in Ontario's freeway-arterial corridors, a review of potential candidates was performed. The criteria for evaluating suitable alternatives included the quality of the path selection technique, the ability to represent dynamic queuing effects, the accuracy and detail of the traffic flow model, and the resolution of the traffic signal representation on parallel arterials. The following models were initially considered: MACK, FREFLO, FRECON, INTRAS, TRAFFICQ, FREQ, CORQ, CORCON, SCOT, TRAFLO, DYNEV, CONTRAM, SATURN, and MICRO-ASSIGNMENT. On the basis of a literature review and a preliminary evaluation of fundamental requirements, some of these initial models were found to be clearly incompatible with the objective of modeling dynamic assignment and queuing in freeway-arterial corridors. Of the remaining models, which included FREQ, CORQ, TRAFLO, DYNEV, CONTRAM, and SATURN, none could fully satisfy all major criteria. However, it appeared that some could potentially be upgraded, given that a considerable amount of further development effort was applied. In this respect, CONTRAM and CORQ appeared most promising because of their superior queuing-based assignment techniques and their treatment of time varying queues and demands. This paper appeared in Transportation Research Record No. 1132, Freeway Management and Operations.

A REVIEW OF THE CHARACTERISTICS OF TRAFFIC FLOW FROM THE POINT OF VIEW OF PASSENGER TRAFFIC CONTROL. Cvetanovic, L. Ro Prometni Centar. Suvrement Promet VOL. 8 NO. 3 1986 pp 127-134 7 Ref. Serbian. AVAILABLE FROM: Ro Prometni Centar Cvijete Zuzoric 5 Zagreb Croatia Yugoslavia

The article discusses the macroscopic and microscopic characteristics of a traffic flow model. Based on the microscopic approach, it analyzes traffic flow behavior in a single lane with vehicles following one another, and, according to the behavior of pairs of vehicles, it presents a conclusion on the behavior of traffic flow in general. Based on the macroscopic approach, it analyzes traffic flow as a stationary phenomenon represented by general average speed, traffic density and intensity. (TRRL)

A ROAD CLASSIFICATION FOR USE IN TRAFFIC MODELLING. Phillips, G; Reeson, D (Local Government Operational Research Unit). Transport and Road Research Laboratory. TRRL Supplementary Report N763 1984 9p 4 Fig. 3 Tab. 7 Ref.. AVAILABLE FROM: Transport and Road Research Laboratory Old Wokingham Road Crowthorne RG11 6AU Berkshire England

Traffic flow characteristics vary substantially from site to site throughout the country. As a result, it is frequently useful to group sites into similar types. General information on each road type can then be used to help estimate traffic flow characteristics at a particular site of a given road type. This report describes a grouping of road sites that is objective and that broadly reflects the underlying mix of journey purposes giving rise to the traffic at the site. The classification is based on the availability of sample data on a weekday in August and a weekday in a neutral month such as May or October. The classification has found application in the DTP Coba method of economic evaluation of major road schemes. (Author/TRRL)

A SIMULATION MODEL FOR THE EVALUATION OF WEAVING CAPACITY. HIGHWAY CAPACITY AND LEVEL OF SERVICE. PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON HIGHWAY CAPACITY, KARLSRUHE, GERMANY, 24-27 JULY 1991. Nakamura, H; Kuwahara, M; Koshi, M. Balkema (AA) P.O. Box 1675 3000 BR Rotterdam Netherlands 90 5410 011 7. 1991 pp 259-270 14 Fig. 2 Tab. 9 Ref.. AVAILABLE FROM: Balkema (AA) Publishers Old Post Road Brookfield Vermont 05036

Statistical analyses of observed volumes are usually employed in order to estimate capacities of highway elements. Capacity of weaving sections, however, is affected by many variables such as four directions of flows and variety of lane configurations, and it is difficult to estimate capacity of weaving sections through statistical analysis based on observed capacity data for various geometries and flow conditions. It is therefore considered that the capacity value may be reproduced by the aggregation of individual driver behaviors. Using vehicle trajectory data obtained from observations on several weaving sections on urban expressways in the Tokyo area, such microscopic variables as spacings and relative speeds of weaving vehicles were analyzed. Based on these analyses, a simulation model which is intended to estimate weaving capacity was developed. Such maneuvers of weaving vehicles as lane changing and acceptable gap searching which affect capacity were particularly precisely modeled. The model was validated for two congested weaving sections of the Tokyo Metropolitan Expressway. Simulated values of capacities were found to fit well with the observed ones.

A SIMULATION STUDY OF ROAD IMPROVEMENT ALTERNATIVES FOR THE BRUCE HIGHWAY FROM CABBAGE TREE CREEK TO KOLAN RIVER. Cox, RL (Queensland Main Roads Department, Australia). Australian Road Research Board 500 Burwood Road Vermont South Victoria 3133 Australia 0 86910 127 7. 1983 pp 155-170 5 Fig. 2 Tab. 3 Phot. 2 Ref.

The experience of the Main Roads Department in Queensland with the traffic simulation model known as TRARR is described. Experience with data collection is detailed as well as simulation findings for a 42.6 km section of the Bruce Highway leading north from Bundaberg. The main findings relate to the staging of two of the road improvement alternatives, the degree of benefit provided by short lengths of auxiliary lane compared with that for longer lengths and the difference in traffic performance for each direction of travel. The problem of processing a long length of road in a single computer run is also detailed. The paper was presented in Session 5: Further Applications. (TRRL) Program and papers from Workshop on Rural Traffic Simulation, Vermont South, Victoria, June 2-3, 1983. The paper was presented in Session 5: Further Applications.

ECIAL PURPOSE PARALLEL COMPUTER FOR TRAFFIC SIMULATION. GROL, HJM; BAKKER, AF. SPORTATION RESEARCH BOARD NATIONAL RESEARCH WASHINGTON DC. Jan 1991 16 PP ENGLISH

H.J.M. VAN GROL, A.F. BAKKER PAPER NO. 910287 PREPARED FOR PRESENTATION AT THE 70TH ANNUAL MEETING OF THE TRANSPORTATION RESEARCH BOARD, WASHINGTON, D.C., JAN. 1991 INCLUDES BIBLIOGRAPHICAL REFERENCES TRANSPORTATION RESEARCH BOARD NATIONAL RESEARCH COUNCIL

JRVEY OF TRANSYT-7F APPLICATIONS. Wilbur, T. Printerhall Limited. Traffic Engineering and Control VOL. 26 NO. Oct 1985 pp 498-501 1 Fig. 7 Ref.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London England

The results are presented of a survey carried out by the Federal Highway Administration as part of the National Signal Timing Optimization Project (NSTOP) to obtain current information on the use of the TRANSYT-7F program in the USA as a tool to develop optimal signal timing plans. Information represented included where the project network was located, the number of intersections that were retimed, whether the intersections operated fixed time, semi-actuated or fully actuated. The survey was sent to approximately 300 individuals; sixty-nine users responded. Results are presented for Dallas, California, Pennsylvania, Missouri, Florida, Illinois and Michigan. Among the conclusions drawn from the survey are: local agencies are using the TRANSYT-7F program successfully and the optimized signal timing plans are resulting in improved traffic flow, fewer stops, less delay and reduced fuel consumption. Collecting and coding the large amount of input data required by TRANSYT-7F was the biggest problem encountered by most agencies, both in terms of cost and staff time. New microcomputer hardware and software should help to alleviate this problem.

A TIME-SERIES FORECAST OF AVERAGE DAILY TRAFFIC VOLUME. Benjamin, J. Pergamon Press Limited. Transportation Research. Part A: General VOL. 20A NO. 1 Jan 1986 pp 51-60 4 Fig. 3 Tab. 10 Ref.. AVAILABLE FROM: Pergamon Press Limited Headington Hill Hall Oxford OX3 0BW England

This paper presents a procedure for forecasting average daily traffic using a time-series analysis. The procedure assumes a logistic function to model traffic volume over a period of years. Model parameters are estimated using ordinary least-squares regression. The method was tested empirically. Model parameters were found to be significant for each of the three different thoroughfares. Further, time-series forecasts compared favorably to observed traffic and to interpolated forecasts for the same period. The method is simpler to use and more economical than the standard demand forecasting procedure and is recommended where land-use patterns are stable and only small modifications to the thoroughfare network are planned. (Author/TRRL)

A TRAFFIC FLOW MODEL WITH TIME DEPENDENT O-D PATTERNS. Vaughan, R; Hurdle, VF; Hauer, E (Newcastle University, Canada; Toronto University, Canada). VNU Science Press Bv P.O. Box 2073 Utrecht Netherlands 90-6764-008-5. 1984 pp 155-178 12 Fig. 7 Ref.

A myriad of trips, each with its own origin, destination, and departure time, interact on a network to produce an intricate pattern of traffic flows. The task of traffic flow theory is to weave a web of cause and effect which - given the triad of origin, destination, and departure time - can replicate the major features of what one would observe in reality. Traditionally, this theory has dealt with exceedingly simple origin-destination structures, a fact which may have limited its applicability. The aim of this paper is to remove this limitation. The building blocks of the broader theory are: a road which traffic may enter and leave at any point, a speed-flow relationship which may vary along the road and depends on the local capacity, and a description of the pattern of trip making by origin, destination, and departure time. We show that the reconstitution of the traffic flow pattern from these building blocks requires two equations: a 'local equation' which governs what happens in a small space-time neighborhood just as in the traditional theories, and a 'history equation' which supplies all the pertinent information about the evolution of the flow pattern which is needed to specify its future course. The use of these two equations is illustrated by a numerical example. (Author/TRRL) Papers presented during the Ninth International Symposium on Transportation and Traffic Theory held in Delft the Netherlands, 11-13 July 1984.

A TRAFFIC MODEL OF PLATOON AND SECONDARY FLOWS. RAUPHAIL, NM. ARCHIVES OF TRANSPORT QUARTERLY VOL. 2 NO. 2 1990 PP 85-97 ENGLISH

PRESENTS A METHODOLOGY FOR ESTIMATING THE EFFECT OF TRAFFIC SIGNAL COORDINATION ON DELAY AND LEVEL OF SERVICE AT SIGNALIZED INTERSECTIONS NAGUI M. RAUPHAIL ILLUSTRATED INCLUDES BIBLIOGRAPHICAL REFERENCES

A USERS GUIDE TO SIMPLE APPLICATIONS OF TRARR. Hoban, CJ. Australian Road Research Board 500 Burwood Road Vermont South Victoria 3133 Australia 0 86910 127 7. 1983 pp 49-90 17 Fig. 5 Tab. 13 Ref.

> TRARR is a rural traffic simulation model developed at the Australian Road Research Board, which is now available to users outside ARRB. A detailed manual has previously been published, and is available with the program in updated computer-readable form. This paper provides an introductory guide for those wishing to use the program for the first time. Instructions are given for setting up the simulation program and running it with standard input files. Further guidelines are presented for creating a file of road data and conducting a structured simulation experiment using different road improvement proposals and various traffic conditions. The interpretation and analysis of simulation results are also briefly discussed. The guide has been revised to take account of changes introduced in TRARR Version 2.3, and is available separately as ARRB Internal Report AIR 359-7A. (Author/TRRL) Program and papers from Workshop on Rural Traffic Simulation, Vermont South, Victoria, June 2-3, 1983. This paper was presented in Session 2: The TRARR Rural Traffic Simulation Model.

ACCOMMODATING TRANSIT IN TRANSYT. Yagar, S. Transportation Research Board. Transportation Research Record N1181 1988 pp 68-76 11 Fig. 1 Tab. 4 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

> Although the TRANSYT traffic model simulates transit vehicles in mixed traffic operation, it does not adequately consider the effects of bus or streetcar stops on the traveled roadway near signalized intersections. Specifically, it assumes that transit vehicles loading and unloading passengers do not delay other vehicles. This reduces the validity of TRANSYT evaluations for cycles in which buses stop at or very near signalized intersections. The overall TRANSYT predictions and optimizations for an average cycle will be seriously threatened if total bus or streetcar dwell time per hour is significant. Therefore, an alternative type of network formulation, which uses dummy nodes and dummy links with appropriate link costs, is proposed for modeling the effects of transit stops on intersection performance. Although it requires one dummy node and four or six dummy links for each transit stop that delays traffic, it significantly improves TRANSYT's realism for such operations. Parameters for these dummy links have been tested over a wide range, and a set of operational values is recommended. Flow profiles illustrating the need for the effects of the recommended formulation are presented in this paper. This paper appears in Transportation Research Record No. 1181, Urban Traffic Systems and Parking.

ACCURACY OF CAPACITY MODELS FOR PERMISSIVE LEFT TURNS FROM AN EXCLUSIVE LANE. SESSION 7. Schorr, SM; Jovanis, PP (Forensic Engineering Services, Pennsylvania; Northwestern University, Evanston). Institute of Transportation Engineers. Compendium of Technical Papers, 1984 pp 1-6 6 Tab. 7 Ref.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

> This research evaluated the accuracy of models of left turn capacities by comparing their estimates with actual field observations. In addition, the research explored the structure of selected capacity models through a series of parametric sensitivity analyses. These tests were intended to reveal those parameters which are most important in each left turn capacity model. Armed with this information, a traffic engineer will know which parameters need to be most accurately measured in the field to obtain reliable capacity estimates. The research concluded by discussing desirable attributes to left turn capacity estimation models. (Author) This paper was presented during the Institute of Transportation Engineers 54th Annual Meeting, San Francisco, California, September 23-27, 1984.

ACCURACY OF O-D ESTIMATES FROM TRAFFIC COUNTS. Lam, WHK; Lo, HP. Printerhall Limited. Traffic Engineering and Control VOL. 31 NO. 6 Jun 1990 pp 358-367 10 Fig. 7 Tab. 8 Ref.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London W1P 3PE England

> The model based on entropy maximization (EM) technique is the most commonly used method for the estimation of an origin-destination (O-D) matrix from traffic counts. However, the accuracy of this model has not yet been well defined. The paper examines how data information affects the EM model performance and estimates the effects of information variability on model accuracy. Empirical results from Shenzhen, a special economic zone in China, are presented. Finally, some important conclusions and suggestions have been drawn for possible improvements and applications of the EM model.

TIVE SIGNAL CONTROL AT ISOLATED INTERSECTIONS. Lin, FB; Vijayakumar, S. American Society of Civil eers. Journal of Transportation Engineering VOL. 114 NO. 5 Sep 1988 pp 555-573 Figs. Refs. 2 App.. AVAILABLE M: American Society of Civil Engineers 345 East 47th Street New York New York 10017

Discussed here are the issues and the research needs related to the development of adaptive control logic for application at isolated intersections. The paper focuses on the information needs for adaptive control, the selection between a binary choice process and a sequencing process for timing adjustment, and future research needs. To be widely applicable, an adaptive control logic needs a vehicle-monitoring system that can provide reliable information and facilitate simultaneous use of real time advance information.

DING SIGNALS TO COORDINATED TRAFFIC SIGNAL SYSTEMS. Machemehl-R.B.; Lee-C.E. Texas Univ. at Austin. ter for Transportation Research. Texas State Dept. of Highways and Public Transportation, Austin. Federal Highway ninistration, Austin, TX. Texas Div. FHWATX84232601F, Aug 83. 94p.

This study investigates the effect of adding or removing traffic signals within a coordinated, signal-controlled street network. The report includes a discussion of coordinated signal systems; arterial street network configurations; optimization of signal settings for progressive movements; simulation of traffic on street networks with specified off-peak vehicular volumes and different intersection control strategies; and analyses of statistical data resulting from the simulation of traffic on several representative street networks. A signal timing optimization program, PASSER II, was used to determine the signal timing patterns for each of twelve representative street networks that were operated under different control strategies. The computer program called NETSIM was then used to simulate traffic on the networks and produce statistics concerning the relative effectiveness of the various control schemes. A total of 98 different network cases were simulated by NETSIM.

DVANCES IN THE PC INTERFACE OF THE TRANSYT-7F TRAFFIC SIMULATION MODEL. LEONARD, JD; RECKER, WW. INSTITUTE OF TRANSPORTATION ENGINEERS MEETING 1989 PP 536-541 ENGLISH

JOHN D. LEONARD AND WILFRED W. RECKER ILLUSTRATED INSTITUTE OF TRANSPORTATION ENGINEERS MEETING COMPENDIUM OF TECHNICAL PAPERS

AN ANALYSIS OF FUEL CONSUMPTION MODELS. Moore, SE (Nairn (RJ) and Partners Proprietary Limited). Society of Automotive Engineers (Australasia) 191 Royal Parade Parkville Victoria 3052 Australia. May 1982 pp 1-13 19 Ref.. REPORT NO: Paper 6

This paper describes the requirements of fuel consumption models to be used by traffic and transportation engineers. These models are necessary for two broad areas; firstly for inclusion in traffic or transportation models and, secondly, for estimating fuel usage from traffic data collected as part of on-street surveys. The model selected by the traffic or transport engineer is simply a trade- off between the accuracy required for his particular purpose versus the cost he is prepared to pay for that accuracy. With particular regard to Australia, previous work in the area of fuel consumption/ traffic and transportation models is outlined. At this stage, it is considered that there is not a single model which meets all the requirements of traffic and transport engineers. Various forms of fuel consumption models, which best meet the requirements of traffic and transport engineers, are described and procedures for estimating these models are proposed. The basis for this estimation is a procedure in which a relationship between instantaneous fuel consumption and power is developed. Power is in turn related to instantaneous velocity and acceleration; also included is road gradient and "average fleet vehicle" mass and engine capacity (a). The paper was presented as Paper 6-Session 2-Fuel Consumption Modelling (1) (SAE 82136). The number of the covering abstract of the conference is TRIS no. 367871. (TRRL) Second Conference on Traffic, Energy and Emissions, Melbourne, May 1982. Program and Papers.

AN ANALYSIS OF THE CHARACTERISTICS AND CONGESTION IMPACTS OF TRUCK-INVOLVED FREEWAY ACCIDENTS. FINAL REPORT. Recker, WW; Golob, TF; Hsueh, C-W; Nohalty, P. California University, Irvine Institute of Transportation Studies Irvine California 92717; California Department of Transportation 1120 N Street Sacramento California 95814; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Dec 1988 174p Figs. Tabs. Refs. 3 App.. REPORT NO: FHWACAUCIITS-RR-88-2; F85T017. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

This report is concerned with the characteristics and consequences of over 9,000 truck-involved freeway accidents and non-accident incidents in a three-county case study region in Southern California. The research was conducted in two major phases: (1) identification of the number and type of truck-involved accidents occurring on freeways in the region, together with statistical analyses of the influence of a wide range of conditions on the frequency and severity of these accidents; and (2) estimation of the impact of these accidents on the freeway system in terms of congestion and delay, and estimation of the total annual economic costs of these accidents. Chapter Two reports the results of statistical analyses of the salient characteristics of over 9,000 truck-involved freeway accidents that occurred in the region during 1983-84. Chapter Three focuses on the immediate consequences of these accidents: accident severity (i.e., injuries and fatalities), incident duration, and lane closure. Chapter Four is an analysis of 424 major incidents involving large trucks on freeways in the region during 1983-85. Chapter Five focuses on the impacts of truck-involved mainline collisions on freeway congestion and delay; simulation models are used to estimate total delay attributable to such collisions for the 1987-88 period. Chapter Six focuses on the total economic costs of these accidents. We conclude that over 10 million vehicle hours, and 154.6 million dollars, may be lost each year due to truck-involved freeway accidents in the region.

AN APPROXIMATE ANALYSIS OF THE HYDRODYNAMIC THEORY ON TRAFFIC FLOW AND A FORMULATION OF A TRAFFIC SIMULATION MODEL. SASAKI, T; FUKUYAMA, M; NAMIKAWA, Y. VNU SCIENCE PRESS UTRECHT NETHERLANDS. 1984 PP 1-20 ENGLISH

TSUNA SASAKI, MASAHARU FUKUYAMA AND YOSHIHARU NAMIKAWA ILLUSTRATED INCLUDES BIBLIOGRAPHICAL REFERENCES NOTE: SOURCE IS MONOGRAPHIC, NOT A SERIES INTERNATIONAL SYMPOSIUM ON TRANSPORTATION AND TRAFFIC THEORY 9TH : 1984 : DELFT, NETHERLANDS PROCEEDINGS OF THE NINTH INTERNATIONAL SYMPOSIUM ON TRANSPORTATION AND TRAFFIC THEORY, DELFT, THE NETHERLANDS, 11-13 JULY 1984

AN EVALUATION OF LEFT-TURN ANALYSIS PROCEDURES. Machemehl, RB. Institute of Transportation Engineers. ITE Journal VOL 56 NO. 11 Nov 1986 pp 37-41 Figs. 1 Tab. 13 Ref.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

A summary is presented of the efforts and conclusions developed in a study which included a review of available left-turn analysis procedures, comparative evaluation of several methods, and field testing of one technique. Existing analysis methods are noted, and guidance provided by the Australian Road Capacity Guide and the 1965 Highway Capacity Manual method are discussed. The Texas Model, a microscopic traffic simulation package used to develop a set of left-turn analysis procedures, is described. An analysis procedure based on this model is compared with the 1985 Highway Capacity Manual. Particular reference is made to single-lane approaches without turn bays or phases, and to single- and multiple-lane approaches with turn bays.

AN EVALUATION OF SIGNAL TIMING AND COORDINATION PROCEDURES VOLUME I: TECHNICAL REPORT; VOLUME II: FIELD MANUAL. Arnold, ED, Jr. Virginia Highway & Transportation Research Council P.O. Box 3817, University Station Charlottesville Virginia 22903; Virginia Department of Highways and Transportation 1221 East Broad Street Richmond Virginia 23219 Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Aug 1985 Final Rpt. v.p. Figs. Tabs. 13 Ref. 3 App.. REPORT NO: FHWA-VA-86-08-09; VHTRC 86-R8, Vol. I. AVAILABLE FROM: Virginia Highway & Transportation Research Council P.O. Box 3817, University Station Charlottesville Virginia 22903

Based on a review of available literature, recommended procedures for timing the various types of signals are provided. Specifically, procedures are included for both pretimed and vehicle-actuated controllers located at isolated intersections and at intersections in a signal system. Simplicity and ease of use are emphasized as the targeted users are field technicians and those responsible for signals in small cities and towns. A separate Field Manual has been prepared which is intended to provide a concise and easily applied set of procedures. Detailed theory and logic behind the procedures are provided in the Technical Report, as are brief descriptions of current computer programs which provide timing information. The Technical Report also presents the results of a questionnaire survey which had the objective of determining the types of signal equipment used in Virginia. (Author)

AN EXTENDED TRAFFIC MODEL FOR FREEWAY CONTROL. Cremer, M; May, AD. STUDIES. ITS RESEARCH REPORT NUCB- May 1985 78P. REPORT NO: ITS-RR

This report presents a basic nonlinear invariant model for simulating motorway traffic flow, and extends it to show more realistic behavior at bottlenecks. Section i lists seven different reasons for developing mathematical models of road traffic flow, and briefly discusses some earlier models. Section II formulates the basic model, presenting and interpreting its equations in terms of their physical meaning; the model is given in a discrete form, to adapt it for running on digital computers. The model covers the whole range of traffic conditions from free flow to heavy congestion. Section III analyses the defects of the basic model, and develops an extended model able to cope with traffic bottlenecks caused by changes in the number of lanes in a highway and by merging of on-ramp flows. Section IV shows how to calibrate the parameters of the extended model to achieve optimal agreement with observed traffic flows. It then uses the calibrated model for a quantitative comparison between the model's performance and the real road traffic flow phenomena, and for evaluating its accuracy. Section v presents some conclusions: there was good agreement between theory and observations, and the bottleneck phenomena were modelled fairly realistically. Future work should include tests of the extended model with more data sets from different traffic situations and different sections of intercity motorways. Appendix a gives a sample of motorway measurement data, and appendix b gives a FORTRAN program listing of the simulation model.

NTERACTIVE SIMULATION PROGRAM FOR INTERSECTION DESIGN AND OPERATIONAL ANALYSIS. FINAL ORT. Plum, R; Michalopoulos, P; Yuan, B. Minnesota University, Minneapolis Department of Civil and Mineral neering Minneapolis Minnesota 55455-0220; Minnesota Department of Transportation Materials and Research ratory, 1400 Gervais Avenue Maplewood Minnesota 55109. Jun 1990 114p 20 Fig. 3 Tab. 19 Ref. 1 App.. REPORT MN/RC-91/07; 9RD0004. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield nia 22161

A microscopic, stochastic model for intersection design and traffic flow analysis is presented in this report. A simulation program, INTERSIM, based on this modeling, is developed. The INTERSIM program can be used to evaluate alternative control schemes and geometric configurations. INTERIM can also assist in solving traffic operation and management problems, e.g., determining optimum signal phasing and timing of intersections via an iterative process. The most common situations encountered in practice are examined. These include: four-way and T-intersections with up to three lanes on each approach; stop sign control; signal control (fixed time or vehicle actuated) with various phasing schemes; detector placement and functions, multi-use lanes; protected and permissive left-turn movements; and right turns on red, among others. The proposed modeling applies to both over-saturated and under-saturated traffic conditions. INTERSIM is superior to the other intersection simulation programs due to its ease of operation and fast execution speed.

N OVERVIEW OF THE PHAROS TRAFFIC SIMULATOR. REECE, D; SHAFER, SA. VAN GORCUM. ROAD USER EHAVIOR : THEORY AND PRACTICE 1988 PP 285-293 ENGLISH

DOUGLAS REECE AND STEVE SHAFER ILLUSTRATED BIBLIOGRAPHY: P. 293 NOTE: SOURCE IS MONOGRAPHIC, NOT A SERIES

ANALYSIS OF EXISTING FORMULAS FOR DELAY, OVERFLOW, AND STOPS. Cronje, WB (Stellenbosch University, South Africa). Transportation Research Board. Transportation Research Record N905 1983 pp 89-93 2 Fig. 3 Tab. 6 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

An analysis is made of existing formulas for average delay, average overflow, and average number of stops for undersaturated conditions. The examination of these formulas covers a large variation in flows and cycle lengths, so recommendations are based on a thorough examination. The formulas examined are those developed by Webster, Miller, and Newell. It is concluded that the Newell formulas give the most accurate results. (Author) This paper appeared in Transportation Research Record No. 905, Traffic Flow, Capacity, and Measurements.

ANALYSIS OF FREEWAY RECONSTRUCTION ALTERNATIVES USING TRAFFIC SIMULATION. Cohen, SL; Clark, J. Transportation Research Board. Transportation Research Record N1132 1987 pp 8-13 8 Fig. 2 Tab. 8 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

Methods for evaluating traffic operations improvements for freeway reconstruction alternatives are discussed. It is asserted that traffic simulation provides a better approach to such analyses than the traditional Highway Capacity Manual (HCM). Several traffic simulation models are described. An application involving a congressionally mandated study of capacity improvements for a bridge in the Washington, D.C., area is described, for which the INTRAS freeway simulation model was chosen as the analysis tool. Required modifications to the INTRAS model and calibration and validation activities are described. In conclusion there is a description of the simulation experiment of the existing eastbound condition and five alternatives and the existing westbound condition and one alternative. The most interesting finding in this study was that an expansion of the eastbound span from three to five lanes performed no better than did several four-lane alternatives. This paper appeared in Transportation Research Record No. 1132, Freeway Management and Operations.

ANALYSIS OF REDUCED-DELAY OPTIMIZATION AND OTHER ENHANCEMENTS TO PASSER 2-80 - PASSER 2-84. Final Report. Research rept. Mar-Aug 83. Chang-E.C.; Messer-C.J.; Marsden-B.G. Texas Transportation Inst., College Station. Federal Highway Administration, Austin, TX. Texas Div. Texas State Dept. of Highways and Public Transportation, Austin. TTI218833751F, FHWATX84503751F. Apr 84. 129p.

The report represents the development and findings of a research project. The brief six-month research effort was directed toward several topic areas which included: development of a practical procedure which could be used to fine-tune the offsets of traffic signals to minimize total delay and maximize progression of traffic in a progression system, development of methods that can better estimate delay to travel in a nearly saturated traffic system, and development of methods to estimate fuel consumption associated with arterial travel movements in an urban network. An enhanced version of the popularly used PASSER II program - PASSER II-84, which deals with the design and operation of signalized intersections, was programmed on SDHPT's computer system. Program documentation and revised data coding instructions were also prepared.

ANALYSIS OF THE PROPOSED USE OF DELAY-BASED LEVELS OF SERVICE AT SIGNALIZED INTERSECTIONS. Berry, DS; Pfefer, RC. Transportation Research Board. Transportation Research Record N1091 1986 p 78-86 2 Fig. 16 Tab. 1 Ref. 1 App.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

Stopped delay calculations were made for many combinations of cycle length, ratio of effective green time to cycle length (g/C ratio), and quality of signal progression, to aid in the following: identifying the relationships between computed delay and volume-to-capacity (v/c) ratio for lane groups at signalized intersections; determining how to solve for v/c ratio and service flow rate when the desired level-of-service (LOS) delay value is known; examining methods for using the delay-based LOSs in intersection design, both geometrics and signal timing. Sensitivity analyses reveal that many combinations of long cycle lengths, low g/C ratios, and adverse progression result in such high delays that LOS levels of A, B, and C are unattainable, even at low v/c ratios. Computer-generated tabulations are proposed to aid in solving for v/c ratios and maximum flow rates associated with desired delay-based LOSs. This paper appeared in Transportation Research Record N1091, Traffic Flow Theory, Characteristics, and Highway Capacity.

ANNUAL TRANSPORTATION CONVENTION, 29 JULY-2 AUGUST 1985. SESSION: OPERATION AND UTILIZATION OF ROADS AND STREETS 2. Council for Scientific & Industrial Res S Africa P.O. Box 395 Pretoria South Africa 0-7988-3576-1. Aug 1985 163p. REPORT NO: CSIR-S-350-VOL-7-TO. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

Contents: International European road traffic signing system trends; Traffic flow and delay warrants for the operation of traffic control signals at isolated intersections; The ORMET signposting demonstration project; Objectives and procedures of metropolitan traffic counting; NETFLO: A new tool for traffic network analysis; The apparent effect of buses on traffic flow rates on 2-Lane approaches to intersections; Ramp control: A case study; The traffic control of the Department of Transport access interchanges; Controlling access on arterials. Text in English with one article in Afrikaans. See also Volume 6-MO, PB88-138672, and Volume 9-WR, PB88-138656.

ANTICIPATORY TRAFFIC MODELING AND ROUTE GUIDANCE IN INTELLIGENT VEHICLE-HIGHWAY SYSTEMS. KAUFMAN, DE; SMITH, RL; LEE, J. UNIVERSITY OF MICHIGAN TRANSPORTATION RESEARCH. IVHS TECHNICAL REPORT ; N90-2 Feb 1990 ENGLISH

DAVID E. KAUFMAN, JAMES LEE, ROBERT L. SMITH OTHER PHYS. DESCRIPTION: 14 LEAVES ILLUSTRATED FEBRUARY 1990 INCLUDES BIBLIOGRAPHICAL REFERENCES LEAF 14 ADDL CORP. AUTHOR INFO: UNIVERSITY OF MICHIGAN. TRANSPORTATION RESEARCH INSTITUTE UNIVERSITY OF MICHIGAN TRANSPORTATION RESEARCH INSTITUTE

ATORY TRAFFIC MODELING AND ROUTE GUIDANCE: A GENERAL MATHEMATICAL FORMULATION. TUNE, S. UNIVERSITY OF MICHIGAN TRANSPORTATION RESEARCH. IVHS TECHNICAL REPORT ; N90-6 Sep NGLISH

STEPHANE LAFORTUNE OTHER PHYS. DESCRIPTION: 5 LEAVES ILLUSTRATED SEPTEMBER 1990 ADDL CORP. AUTHOR INFO: UNIVERSITY OF MICHIGAN. TRANSPORTATION RESEARCH INSTITUTE UNIVERSITY OF MICHIGAN TRANSPORTATION RESEARCH INSTITUTE

CATION OF TRANSYT-7F IN CHINA. Wong, SY. Institute of Transportation Engineers. ITE Journal VOL. 58 NO. 8 988 pp 38-42 Figs. Tabs. Refs.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, 410 Washington D.C. 20024

The process and results are described of developing signal timing plans using TRANSYT-7F in Shenzhen, China. The details are described of the signal timing plan development process including the link-mode diagram development, data collection, input coding, model calibration, cycle selection, optimization, and fine tuning. The results from the before and after TRANSYT runs are tabulated. The floating car method was used to conduct before and after field studies. The results show that total travel time decreased 5%, total number of stops decreased 7%, total delay decreased 12%. TRANSYT -7F was proved a viable tool in developing signal timing.

LICATION GUIDE FOR THE MICROCOMPUTER VERSION OF PASSER III-88. INTERIM REPORT (REVISED). bro, DB; Bonneson, JA. Texas Transportation Institute Texas A&M University College Station Texas 77843; Texas State partment of Highways & Public Transp Transportation Planning Division, P.O. Box 5051 Austin Texas 78763; Federal hway Administration 400 7th Street, SW Washington D.C. 20590. Apr 1990 68p 33 Fig. 4 Tab. 17 Ref. 1 App.. REPORT : FHWA/TX-90/478-2F; Res Rept 478-2F. AVAILABLE FROM: National Technical Information Service 5285 Port Royal ad Springfield Virginia 22161

This report describes the Applications Guide for the microcomputer version of PASSER III-88, a practical computer program designed to assist transportation engineering professionals in the analysis of pretimed or traffic-responsive, fixed-sequence signalized diamond interchanges. The program can evaluate existing or proposed signalization strategies, determine signalization strategies which minimize the average delay per vehicle, and calculate signal timing plans for interconnecting a series of interchanges along continuous one-way frontage roads. In addition, the program can evaluate the effectiveness of various geometric design alternatives, e.g., lane configurations, U-turn lanes, and channelization. The report describes procedures for applying the program to "real world" diamond interchange operational problems. Procedures for evaluating existing conditions; optimizing phase sequences, green splits, offsets, and cycle lengths; and converting the program's output to controller settings are presented. These procedures provide a consistent approach to diamond interchange analysis. Application of these procedures in conjunction with PASSER III-88 will enable users to evaluate a greater number of alternatives and be more confident in the efficiency of the resultant solution. Research study title: Operations and Design Applications Using PASSER III-85.

APPLICATION OF SIMULATION TO EVALUATE THE OPERATION OF MAJOR FREEWAY WEAVING SECTIONS. Skabardonis, A; Cassidy, M; May, AD; Cohen, S. Transportation Research Board. Transportation Research Record N1225 1989 pp 91-98 8 Fig. 14 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

This paper describes the findings from the application of the INTRAS microscopic simulation model to evaluate the traffic performance at major freeway weaving sections. The work performed is part of an ongoing research project to develop improved weaving analysis procedures that are particularly applicable to California conditions. The INTRAS model was modified to predict the speeds of weaving and nonweaving vehicles and applied on eight major freeway weaving sections for a range of traffic conditions at each site. Good agreement was obtained between the measured and predicted values. Comparisons with speeds estimated from existing analytical procedures indicated that INTRAS predictions are considerably closer to the field measurements. The potential of the model to predict the capacity and level of service at weaving areas was also investigated. The model produced consistent results on the data sets tested, indicating that it may be used in conjunction with field measurements to develop improved methodologies for the design and analysis of freeway weaving sections. Future steps in this direction are discussed. This paper appears in Transportation Research Record No. 1225, Highway Capacity, Flow Measurement, and Theory.

APPRAISAL OF EIGHT SMALL AREA TRAFFIC MANAGEMENT MODELS. Australian Road Research Board. Australian Road Research VOL. 13 NO. 1 Mar 1983 pp 25-33 7 Tab. 49 Ref.

Eight small area traffic management packages or models are selected for appraisal. These models are useful for predicting the impact of traffic control measures before implementation. These measures include street closure, turn bans, priority junctions, one-way street systems, traffic signals and roundabouts. Packages for freeway analysis are not included in this study. The criteria adopted in the appraisal are the level of detail, possible applications and validations, assignment algorithms adopted, computational requirements and documentation. Saturn was found to be an "all rounder" with a theoretically sound assignment method, an accurate simulation of traffic progression and the capacity for modelling a variety of control measures. However, an overseas model such as Saturn has built-in parameters which may not be suitable for local Australian traffic operations. Traffic models suitable for local conditions should therefore be considered wherever appropriate. (Author/TRRL)

APPRAISAL OF TRAFFIC STREAM FRICTION. Mahalel, D (Technion-Israel Institute of Technology). Pergamon Press Limited. Transportation Research. Part A: General VOL. 18A NO. 3 May 1984 pp 225-230 6 Fig. 13 Ref.

This paper presents a simulation model to evaluate the quality of traffic flow. The evaluation is based on counts of the number of potential speed changes on a stretch of road and the estimated number of times a vehicle is limited in changing lanes. In order to describe the behavior of the traffic flow process, two models were developed. One model describes vehicle arrival patterns on a road cross section; the other model, vehicle speeds. The stochastic process of speed is described as an autoregression process, whereas vehicle arrivals are presented as a markovian process. Simulation results indicate an increase in traffic stream friction with an increase in vehicle-speed standard deviation and a reduction in average speed. The dependence of vehicle arrivals in adjacent lanes seems to increase the amount of friction in each lane. The simulation model developed enables a comparison of the quality of traffic flow at different sites, as well as a before-and-after study of any particular site. (Author/TRRL)

ARCADY2 AND PICADY2: ENHANCED VERSIONS OF TRRL PROGRAMS FOR USE IN JUNCTION DESIGN. Semmens, MC; Taylor, ME (Transport and Road Research Laboratory). Printerhall Limited. Traffic Engineering and Control VOL. 26 NO. 5 May 1985 pp 271-272 2 Ref.

This article briefly describes additional traffic engineering facilities which have been incorporated into two traffic modelling computer programs used to predict capacities and delays at junctions and roundabouts. The programs are ARCADY (assessment of roundabout capacity and delay) and PICADY (priority intersection capacity and delay). These programs are well-established aids in junction design and assessment. They are used primarily for modelling peak periods. See also IRRD nos 251410, 251411 and 273533. (TRRL)

ARCADY2: AN ENHANCED PROGRAM TO MODEL CAPACITIES, QUEUES AND DELAYS AT ROUNDABOUTS. RESEARCH REPORT. Semmens, MC. Transport and Road Research Laboratory Old Wokingham Road Crowthorne RG11 6AU Berkshire England 0266-5247. 1985 31p Figs. Tabs. Refs.. REPORT NO: RR 35. AVAILABLE FROM: Transport and Road Research Laboratory Old Wokingham Road Crowthorne RG11 6AU Berkshire England

An enhanced version of ARCADY, a computer program which models capacities, queues and delays at all types of single-island roundabouts, is described. The program uses empirical formulae to calculate entry capacities, and time-dependent queuing equations for queue and delay calculations. The enhancements include facilities to predict geometric delays and accident frequencies and to include the effects of pedestrian (zebra) crossings adjacent to the junction; these are provided using the results of recent empirical and analytical studies. Additionally, the flexibility of the program (now known as ARCADY2) has been increased, with the availability of micro-computer and interactive versions. User inputs consist of various geometric characteristics of the roundabout, and traffic (and pedestrian) demand flow information (which may be specified in a number of ways). Peak periods are normally modelled and capacities, queues and delays are calculated for each entry for each of a succession of short time segments (usually 10 or 15 minutes) within the period. The user is therefore able to assess the performance of both planned and existing roundabout designs, in terms of queuing delay, geometric delay and safety. Details of the required input parameters are given, the output is described and a full example is included. (Author/TRRL)

COM: MODELS FOR ESTIMATING LIGHT TO HEAVY VEHICLE FUEL CONSUMPTION. Biggs, DC. AUSTRALIAN D RESEARCH BOARD. RESEARCH REPORT NARR Sep 1988 61P. REPORT NO: 152

A model, known as arfcom, is described for estimating the fuel consumption of vehicles ranging from cars to 40 tonne articulated trucks. Arfcom contains three forms of fuel consumption model (instantaneous, four mode elemental and running speed) which use vehicle speed data ranging from second by second to average travel speeds. Arfcom is a detailed power based model which is capable of estimating the fuel consumption due to speed changes induced by curvature, grade or traffic control devices and due to the extra power required to overcome grade and cornering resistance. Expressions and/or tables are given for calculating the power components and default vehicle parameters from a small number of easily observable parameters. The model and the default parameters are validated using data from a number of sources. The limited input data requirements, accuracy at a trip and driving mode level and the three forms of fuel model make arfcom suitable for use in the areas of rural and urban traffic and transport management. Use of the model in conjunction with traffic models in rural and urban applications is discussed and examples of the use of arfcom are given. Vehicle parameters for ten vehicle classes and typical proportions of vehicles kilometres of travel in each class are given (a). The isbn of the microfiche version is 0-86910-354-7.

RTERIAL ANALYSIS PACKAGE (AAP) USER'S MANUAL. Courage, KG; Wallace, CE; Reaves, DP. Florida University, inesville Transportation Research Center Gainesville Florida 32611; Federal Highway Administration Office of Research d Development, 400 7th Street, SW Washington D.C. 20590. Nov 1986 311p. REPORT NO: FHWA-IP-86-001; FCP 209-16. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

The Arterial Analysis Package (AAP) combines three of the most popular traffic signal timing optimization and traffic flow analysis models into a single package. The separate programs that have been integrated into the AAP are: SOAP, an isolated intersection model; PASSER II, an arterial bandwidth model; and TRANSYT, a sophisticated macroscopic simulation and system optimization model. The AAP has the advantage of allowing the traffic engineer or analyst direct access to all three of these programs using simple, unified inputs and outputs. Thus designs can be based on either maximizing the bandwidth or minimizing stops, delay and fuel consumption by coding one input data file and simply selecting the appropriate component program. The AAP contains microcomputer based input processors that further simplify the input coding process. The AAP operates in both mainframe and microcomputer environments.

ARTERIAL PRIORITY OPTION FOR THE TRANSYT-7F TRAFFIC-SIGNAL-TIMING PROGRAM. Moskaluk, MJ; Parsonson, PS. Transportation Research Board. Transportation Research Record N1181 1988 pp 57-60 2 Fig. 2 Tab. 2 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

The objective of this research was to modify TRANSYT-7F so that arterial priority can be increased and minor-movement performance degradation can be controlled. The product is known as TRANSYT-7F with Arterial Priority Option (APO). TRANSYT-7F "globally" minimizes overall stops and delay to all vehicles. This is satisfactory for a grid network on which good traffic performance is desired equally for every street. However, it is unsatisfactory for arterials on which progression for the through movement typically is considered much more important than minimizing stops and delay for left-turning and side-street motorists. In the United States, TRANSYT-7F is widely perceived as unsatisfactory for arterial signal timing. TRANSYT-7F with APO modifies the iterative-search process to give priority to the arterial. APO changes the optimization process, not the traffic flow model. In general, the user specifies which links are to receive priority and the degree of saturation for the minor movements (nonpriority links). The performance index (PI) equation is formulated to minimize stops and delay for only the priority links. The degree of saturation specified by the user for the minor movements is used to control the performance degradation to acceptable levels. The results of a program run may be used to make changes to the list of priority links and to the required degree of saturation of one or more nonpriority links on the basis of the engineer's judgment. APO is thus user interactive; the engineer retains control over the optimization and can tailor it to local conditions. This paper appears in Transportation Research Record No. 1181, Urban Traffic Systems and Parking.

ARTERIAL PRIORITY OPTION FOR THE TRANSYT-7F TRAFFIC-SIGNAL-TIMING PROGRAM. MOSKALUK, J; PARSONSON, PS. NATIONAL RESEARCH COUNCIL TRANSPORTATION RESEARCH WASHINGTON DC. 1988 27 pp ENGLISH

BY M. JOHN MOSKALUK AND PETER S. PARSONSON ILL., CHART COVER TITLE PAPER PRESENTED AT THE 1988 ANNUAL MEETING OF THE TRANSPORTATION RESEARCH BOARD, WASHINGTON, D.C ADDL CORP. AUTHOR INFO: NATIONAL RESEARCH COUNCIL U.S.. TRANSPORTATION RESEARCH BOARD NATIONAL RESEARCH COUNCIL TRANSPORTATION RESEARCH BOARD

ARTERIAL PROGRESSION--NEW DESIGN APPROACH. Wallace, CE; Courage, KG (Florida University, Gainesville). Transportation Research Board. Transportation Research Record N881 1982 pp 53-59 4 Fig. 2 Tab. 9 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

This paper proposes a new approach for the design of traffic signal timings to coordinate the progression of traffic on arterial highways. The two most popular signal optimization policies in use today are the maximal bandwidth approach and the minimum delay and stops approach. The new approach is proposed as a measure of the quality of progression perceived by the driver. It deals with progression opportunities (PROS), and the policy is to maximize the number of PROS available on an arterial signal system. It differs from the maximal bandwidth approach by considering progression opportunities that occur outside the traditional through progression band. Arterial progression design based on this approach will usually show decreased stops and delay compared with the maximal bandwidth design without suffering the loss of perceived progression associated with direct minimization of stops and delay. The number of progression opportunities presented to the driver at any point in time is, by definition, the number of successive green signals that will be encountered at the design speed without stopping. (Author) This paper appeared in Transportation Research Record No. 881, Traffic Control Devices and Traffic Signal Systems.

ARTERIAL SIGNAL TIMING OPTIMIZATION USING PASSER II-87. Chang, ECP; Messer, CJ; Garzia, RU. Institute of Transportation Engineers. ITE Journal VOL 58 NO. 11 Nov 1988 pp 27-31 Figs. 3 Ref.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

The article describes program features of PASSER II-87, its program implementation, and left-turn signal treatments. PASSER II-87 (version 1.0) facilitates arterial signal design and capacity evaluation. Improvements were made to the analysis, interpretation and understanding of it for improving both arterial street and individual intersection analysis. The new system has many advantages over the existing PASSER II-84 program. It provides a user-friendly, menu interface, full-screen cursor movement, and accepts all the existing coded PASSER II-84 data without requiring user modifications. PASSER II-87 provides the graphical traffic input and the assistant function to help users with capacity analysis procedures described in the Highway Capacity Manual. The system can analyze all the commonly available left turn signal treatments with or without protected left turn bays. The new system provides an improved analysis scheme for allowing the input of the existing or user-selected timing plan for arterial capacity evaluation.

ARTERIAL SIGNAL TIMING OPTIMIZATION USING PASSER II-87. MICROCOMPUTER USER'S GUIDE. FINAL REPORT. Chang, EC-P; Lei, JC-K; Messer, CJ. Texas Transportation Institute Texas A&M University College Station Texas 77843; Texas State Department of Highways & Public Transp Transportation Planning Division, P.O. Box 5051 Austin Texas 78763; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Jul 1988 105p 28 Fig. 1 Tab. 14 Ref. 2 App.. REPORT NO: FHWA/TX-88/467-1; Res Rept 467-1. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

PASSER II-87 microcomputer program version 1.0 has been developed and is available for public distribution. PASSER II can be used to assist transportation professionals to analyze (1) Isolated intersection timing evaluations, (2) Progression signal timing optimization, and (3) "Existing" timing evaluations. The system contains the updated microcomputer version of the PASSER II program, advanced analyses similar to and beyond those used in the 1985 Highway Capacity Manual, and the latest Artificial Intelligence technology and Expert Systems designs. PASSER II-87 can analyze "Permitted", "Protected", and complicated permitted/protected or protected/permitted "Combined Phase" left turn signal treatments. The microcomputer system will be distributed with the intelligent, user-friendly, menu-driven, full-function, input/output processor, main executable program, optional user help information, and microcomputer user's guide. The new program provides the enhanced program output and improved signal timing reports, allows the user to modify all the embedded data, and accepts all the existing coded

PASSER II or PASSER II-84 data without requiring any user revisions. The PASSER II-87 microcomputer system can provide alternative left turn analysis and advanced capacity evaluation well beyond the Left Turn Analysis Package and the 1985 Highway Capacity Software packages. Research study title: Enhancement to PASSER II-84. The software can be ordered through: McTrans, The Center for Microcomputers in Transportation, University of Florida, 512 Weil Hall, Gainesville, Florida 32611, (904)-392-0378 or Electronic Bulletin Board (305)-554-2145.

ARTERIAL SIGNAL TIMING OPTIMIZATION USING PASSER II-90: PROGRAM USER'S MANUAL (REVISED). Final Research rept. Chang-E.C.P.; Messer-C.J. Texas Transportation Inst., College Station. Federal Highway Administration, Austin, TX. Texas Div. Texas Dept. of Transportation, Austin. Transportation Planning Div. TTI21886467, RR4672F, FHWATX904672F. Jun 91. 120p.

PASSER II-90 microcomputer program version 1.0 has been developed and is now available for public distribution. PASSER II can assist transportation professionals in (1) isolated intersection timing evaluation, (2) progression timing optimization, (3) 'existing' timing evaluation, and (4) visualization of the signal timing results. The system contains the latest PASSER II features, advanced 1985 Highway Capacity Manual (HCM) analysis, Expert Systems design, and microcomputer graphics visual simulation. PASSER II-90 can analyze signal operations with 'Permitted,' 'Protected,' and permitted/protected or protected/permitted left turn signal treatments. The microcomputer system will be distributed with an intelligent, user-friendly, menu-driven input/output processor with the executable main program, optional help information, dynamic arterial visualization system, and a program user's manual. The new program provides enhanced analysis tools, outputs improved signal timing reports, allows the user to modify all embedded data, accepts all existing coded PASSER II, PASSER II-84, or PASSER II-87 data, and allows data file exchange with TRANSYT-7F through the FHWA's new Arterial Analysis Package (AAP). The PASSER II-90 microcomputer traffic engineering package can significantly improve arterial evaluation, signal design, and progression analysis.

ASSESSING THE TRAFFIC IMPACTS OF FREEWAY INCIDENTS AND DRIVER INFORMATION. Garrison, D; Mannering, F. Institute of Transportation Engineers. ITE Journal VOL. 60 NO. 8 Aug 1990 pp 19-23 Figs. 14 Ref.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024-2729

Traffic simulation modeling alternatives are briefly discussed, and the chosen traffic model and the study areas to which it was applied are described. The effects of driver information and incident duration, severity, and location are quantified and discussed, and recommendations are made for future work. The ability of a user equilibrium-based traffic simulation model to simulate the traffic-related impacts of urban freeway incidents is demonstrated. The paper also shows important relationships between driver information, incident duration, incident location, and overall system performance, as measured in terms of vehicle hours and average commute time. The study findings show that incident-impacted roadways need to be rapidly restored to full capacity because the cost of urban incidents can easily exceed $2,000 per minute of incident duration.

ASSESSING THE TRAFFIC IMPACTS OF TRANSPORTATION AND LAND DEVELOPMENT SCENARIOS. Deakin, EA; Skabardonis, A. Eno Foundation for Transportation, Incorporated. Transportation Quarterly VOL. 39 NO. 4 Oct 1985 pp 605-626. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

This article describes the application of a network-oriented signal timing model, TRANSYT, to evaluate development, parking, and traffic management options for an urban network. Maintenance of optimal signal timing, studies of new developments and alternative traffic and parking options appear to offer major opportunities for TRANSYT application. First, brief descriptions are given of the TRANSYT model and the study area used as a case example. Alternative policy options tested with TRANSYT are then discussed, along with results of the model application. An assessment of the study and conclusions about needed model development and refinement are presented in the last sections.

ASSESSING TRAFFIC AND EMERGENCY BENEFITS OF RAILROAD GRADE SEPARATIONS. Easa, SM; McColl, DR. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 113 NO. 6 Nov 1987 pp 593-608 Figs. Tabs. Refs.. REPORT NO: ASCE Paper 21939. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017

The benefits of constructing grade separations at four railroad crossings in Thunder Bay, Canada, are evaluated. The purpose of the study is to determine the two crossings whose grade separations provide the most efficient traffic operations and maximum accessibility of emergency services (fire stations and hospitals). Efficiency is evaluated by several measures of performance including travel time, delay, and fuel consumption. Accessibility is evaluated by the travel time between the emergency services locations and various areas in the city. Traffic volume data were collected in May 1985 during the afternoon peak period (4:30-5:30 P.M.) for 15-minute intervals. These data, along with other data related to land uses, are used to establish the origin-destination (O-D) demands through the use of a recently developed model, LINKOD. These O-D demand and the characteristics of the network represent the basic input to a traffic management model, CORCONF. The CORCONF model is used to evaluate the impacts of various grade-separation alternatives on both efficiency and accessibility. In addition to analyzing a real-world problem, this paper also discusses some aspects related to the application of the models described herein, which should prove useful for potential users of the models.

AT LAST - A TRANSYT MODEL DESIGNED FOR AMERICAN TRAFFIC ENGINEERS. Wallace, CE (Florida University, Gainesville). Institute of Transportation Engineers. ITE Journal VOL 53 NO. 8 Aug 1983 pp 28-31 11 Ref.. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

The TRANSYT (TRAffic Network StudY Tool) model was developed by Dennis I. Robertson in the late 1960s. Since that time, numerous improvements and enhancements have been made by Mr. Robertson and his colleagues at the Transport and Road Research Laboratory (TRRL). An increasing number of engineers in numerous countries use TRANSYT Version 5 and recent versions. TRANSYT-7F is a major new tool available to traffic engineers for analysis of traffic signal systems, evaluation of alternative control strategies and design of optimal signal settings.

AUTOMATIC DETECTION OF TRAFFIC INCIDENTS ON A SIGNAL-CONTROLLED ROAD NETWORK. Thancanamootoo, S; Bell, MGH. NEWCASTLE-UPON-TYNE. RESEARCH REPORT N76 Jun 1988 34P

This report investigated the feasibility of automatic incident detection in a signal controlled urban road network. Part 1 contained the results of a literature review on incident detection as applied to motorways and high speed roads. The development of an automated incident detection algorithm for a signal controlled urban road network was described in part 2. The algorithm, based on detector occupancy, was tested using both simulated and real data. The real data was taken from the London and middlesbrough SCOOT systems. The simulated data was obtained by using MULTSIM, a microscopic traffic simulation program which reproduced output from vehicle detectors on a multi-lane signal controlled road, and which also allowed for the specification of capacity reducing incidents during the simulation. The results, although not conclusive, suggested that incident detection in an urban road network was feasible. However, the algorithm needed to be adapted to suit the different road geometric and traffic conditions encountered in an urban network.

AUTOMATIC UPDATING OF TRAFFIC VOLUME DATA FOR SIGNAL TIMING PLAN DEVELOPMENT. FINAL REPORT. VOLUME 1. Kell, JH; Fullerton, IJ. JHK and Associates P.O. Box 3727 San Francisco California 94119; Federal Highway Administration Turner Fairbank Hwy Res Cntr, 6300 Georgetown Pike McLean Virginia 22101. Jul 1987 45p. REPORT NO: FHWA/RD-87/081; Rept No 4725. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

The purpose of this research was to test the validity of using automatically-collected traffic volumes from selected system detector sites to generate a full TRANSYT-7F data file for calculating signal network timing plans. Termed the 1.5 GC control concept, this approach assumes that volume shifts on selected links will accurately represent shifts throughout the network. Tests were run at two significantly different test sites and included several detector placement scenarios. The essential tasks included determining from a pre-existing data set the factors to be used to designate which volume data (locations) would serve as a surrogate to represent data collected by "system detectors." Site-specific algorithms were devised to synthesize TRANSYT data from the system detector data. New turning movement volume data were then collected at all signalized intersections at the same time link volume counts were manually collected at system detector sites. Applying the algorithms, TRANSYT-7F input files were created and signal settings were then generated using the estimated link volumes and link-to-link movement data. This TRANSYT run was then compared to the optimum settings generated using the new full TRANSYT data set. Results from multiple TRANSYT runs for both test sites strongly suggest that the 1.5 GC approach as simulated in this research is a viable alternative to the labor-intensive conventional field data collection currently used to develop TRANSYT-7F volume data files. This allows more frequent updates of timing plans to meet changing traffic conditions.

TOMATIC UPDATING OF TRAFFIC VOLUME DATA FOR SIGNAL TIMING PLAN DEVELOPMENT. FINAL REPORT. LUME 2. Kell, JH; Fullerton, IJ. JHK and Associates P.O. Box 3727 San Francisco California 94119; Federal Highway inistration Turner Fairbank Hwy Res Cntr, 6300 Georgetown Pike McLean Virginia 22101. Jul 1987 264p. REPORT NO: WA/RD-87/112; Rept No 4725. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road ingfield Virginia 22161

The purpose of this research was to test the validity of using automatically-collected traffic volumes from selected system detector sites to generate a full TRANSYT-7F data file for calculating signal network timing plans. Termed the 1.5 GC control concept, this approach assumes that volume shifts on selected links will accurately represent shifts throughout the network. Tests were run at two significantly different test sites and included several detector placement scenarios. The essential tasks included determining from a pre-existing data set the factors to be used to designate which volume data (locations) would serve as a surrogate to represent data collected by "system detectors." Site-specific algorithms were devised to synthesize TRANSYT data from the system detector data. New turning movement volume data were then collected at all signalized intersections at the same time link volume counts were manually collected at system detector sites. Applying the algorithms, TRANSYT-7F input files were created and signal settings were then generated using the estimated link volumes and link-to-link movement data. This TRANSYT run was then compared to the optimum settings generated using the new full TRANSYT data set. Results from multiple TRANSYT runs for both test sites strongly suggest that the 1.5 GC approach as simulated in this research is a viable alternative to the labor-intensive conventional field data collection currently used to develop TRANSYT-7F volume data files. This allows more frequent updates of timing plans to meet changing traffic conditions.

BANDWIDTH-CONSTRAINED DELAY OPTIMIZATION FOR SIGNAL SYSTEMS. 1988 PAST-PRESIDENTS' AWARD. Liu, CC. Institute of Transportation Engineers. ITE Journal VOL. 58 NO. 12 Dec 1988 pp 21-26 1 Fig. Tabs. 16 Refs.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

An approach is described that integrates the best features of the delay/stop optimization and progression bandwidth optimization techniques. Through this technique, the four variables, green phase time, offset, cycle length, and left-turn phase sequence, can be explicitly optimized in stages. The problems in combining delay/stops and bandwidth considerations are discussed. The approach here described starts with using a bandwidth solution as the initial solution for Transyt-7F. However, the key feature lies in the incorporation of additional bandwidth constraints into the optimization procedure of Transyt-7F. This model, called BWC, was thoroughly tested with 10 real-world arterials. The results from the testing are summarized and tabulated. Four real-world networks were chosen to test the effects of arterial bandwidth constraint within networks. This approach recognizes the need of the traffic engineer in providing perceived signal progression to motorists while optimizing total system delay. The advantages of this approach over previous approaches are pointed out.

BASIC CONCEPTS IN THE IMAURO SYSTEM FOR DYNAMIC SIMULATION OF TRAFFIC FLOWS: SOME COMMENTS. Goodwin, PB. Oxford University, England Transport Studies Unit, 11 Bevington Road Oxford OX2 6NB England. Jun 1989 20p. REPORT NO: TSU-REF-467. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

IMAURO is a traffic simulation model being developed by the Belgian Road Research Center and its partners as part of the DRIVE program for the European communities. The Transport Studies Unit, University of Oxford, has been asked to provide some comments and advice as an outside agency not involved in the model development. The comments particularly address conceptual questions in which work is still processing within the IMAURO team.

BENCHMARK STUDY OF THE I-DYNEV EVACUATION TIME ESTIMATE COMPUTER CODE. Urbanik, T; Moeller, MP; Barnes, K. Battelle Memorial Institute/Pacific Northwest Labs Battelle Boulevard, P.O. Box 999 Richland Washington 99352. Jun 1988 52p. REPORT NO: PNL-6171. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

The report compares observed vehicle movement on a highway network during periods of peak commuter traffic with a simulation of the traffic flow made with an I-DYNEV computer model. The purpose of the comparison is to determine if the model can accurately simulate the patterns of vehicular movement and delay during congested commuter traffic. The results indicate that the I-DYNEV model adequately simulates the patterns of vehicular movement and delay associated with an evacuation, provided that the model's capacity reduction factor is an input parameter. Also available from Supt. of Docs.

BENEFIT-COST EVALUATION OF LEFT-TURN LANES ON UNCONTROLLED APPROACHES OF RURAL INTERSECTIONS (ABRIDGMENT). McCoy, PT; Hoppe, WJ; Dvorak, DV. Transportation Research Board. Transportation Research Record N1026 1985 pp 40-43 2 Tab. 26 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

> Left-turn lanes are provided on uncontrolled approaches of rural intersections to improve the safety and efficiency of traffic operations on these approaches. Although the safety and operational effects of left-turn lanes are well recognized, there are no generally accepted guidelines that define the circumstances under which the costs of these lanes are justified by the benefits they provide. The objectives of this were (a) to evaluate the benefits and costs of left-turn lanes on the uncontrolled approaches of intersections of rural two-lane highways and (b) to determine the traffic volumes that warrant these lanes in Nebraska. The road-user cost savings associated with the reductions in accidents, stops, delay, and fuel consumption provided by left-turn lanes were evaluated over a range of traffic volumes and compared with the costs of left-turn lanes over the same range. The safety effectiveness of the lanes was based on accident experience on rural two-lane highways in Nebraska. The NETSIM traffic simulation model was used to determine their operational effectiveness. Volumes for which the road-user cost savings exceeded the lane costs were determined to warrant left-turn lanes. The warrants developed in this research are limited to prevailing conditions typical of those on rural two-lane highways in Nebraska. However, the procedure used to develop these warrants is applicable to other locations. This paper appeared in Transportation Research Record N1026, Evaluation Methods and Design and Operational Effects of Geometrics.

BTS (VERSION 1.0): BOTTLENECK TRAFFIC SIMULATOR USER'S MANUAL. LIN, WH; HALL, RW. INSTITUTE OF TRANSPORTATION STUDIES UNIVERSITY OF. PATH WORKING PAPER, NUCB- 1991 24 PP ENGLISH. REPORT NO: ITS-PWP-91-1

> DESCRIBES THE COMPUTER PROGRAM BTS WHICH IS A MACROSCOPIC TOOL FOR SIMULATING THE PERFORMANCE OF FREEWAY BOTTLENECKS WEI HUA LIN, RANDOLPH W. HALL OTHER PHYS. DESCRIPTION: I CHARTS PROGRAM ON ADVANCED TECHNOLOGY FOR THE HIGHWAY ADDL CORP. AUTHOR INFO: PROGRAM ON ADVANCED TECHNOLOGY FOR THE HIGHWAY CALIF ADDL CORP. AUTHOR INFO: UNIVERSITY OF CALIFORNIA, BERKELEY. INSTITUTE OF TRANSPORTATION STUDIES INSTITUTE OF TRANSPORTATION STUDIES UNIVERSITY OF CALIFORNIA AT BERKELEY

BUS-STOPS, CONGESTION AND CONGESTED BUS-STOPS. Gibson, J; Baeza, I; Willumsen, L. Printerhall Limited. Traffic Engineering and Control VOL. 30 NO. 6 Jun 1989 7p Figs. Tabs. Refs.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London England

> This paper discusses some issues involved in estimating the effects of bus-stops on delay to buses, their passengers and to other traffic. It starts by reviewing the current understanding of bus traffic behavior, mostly oriented to the situation prevailing in industrialized countries where bus flows are low, congestion is generated by other traffic (particularly cars) and bus-stops do not create major problems. It then moves on to analyze the problems usually encountered in developing countries where the number of buses is much higher and they contribute to congestion at least as much as cars. In this case, the problem is a good deal more complex as there is increased interaction between buses, passengers and bus-stop layout and operation. A conceptual framework for these interactions and precise definitions of bus-stop capacity and delays are then developed. The generation of analytical expressions for these variables is limited because the underlying process is a complex stochastic one. Therefore, a computer simulation program has been written to model this behavior and its structure and main features are described. The paper concludes with some results from this program and a few general conclusions.

CALIBRATING SIDRA. RESEARCH REPORT. Akcelik, R. Australian Road Research Board 500 Burwood Highway Vermont South Victoria 3133 Australia 0518-0758 0-86910-433-0. Mar 1990 115p. REPORT NO: ARR180

> This report presents detailed documentation on the fundamental aspects of SIDRA (version 3.2) capacity and performance estimation models and signal timing computation method. The use of the Default Values File for calibrating SIDRA models is explained. A collection of the reprints of papers by the author, which give detailed discussions on SIDRA models, is included. Although originally based on ARRB Research Report ARR No 123, SIDRA traffic models and timing computation methods are now substantially more advanced. By documenting the SIDRA models in detail, this report will help to explain the differences between the ARR No 123 and SIDRA traffic models (A).

RATION OF TRANSYT PLATOON DISPERSION MODEL FOR PASSENGER CARS UNDER LOW-FRICTION FLOW ITIONS (ABRIDGMENT). McCoy, PT; Balderson, EA; Hsueh, RT; Mohaddes, AK (Nebraska University, Lincoln). portation Research Board. Transportation Research Record N905 1983 pp 48-52 1 Fig. 5 Tab. 8 Ref.. AVAILABLE I: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

The calculation of delay and stops by the TRANSYT program and in turn the effectiveness of the signal timings resulting from its optimization procedure depend on the ability of its platoon dispersion model to accurately predict traffic flow patterns from one signal to another. Therefore, calibration of the dispersion factor alpha and travel-time factor beta in the model is important to the successful implementation of the TRANSYT program. However, because of limited research, a definitive description of the relationship between the appropriate values of alpha and beta and roadway conditions does not exist. The objective of this research was to contribute to the ultimate development of a definitive description of this relationship by calibrating this model for passenger cars under low-friction traffic flow conditions. Platoon dispersion studies were conducted on six arterial street segments (2 two-way two-lane segments and 4 four-lane divided segments). Traffic flow patterns of nearly 1700 platoons were analyzed. The results indicated that less platoon dispersion was observed in this study than has been found in other studies of low-friction traffic flow conditions. It was concluded that appropriate values of alpha and beta for passenger cars under these conditions are alpha equal to 0.21 and beta equal to 0.97 on two-way two-lane streets and alpha equal to 0.15 and beta equal to 0.97 on four-lane divided streets. (Author) This paper appeared in Transportation Research Record No. 905, Traffic Flow, Capacity, and Measurements.

AN YOU AFFORD NOT TO USE TRAFFIC MODELS?. Liu, C; Kanaan, A; AEPCO Inc., Rockville, Md. and Santiago, ; and Lieu, H.; Federal Highway Administration, McLean, Va. Paper presented at the Engineering Foundation Conference n Traffic Management: Issues and Techniques, April, 1991

Urban traffic congestion has had a significant ipact on transportation systems nationwide. Travel time, travel safety, environmental quality, and , ultimately, the quality of life are all adversely affected. In an effort to relieve the congestion problems, traffic engineers are constantly developing, improving, and evaluating transportation system design, traffic control, and traffic management strategies. Computerized simulation and optimization tools offer an effective, efficient, and low-risk mean to achieve that objective. This paper debates several issues related to the use of computerized traffic models and tries to resolve the issue of why the practicing traffic engineering community resists these powerful tools. The paper concludes not by addressing the issue of "why aren't you using traffic models?," but rather by presenting the arguments for, "how can you afford not to use them?" It is written for the practicing engineer who does not necessarily need to be a computer expert.

CAPACITY AND LEVEL OF SERVICE BY SIMULATION--A CASE STUDY OF TRAF-NETSIM. HIGHWAY CAPACITY AND LEVEL OF SERVICE. PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON HIGHWAY CAPACITY, KARLSRUHE, GERMANY, 24-27 JULY 1991. Wong, S-Y. Balkema (AA) P.O. Box 1675 3000 BR Rotterdam Netherlands 90 5410 011 7. 1991 pp 467-483 12 Fig. 7 Tab. 10 Ref.. AVAILABLE FROM: Balkema (AA) Publishers Old Post Road Brookfield Vermont 05036

We explore the prospect of using TRAF-NETSIM, a microscopic simulation model, to estimate capacity and level of service through a case study. In the case study, we collected stopped delay, saturation flow, bus dwell time, double parking duration, vehicle and pedestrian volumes, etc. These data served as the bases to run and to calibrate the model, and to check the model results. Although TRAF-NETSIM does not provide capacity and level of service directly, we showed how to make use of its detail simulation capabilities and graphics to obtain capacity and level of service. We also showed how to calibrate the model to represent local traffic conditions. The simulated capacity, stopped delay and level of service were very close to the field results. Since TRAF-NETSIM is a stochastic model, there is concern that its results may vary. We examined its variability by inputting different random number seeds with different simulation times. We find that the variation of capacity was insignificant while that of stopped delay was mixed. We also examined the required number of runs and length of simulation times to obtain 95% level of confidence. TRAF-NETSIM has many advantages. Its animated and static graphics can show what is going on or how the result is derived. Its numerous calibrating parameters enable it to be applicable to many traffic conditions. It produces many statistics which are useful for other analyses. It considers individual factors as well as the interaction of different factors which may affect capacity and level of service. One can analyze the impacts of these factors on one intersection or on the network as a whole. The prospect of using a simulation model such as TRAF-NETSIM for capacity and level of service appears to be promising.

CAPACITY FACTOR OR CYCLE TIME OPTIMIZATION FOR SIGNALIZED JUNCTIONS: A GRAPH THEORY APPROACH. Cantarella, GE; Improta, G. Pergamon Press Limited. Transportation Research. Part B: Methodological VOL. 22B NO. 1 Feb 1988 pp 1-23 25 Ref.. AVAILABLE FROM: Pergamon Press Limited Headington Hill Hall Oxford OX3 0BW England

In this paper a method for setting traffic signals of individual signalized junctions is presented. Capacity f[illegible] maximization and cycle time minimization are considered as objective functions. The correspondence betw[illegible] cycle time and capacity factor is discussed. The influence of minimum green and maximum red constraints is analyzed. Once this correspondence is known, an efficient problem-oriented algorithm, based on a pert-like technique, is proposed for the solution of the problem. (Author/TRRL)

CAR TRAFFIC FORECASTING - BACKSIGHTS, INSIGHTS AND FORESIGHTS. Duffell, JR (Hatfield Polytechnic). Kinslea Press Limited. Municipal Engineer VOL. 109 NO. 6 Jun 1982 pp 132-139 13 Fig. 12 Ref.

The paper seeks to develop a robust model as a basis for predicting year on year changes in car traffic flow, inputting those variables which, on examination, have appeared most susceptible to modelling cause and effect - namely real personal disposable income and fuel prices (not deflated for retail price index changes). The paper has also attempted to review the evolution of car traffic forecasting, a complex subject in which most of the research effort has gone into modelling and hence predicting car ownership. The author has endeavored to extend this to the use of a car and hence total changes in car traffic levels nationally. Amongst the conclusions listed are the following: car-traffic forecasting can be undertaken from a sounder conceptual base using a causal as distinct from extrapolatory model; petrol deliveries and sales can give early indication of motorists' response to changing economic circumstances well ahead of published car traffic census data; a possible trend to smaller vehicles may now be evident following the second oil crisis of 1979. (TRRL)

CARSIM: CAR-FOLLOWING MODEL FOR SIMULATION OF TRAFFIC IN NORMAL AND STOP-AND-GO CONDITIONS. Benekohal, RF; Treiterer, J. Transportation Research Board. Transportation Research Record N1194 1988 pp 99-111 7 Fig. 4 Tab. 26 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

A CAR-following SIMulation model, CARSIM, with more realistic features to simulate not only normal traffic flow but also stop-and-go conditions on freeways, has been developed. The features of CARSIM are: (1) marginally safe spacings are provided for all vehicles, (2) start-up delays of vehicles are taken into account, (3) reaction times of drivers are randomly generated, (4) shorter reaction times are assigned at higher densities, and (5) dual behavior of traffic in congested and non-congested conditions is taken into consideration in developing the car-following log[illegible] of this model. The validation of CARSIM has been performed at microscopic and macroscopic levels. At th[illegible] microscopic level, the speed change patterns and trajectories from CARSIM were compared with those from field data; whereas at the macroscopic level, average speed, density, and volume computed in CARSIM were compared with the values from real world traffic conditions. The regression analysis of simulation results versus field data yielded R-squared values of 0.98 and higher, indicating that the results from CARSIM are very close to the values obtained from field data. One example of the application of CARSIM to study traffic-wave propagation is presented. This paper appears in Transportation Research Record No. 1194, Traffic Flow Theory and Highway Capacity.

CASE STUDY EVALUATION OF ALTERNATIVE SIGNAL TIMING PLANS FOR AN OVERSATURATED STREET NETWORK. Berg, WD; Lau, KY; Dettmann, DC; Rylander, G. F. (Wisconsin University, Madison). Institute of Transportation Engineers. ITE Journal VOL. 52 NO. 4 Apr 1982 pp 23-27 5 Ref.. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

The purpose of this article is to discuss the analytical methodology which was used, and the relative effectiveness of the alternative signal timing plans in relieving the oversaturated flow conditions.

CASE STUDY EVALUATION OF THE SAFETY AND OPERATIONAL BENEFITS OF TRAFFIC SIGNAL COORDINATION. Berg, WD; Kaub, AR; Belscamper, BW. Transportation Research Board. Transportation Research Record N1057 1986 pp 58-64 9 Fig. 4 Tab. 4 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

A high-volume urban arterial was analyzed to determine if rear-end accident frequency might be decreased by reducing the frequency of vehicular stops at five signalized intersections. The potentially most cost-effective technique for reducing the frequency of stops was to coordinate the signal controllers and permit the progressive flow of platoons of vehicles. The TRANSYT model was used to develop optimized timing plans for a hypothetical time-of-day signal control system. Detailed performance data for both the existing conditions and the proposed coordinated signal system were generated using the NETSIM model. Accident records were then analyzed and correlated with the estimated frequency of vehicular stops under existing conditions. The accident prediction model was used to estimate the safety impacts of the proposed signal coordination. Evaluation of the simulation output and accident prediction estimates revealed that a small reduction in the frequency of rear-end collisions should be possible if the traffic signals are coordinated. In addition, concurrent benefits would accrue in terms of reductions in frequency of stops and in delay. This paper appeared in Transportation Research Record N1057, Traffic Signal Systems.

CHARACTERIZING THE QUALITY OF TRAFFIC SERVICE IN URBAN STREET NETWORKS. Herman, R; Ardekani, S. Texas University, Austin Center for Transportation Research Austin Texas 78712; Texas State Department of Highways & Public Transp Transportation Planning Division, P.O. Box 5051 Austin Texas 78763; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Nov 1984 Final Rpt. 202p Figs. Tabs. 70 Ref. 2 App.. REPORT NO: FHWA-TX-85-44+304-2F. AVAILABLE FROM: Texas University, Austin Center for Transportation Research Austin Texas 78712

The characterization of the quality of traffic service in urban street networks has been made according to the Two-Fluid Model of Town Traffic. A comparison of traffic related characteristics in various cities around the world using the Two-Fluid methodology has given insight into the physical network features which most strongly affect the quality of traffic service and the model parameters. Through ground experiments and simultaneous aerial observations, it has been shown that the model assumptions are reasonable. The Two-Fluid model has also been used in before/after studies in Dallas, Lubbock and San Antonio, where changes in traffic control strategies and mix of vehicles had taken place. The sensitivity of the model parameters to the vehicle type used in the data collection has also been investigated. Finally, time-lapse aerial photographs of traffic in Austin and Dallas have been reduced and analyzed to establish relations among network-wide averages of fraction of vehicles stopped, speed, concentration and flow, hence improving the Two-Fluid methodology by allowing the comparison of the quality of traffic service in various networks to be made under similar vehicular concentrations. (Author) Study conducted in cooperation with the Federal Highway Administration. Research Study Title, Quality of Traffic Service.

COMMENTS ON THE APPLICATION OF QUEUING THEORY TO DELAYS AT SIGNALS. Akcelik, R. Australian Road Research Board. Australian Road Research VOL. 20 NO. 3 Sep 1990 pp 53-61 19 Ref.. AVAILABLE FROM: Australian Road Research Board Executive Director, P.O. Box 156 Nunawading Victoria 3131 Australia

This technical note presents comments on the results of the application of queuing theory to delays at signalized intersections given in a paper by Blunden and Vandebona (see IRRD 822829). The relationship between the Australian and other delay models used around the world is explained. The importance of a continuous delay model that applies to both undersaturated and oversaturated conditions is emphasized. The simulation results given by Blunden and Vandebona are analyzed. It is concluded that the simulation model used in deriving the delay results needs to be specified in detail to facilitate comparison with analytical models. (Author/TRRL)

COMPARATIVE ANALYSIS OF LEFT-TURN PHASE SEQUENCING (ABRIDGMENT). Machemehl, RB; Mechler, AM (Texas University, Austin). Transportation Research Board. Transportation Research Record N956 1984 pp 37-40 6 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

Guidelines for left-turn phase use do not generally include recommendations for left-turn signal phase sequence patterns. In this research, the TEXAS simulation model is employed to study the effects of various left-turn sequence patterns on traffic operations in order to establish guidelines for using most typical sequence patterns. Recent literature on the effects of left-turn sequence patterns on intersection delay and accidents is reviewed. Using vehicular delay as a basis for comparison, protected only and protected/permissive left-turn phasing with pretimed control are studied. Dual leading and dual lagging left-turn phase sequences, supplemented by permissive turning and pretimed control, are also studied. Furthermore, split, dual, and composite sequences are compared for the pretimed case. The examination of basic phase sequencing schemes under actuated signal control essentially duplicates that for pretimed control. Finally, guidelines for the implementation of phase sequence patterns are presented. (Author) This paper appeared in Transportation Research Record Number 956, Traffic Control Devices and Grade Crossings.

COMPARATIVE ANALYSIS OF MODELS FOR ESTIMATING DELAY FOR OVERSATURATED CONDITIONS AT FIXED-TIME TRAFFIC SIGNALS. Cronje, WB. Transportation Research Board. Transportation Research Record N1091 1986 p 48-59 9 Fig. 8 Tab. 4 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

To optimize a fixed-time traffic signal, a model is required to estimate with sufficient accuracy the measure of effectiveness necessary for the optimization process. Suitable models have been developed for the degree of saturation (x) in the range 0 is less than x is less than 0.9. Reliable models have also been developed for the zone of the degree of saturation x is greater than 1.1. In this zone, traffic can be treated deterministically. However in the range 0.9 is less than or equal to x 1.10, the deterministic approach fails and a model should be based on the probabilistic approach to traffic flow. The ideal model should be applicable over the entire range of the degree of saturation. Only two such models have been encountered in the literature. Because of shortcomings of these models and the lack of a reliable model in the transition zone from undersaturation to oversaturation, an alternative model was developed by Cronje (Transportation Research Record 905, 1983). This model is based on a Markov process and the geometric probability distribution, and is referred to in this paper as the M Geom Model. In this paper, the M Geom Model is compared with the models developed by Mayne and Catling on a cost basis. Monetary rates are assigned to the measures of effectiveness, namely, total delay and number of stops, for a wide range of cycle lengths, flows, and degree of saturation. The results indicate that the M Geom Model estimates cost more accurately and is consequently recommended for optimizing fixed-time traffic signals. This paper appeared in Transportation Research Record N1091, Traffic Flow Theory, Characteristics, and Highway Capacity.

COMPARATIVE ANALYSIS OF TWO LOGIC FOR ADAPTIVE CONTROL OF ISOLATED INTERSECTIONS. Lin, F-B. Transportation Research Board. Transportation Research Record N1194 1988 pp 6-14 7 Fig. 11 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

Adaptive signal control has the potential to provide improved control at isolated intersections. Adaptive control, however, has limitations due to its need to rely on estimated flow conditions for making signal timing decisions. Such estimated flow conditions always differ from the actual conditions, and the discrepancies can offset the benefit of having an elaborate decision making process in a control logic. Therefore, an issue can be raised as to whether it is necessary to rely on strenuous decision-making processes for adaptive control. This study compares the relative merits of a simple queue based logic and a logic that relies on a much more complicated procedure for making timing decisions. It is found that the queue-based logic is nearly as effective as the more complicated logic. This finding points to a direction for the development of new control logic that can be widely used to replace existing traffic-actuated control logic. This paper appears in Transportation Research Record No. 1194, Traffic Flow Theory and Highway Capacity.

COMPARATIVE ASSESSMENT OF 1985 HCM DELAY MODEL. Sadegh, A; Radwan, AE. American Society of Civil Engineers. Journal of Transportation Engineering VOL 114 NO. 2 Mar 1988 pp 194-208 Figs. Tabs. Refs. Apps.. REPORT NO: ASCE Paper 22278. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017

Delay is an important measure of effectiveness in traffic studies; it represents the direct cost of fuel consumption and indirect cost of time loss to motorists. The 1985 Highway Capacity Manual (HCM) used delay as the principal measure of level-of-service at signalized intersections. The manual introduced a delay model that is based partially on the traditional Webster model. The goals of this study were: (1) to review the delay models currently being used in the SOAP84 computer model for an isolated intersection and by the TRANSYT-7F computer model for an arterial; (2) compare them with the original model developed by Webster and the new model proposed by the HCM; and (3) assess the HCM model in both isolated intersection and urban arterial environments. The results show that the new HCM delay model is sensitive to arrival type; thus it is important to know which arrival type to use. The delay values calculated by the new HCM model, SOAP84, and TRANSYT are close to the values resulting from NETSIM.

COMPARING CAPACITIES AND DELAY ESTIMATES BY HIGHWAY CAPACITY SOFTWARE AND TRAF-NETSIM TO FIELD STUDIES. Wong, S. (Federal Highway Administration, Washington, D.C.). Institute of Transportation Engineers, ITE 1990 Compendium of Technical Papers, pp. 224-227.

MPARISON OF FIXED TIME AND FLEXIBLE PROGRESSIVE TRAFFIC CONTROL IN SLOUGH. Lines, CJ; Lucas, CF. RL Supplementary Report 1984 Monograph 8p 2 Fig. 2 Tab. 7 Ref.. REPORT NO: SR 837

Since 1977 Slough Borouch Council have operated a compact urban traffic control (utc) system in which a central computer coordinates the timings of traffic signals in slough. The signals are controlled by a flexible progressive system in which the central computer allows the timings to vary by a few seconds from the present" fixed time plans" which maintain coordination. The variations in timings are determined by the presence or absence of vehicles over stop-line detector loops; similar systems have been used for many years at other sites. In spring 1983, the TRRL conducted a survey to compare the flexible progressive system with a fixed time system that used the same coordination plans. A "floating car" survey method was used to measure journey times along the A4 Bath road and A355 Farnham road during four periods of the day for five weeks in spring 1983. The results show no significant differences in journey times measured with the two control systems, although there is some indication that the flexible progressive system gives slightly shorter journey times in the morning peak. It is possible that the flexible progressive control system can adapt to small changes in flow, and so reduce the need for updating the fixed time plans. (Author/TRRL)

OMPARISON OF MACROSCOPIC MODELS FOR SIGNALIZED INTERSECTION ANALYSIS. Hagen, LT; Courage, KG. Transportation Research Board. Transportation Research Record N1225 1989 pp 33-44 14 Fig. 10 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

The signalized intersection methodology presented in the 1985 Highway Capacity Manual (HCM) introduced a new delay model, which naturally invites comparison with the delay models contained in existing traffic signal timing design and analysis techniques. This paper compares the HCM delay computations with those performed by the Signal Operations Analysis Package (SOAP) and by TRANSYT-7F Release 5. The paper focuses on the effect of the degree of saturation, the peak-hour factor, and the period length on delay computations and on the treatment of left turns opposed by oncoming traffic. All of the models agreed closely at volume levels below the saturation point. When conditions became oversaturated, the models diverged; however, they could be made to agree by the proper choice of parameters. The computed saturation flow rates for left turns opposed by oncoming traffic also agreed closely. However, the treatment of protected plus permitted left turns produced substantial differences. It was concluded that neither SOAP nor the HCM treats this case adequately. Therefore, an alternative model based on a deterministic queuing process was proposed and evaluated. This paper appears in Transportation Research Record No. 1225, Highway Capacity, Flow Measurement, and Theory.

COMPARISON OF SOAP AND NETSIM: PRETIMED AND ACTUATED SIGNAL CONTROLS. Nemeth, ZA (Ohio State University). Transportation Research Board. Transportation Research Record N905 1983 pp 84-89 13 Fig. 2 Tab. 3 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

Delay and fuel-consumption rates estimated by the relatively easy-to-use, deterministic Signal Operations Analysis Package (SOAP) were compared with results generated by the microscopic and stochastic Network Simulation Model (NETSIM). The study involved three cases of isolated signalized intersections: two-phase pretimed controller, two-phase fully actuated controller, and multiphase pretimed controller. More than 80 combinations of left-turning and through traffic volumes were investigated in each case. Whereas SOAP estimates excess fuel consumption at intersections, NETSIM generates total fuel consumption. The difference between the two was found to be fairly uniform and corresponded to a realistic 18-mile/gal fuel efficiency under uninterrupted 30-mph flow conditions. In terms of delay predictions, SOAP and NETSIM are found to be entirely compatible after the differences in delay definitions, SOAP's more conservative left-turn saturation-flow-rate relationship, and NETSIM's delay sensitivity to unit extensions for actuated signal controllers were taken into account. In addition, the volume/capacity ratio at which SOAP begins to overestimate delay due to the use of Webster's delay equation may be lower than now assumed. Last, the difference between SOAP and NETSIM average delays can probably be reduced by a more studied coordination between SOAP and NETSIM input parameters. Evidence is offered to the operating engineer that the easy-to-use SOAP produced results supported by the sophisticated NETSIM. (Author) This paper appeared in Transportation Research Record No. 905, Traffic Flow, Capacity, and Measurements.

COMPUTER APPLICATIONS IN TRAFFIC SIGNAL MANAGEMENT. SESSION 4. Skabardonis, A; May, AD (California University, Berkeley). Institute of Transportation Engineers. Compendium of Technical Papers, 1984 pp 1-5 4 Fig. 8 Tab. 13 Ref.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

This paper describes the activities in developing and applying improved computer techniques in traffic signal management, performed in the technical center established at the Institute of Transportation Studies (ITS), as part of the Fuel Efficient Traffic Signal Management (FETSIM) project. The center provides technical support to local agencies, develops software and conducts research for most efficient use of the state of the art computer programs. A description of the available programs is given and how these tools can be used in the various phases of a signal retiming study. Selected applications are presented. The implications of using these techniques and future developments are also discussed. (Author) This paper was presented during the Institute of Transportation Engineers 54th Annual Meeting, San Francisco, California, September 23-27, 1984.

COMPUTER USER MANUAL FOR PROGRAM "LATM"--A PROGRAM PACKAGE FOR LOCAL AREA TRAFFIC MODELLING. Taylor, MAP. Commonwealth Scientific & Indus Res Org, Australia Division of Building Research, P.O. Box 56 Highett Victoria Australia 0 643 02818 8. 1982 Monograph 45p 5 Fig.

The package produces short duration traffic assignments for small area networks representing part of an urban area. It can be used for the evaluation of alternative traffic systems management schemes, studies of traffic generators such as shopping centers, or studies of congestion and network performance. The package uses externally supplied, dynamic travel demands over a specified time interval (eg a peak hour) which is itself divided into a number of computation sub-intervals. Demand is assumed to be constant in each sub-interval, but may vary between sub-intervals. Network travel conditions are also varied between sub-intervals. It is possible to distinguish between different turning manoeuvres at intersections, between intersection types, and between road and street types. Queues may exist on all intersection approaches. The model uses a probabilistic path choice procedure based on perceived travel times to account for the possible multiplicity of available network paths of comparable travel time and the assumed imperfect knowledge of the network by travellers. (TRRL)

CONCURRENT USE OF MAXBAND AND TRANSYT SIGNAL TIMING PROGRAMS FOR ARTERIAL SIGNAL OPTIMIZATION. Cohen, SL (Federal Highway Administration). Transportation Research Board. Transportation Research Record N906 1983 pp 81-84 2 Tab. 7 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

Number of computer programs have been developed for the purpose of optimizing signal timing. All of the current programs, however, have some deficiencies. The TRANSYT program, which is the most widely used, has a good traffic model and optimize green phase time. However, it does not get a globally optimal solution, optimize phase sequence, or really optimize cycle length. The MAXBAND program, which optimize arterial bandwidth, does all of the above but is deficient in that green time is not optimized and the traffic model used is oversimplified. It is shown that a feasible way to overcome these deficiencies is to use the MAXBAND program to develop an initial timing plan for TRANSYT. This initial timing plan includes both cycle length and phase sequence optimization. The timing plans produced by the TRANSYT and MAXBAND programs separately were compared with the combined timing plans by using the NETSIM model. The results indicate that a substantial improvement in measures of effectiveness is obtained with the combined timing plans. This paper appeared in Transportation Research Record No. 906, Urban Traffic Systems.

CONGESTION-BASED CONTROL SCHEME FOR CLOSELY SPACED, HIGH TRAFFIC DENSITY NETWORKS. Lieberman, EB; Rathi, AK; King, GF; Schwartz, SI. Transportation Research Board. Transportation Research Record N1057 1986 pp 49-57 2 Fig. 5 Tab. 10 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

The development and field testing of a traffic control policy designed for congested conditions in the high-density sectors of the Manhattan central business district (CBD) are described. Rather than providing progressive movement in the conventional sense, the primary objective of this control policy is to minimize the frequency and extent of intersection spillback. In the Manhattan CBD, queues develop along the cross streets; these queues often spill back into the upstream intersections, physically blocking the movement of traffic along the north-south arterials. The traffic control policy described yields signal timing for the one-way cross streets that exhibit a backward progression and flared green times that increase in the direction of traffic flow. The arterial traffic is serviced by a signal-timing pattern that exhibits zero relative offsets. The NETSIM traffic simulation model was used to test different concepts during the development phase of the effort. The new policy was then compared with the existing timing plan, by using NETSIM, and the results indicated that the number and duration of spillback blockage were markedly decreased, with a concomitant reduction in vehicle travel time and number of stops, coupled with an increase in vehicle trips serviced. A before-and-after field study yielded similar results, with the new policy providing a 20 percent reduction in overall travel time. This paper appeared in Transportation Research Record N1057, Traffic Signal Systems.

NGESTION, FLOW AND CAPACITY. HIGHWAY CAPACITY AND LEVEL OF SERVICE. PROCEEDINGS OF THE ERNATIONAL SYMPOSIUM ON HIGHWAY CAPACITY, KARLSRUHE, GERMANY, 24-27 JULY 1991. Liu, G-Q. kema (AA) P.O. Box 1675 3000 BR Rotterdam Netherlands 90 5410 011 7. 1991 pp 245-251 10 Fig. Refs.. AVAILABLE OM: Balkema (AA) Publishers Old Post Road Brookfield Vermont 05036

A new model reflecting the relationships between congestion, flow and capacity is presented. The two concepts of capacity are dealt with in this model: one is the output capacity of a length-limited link or road in traffic systems, which is the same meaning as the capacity usually adopted in the Highway Capacity Manual; another is the carrying capacity of the link. Both of the two capacities influence traffic congestion: the finiteness of the output capacity is a critical factor for causing congestion; the carrying capacity affects the time evolution of traffic congestion on such a link. Through analyzing the new model, one may find that the time evolution of traffic congestion on a link can exhibit an extraordinarily rich spectrum of dynamic behavior, from stable states, to regular oscillations, to apparently random fluctuations--chaotic behavior. This implies that there can be complicated patterns in traffic flow under congested conditions.

ONSEQUENCES FOR TRAFFIC FLOW DURING A TEMPORARY ROAD-BLOCK (II). Botma, H; Stembord, HL (Delft University Of Technology). Royal Dutch Touring Club ANWB. Verkeerskunde VOL 36 NO. 7 Jul 1985 pp 314-316 2 Fig. 2 Tab. Dutch

In Part I of the article the theoretical aspects of the mathematical model to study the consequences of a temporary road-block on traffic flow are mentioned and the location and data acquisition are described. In the second part a further analysis is given of the consequences of errors in the input data such as for instance the 24 hour traffic density, the distribution over the day, the traffic composition and the capacity on the values which should be calculated as the total time of delay, the length of queue, the total number of vehicles involved, etc. In addition, possibilities for practical use of the method are presented. (TRRL)

CONSIDERATIONS IN THE LENGTH OF THE YELLOW INTERVAL. Shanteau, RM. Purdue University. Engineering Bulletin of Purdue University N154 Mar 1983 pp 115-120 2 Fig. 1 Tab. 8 Ref.. AVAILABLE FROM: Purdue University West Lafayette Indiana 47907

Most modern methods for setting the yellow interval at traffic signals start with the presumption that the yellow should be long enough so that a reasonable driver is never placed in a position of neither being able to enter on yellow nor stop before entering the intersection. If the yellow is too short, a dilemma zone is created wherein a reasonable driver occasionally must either enter on red or stop beyond the stop line. The methods then go on to use a definition for a reasonable driver that is similar to the one in the ITE Handbook, which uses reasonable limiting values of one second for the reaction time and 10 (or 15) ft/sec/sec for the deceleration rate. These values are assumed to be constant over all speeds. A kinematic model of vehicle behavior is then used to predict the minimum yellow time necessary to avoid a dilemma zone. Difference between procedures then center around the exact values that are appropriate for a reasonable driver. The concept that a dilemma zone exists and that the avoidance of one should be used as a basis for setting the minimum length of the yellow interval is probably valid. It could be that a longer clearance interval is needed for safety, but then the usual procedure is to provide the excess time as an all-red interval. This paper concentrates on the manner in which a reasonable driver is defined and the dilemma zone determined. Its main departure is with the assumption that driver reaction time and declaration rate are constant over all speeds. It appears that existing data do not necessarily support the idea that reaction times and deceleration rates are constant over all speeds for a consistently defined reasonable driver. (Author) This paper was presented during the proceedings of the 69th Annual Road School, March 8-10, 1983.

CONTROL OF FREEWAY TRAFFIC FLOW. Smulders, SA. S.Smulders Kervelgaarde 7 Nieuwegein Netherlands. 1990 162p 104 Ref. Dutch. AVAILABLE FROM: S. Smulders Kervelgaarde 7 Nieuwegein Netherlands

In this thesis a freeway traffic control problem is addressed and solved. The control problem consists of designing an optimal policy for the variable speed signs of the Dutch motorway control and signalling system. The aim is to reduce the instabilities of traffic flow that occur if demand is high, and thereby to reduce the probability of congestion and increase safety. At a first step towards solving the problem a mathematical model for freeway traffic is presented. The model behavior is investigated by means of stochastic simulation. To obtain an estimate of the passing speed probability density function incorporated in the traffic model, an analysis of freeway traffic data is carried out. Based on the model developed a filter is presented. This algorithm estimates the state of traffic, consisting of traffic densities and mean speeds of all freeway sections, from available count and speed measurement data. Thereafter the actual control problem is addressed. Several suggestions for further study are presented. (TRRL)

CONTROL STRATEGIES AND DETECTOR PLACEMENT GUIDELINES FOR A 1.5 GENERATION TRAFFIC CONTROL SYSTEM. Kessmann, RW; Ku, CS; Cooper, DL. Kessmann and Associates, Incorporated 18333 Egret Bay Boulevard Houston Texas 77058. Feb 1985 116p. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

The objectives of this study were twofold. The first objective was to evaluate and analyze alternative traffic signal timing optimization strategies for purposes of selecting the best strategy for inclusion in a 1.5 Generation traffic control system. The second objective of this study was to establish guidelines to be used by practicing traffic engineers in determining locations of detectors required to effectively accomplish the following functions using the selected strategy: a) computation of optimal signal timing plans in a 1.5 Generation mode of system operation; b) automatic selection of prestored timing plans in a First Generation traffic responsive mode of system operation; c) identification of "poor" timing plan performance.

CONTROL SYSTEM DESIGN FOR AN INDIVIDUAL SIGNALIZED JUNCTION. Improta, G; Cantarella, GE (Naples University, Italy). Pergamon Press Limited. Transportation Research. Part B: Methodological VOL. 18B NO. 2 Apr 1984 pp 147-167 17 Fig. 5 Tab. Refs.

The traffic signal settings for a single road junction have been often evaluated by mathematical programming techniques. This paper proposes a new approach to the problem which allows all the regulation variables to be incorporated into a binary-mixed-integer-linear-programming model. This general model permits some of the limitative assumptions involved in other formulations of the problem based on the stage matrix to be removed. The model can be easily solved obtaining a fast computation of the globally optimal control system design. A detailed treatment is given for the particular structure of the mathematical programming schemes obtained by considering delay minimization, capacity reserve maximization, or cycle time minimization as the objective. (Author/TRRL)

COORDINATION OF ACTUATED ARTERIAL TRAFFIC SIGNAL SYSTEMS. Jovanis, PP; Gregor, JA. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 112 NO. 4 Jul 1986 pp 416-432 6 Fig. 6 Tab. 24 Ref.. REPORT NO: ASCE Paper 20775. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017

Coordinated timing plans may be developed for actuated signal systems but all existing optimization methods require that each actuated signal be converted to its nearest equivalent pretimed unit. Using bandwidth maximization as a starting point, a new procedure is developed that specifically accounts for actuated timing flexibility. Yield points and force offs at non-critical signals are adjusted so they just touch the edges of the through-band while critical signals are unmodified. This method is applied to a data set describing midday traffic conditions on an urban arterial system of six signals in central Illinois. Simulation is used to evaluate these timing plans and compare them with corresponding pretimed alternatives.

CURRENT KNOWLEDGE OF RURAL TRAFFIC BEHAVIOR. McLean, JR. Australian Road Research Board 500 Burwood Road Vermont South Victoria 3133 Australia 0 86910 127 7. 1983 pp 13-36 8 Fig. 6 Tab. 33 Ref.

The results of empirical research relevant to two-lane flow are summarized. These are considered as component characteristics, such as desired speed distributions, speed- geometry relations and overtaking gap-acceptance, and the aggregate characteristics as given by speed-flow and capacity. It is shown that there has been a time trend of decreasing coefficient of variation for car desired speed distributions and a general increase in truck speeds.

Typical truck power/mass ratios have increased significantly beyond the values assumed in the 1965 highway capacity manual, but there is a lack of recent data relevant to Australian conditions. There is marked variation in overtaking gap-acceptance results reported from different studies, which reflects both the complexity of driver behavior in overtaking and practical difficulties in the collection and interpretation of overtaking data. Speed- flow relations are found to be very site dependent and can provide only a coarse description of the flow process. Recent estimates of two-lane road capacity suggest total capacities in excess of the 2000 veh/h assumed in the 1965 capacity manual. (TRRL) Program and papers from Workshop on Rural Traffic Simulation, Vermount South, Victoria, June 2-3, 1983. This paper was presented in Session 1: Rural Traffic Simulation.

...AY ALLEVIATED BY LEFT-TURN BYPASS LANES. Bruce, EL; Hummer, JE. Transportation Research Board. ...sportation Research Record N1299 1991 pp 1-8 3 Fig. 3 Tab. 10 Ref.. AVAILABLE FROM: Transportation Research ...rd Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

The effectiveness of a left-turn bypass lane on a two-lane rural T-intersection shown by delay data was examined in this research. The bypass lane was a 12-ft-wide marked lane that through traffic may use to move around a vehicle that has stopped to make a left turn onto the minor road of the T. Delay data were generated by the TRAF-NETSIM traffic simulation program sponsored by the FHWA. Delay can be converted into driver cost, which can be compared with the cost of constructing the lane, to provide a good indication of the point at which the extra lane would be warranted. Seven factors that may affect the need for the extra lane were tested: the opposing through volume, the opposing right-turn volume, the through volume, the left-turn volume, vehicle speed, and the distance to the nearest upstream and downstream signal. The presence of a bypass lane was also tested to allow comparison between situations with and without left-turn bypass lanes. Sixty-four simulations were run to test the factors and the interaction among factors. The results indicated that the presence of a bypass lane was a significant factor in delay, especially when higher levels of opposing and left-turn volumes were present. Significant delay and percent stops savings can be realized by including a left-turn bypass lane in certain situations. This paper appears in Transportation Research Record No. 1299, HOV Facilities and Transportation Systems Management 1991.

DELAY ANALYSIS FOR FREEWAY CORRIDOR SURVEILLANCE, COMMUNICATION, AND CONTROL SYSTEMS. Derr, BR. Transportation Research Board. Transportation Research Record N1132 1987 pp 77-81 4 Fig. 1 Tab. 4 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

A method of estimating the delay savings due to installation of a freeway corridor surveillance, communication, and control (SC&C) system is discussed. Using reasonable assumptions, the model estimates recurrent delay by speed-flow relationships and includes the effects of diversion to the frontage road. The nonrecurrent delay savings is found by using a graphical technique on a plot of time versus cumulative vehicles. The model parameters are easily adjusted for local conditions. The model provides a valuable tool for ranking SC&C projects and obtaining an estimate of their benefits. This paper appeared in Transportation Research Record No. 1132, Freeway Management and Operations.

DELAY AT LIGHT RAIL TRANSIT GRADE CROSSINGS. Research rept. Sep 83-Sep 87. Cline-J.C.; Urbanik-T.; Rymer-B. Texas Transportation Inst., College Station. Federal Highway Administration, Austin, TX. Texas Div. Texas State Dept. of Highways and Public Transportation, Austin. TTI2108433910, FHWATX8733910. Mar 86. 67p.

The report represents the results of computer simulation work using Federal Highway Administration's NETSIM model to evaluate the delays incurred by automobile traffic when light rail transit (LRT) vehicles cross arterial streets at-grade. The operation simulated indicates the upperbounds of delay that would occur when light rail transit vehicles operating in street medians, and special signal phasing are not considered.

DELAY MODELS FOR MIXED PLATOON AND SECONDARY FLOWS. Rouphail, NM. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 114 NO. 3 Mar 1988 pp 131-152 Figs. Tabs. Refs. Apps.. REPORT NO: ASCE Paper 22254. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017

A mathematical model is described for estimating approach delays at pretimed, signalized, coordinated intersections. The delay models incorporate the size of and flow rate within the progression bandwidth. Platoon dispersion and secondary flows are considered via a simplified platoon-dispersion algorithm calibrated from the TRANSYT-7F model. The basic premise in this study is that traffic is assumed to arrive at the progressed approach in two average flow rates, one within the progression bandwidth, and another outside of it. This modeling concept represents a middle ground between bandwidth models that assume a constant low rate in the dispersed platoon and TRANSYT-like techniques where arrival flow rates vary in each time slice of the cycle length. The delay models are evaluated with Webster's delay formula for random arrivals and with simulated data in NETSIM; in both cases the results compare very favorably. Pending field validation of the delay estimates, an immediate application of the models is the development of progression adjustment factors, which can be readily estimated from system signal-timing parameters and flow rates derived herein.

DELAY MODELS OF TRAFFIC-ACTUATED SIGNAL CONTROLS. Lin, FB; Mazdeyasna, F (Clarkson College of Technology, New York). Transportation Research Board. Transportation Research Record N905 1983 pp 33-38 7 Fig. 8 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

Traffic-actuated signal controls have more control variables for engineers to deal with than a pretimed control. The increased sophistication in their control logic provides greater flexibilities in signal control but also makes the evaluation of their performance more difficult. At the heart of the problem is that traffic delays cannot be readily related to the control variables of a traffic-actuated control. This prompts practicing engineers to rely mostly on short-term, subjective field observations for evaluation purposes. To provide an improved capability for evaluating alternative timing setting, delay models are developed in this study for semiactuated and full-actuated controls that employ motion detectors and sequential phasing. These models are based on a modified version of Webster's formula. The modifications include the use of average cycle length, average green-duration, and two coefficients of sensitivity that reflect the degree of sensitivity of delay to a given combination of traffic and control conditions. Average cycle length and average green duration are dependent on the settings of the control variables and the flow pattern at an intersection. They can be estimated by existing methods. (Author) This paper appeared in Transportation Research Record No. 905, Traffic Flow, Capacity, and Measurements.

DEMAND-RESPONSE DECENTRALIZED URBAN TRAFFIC CONTROL. PART 2. NETWORK EXTENSIONS. Gartner, NH; Kaltenbach, MH; Miyamoto, MM. Lowell University, Massachusetts Lowell Massachusetts 01854. Jul 1983 159p. REPORT NO: ULRF-05-2998-2; DOT/OST/P34-85/009. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

Part 1 of this study described the development of models and a strategy for optimal real-time control of traffic at a signalized intersection. The work has been extended in a number of ways which are described in this report. First, a NETSIM based simulation study was conducted to test the effectiveness of the strategy using field collected traffic flow data. Second, the basis demand-responsive optimization module was modified to consider impacts on adjacent nodes and thus allow its integration into a decentralized network control system. Various flow estimation procedures were developed and tested for this purpose. Finally, an open-loop feedback model is described which combines simulation add optimization within an integrated network structure. The results reported in this study indicate the feasibility and advantages of applying demand-responsive strategies for traffic signal control at individual intersections as well as at flexibly coordinated network configurations. See Also PB82-220088.

DEMONSTRATION OF THE EFFECTS OF HARMONIZED SPEED ON EFFICIENCY AND TRAFFIC SAFETY - A TRAFFIC SIMULATION STUDY OF TRAFFIC INTERACTION EFFECTS. REPORT SUMMARY. Carlsson, A; Nilsson, G. National Swedish Road & Traffic Research Institute. Nordic Road and Transport Research VOL. 1 NO. 1 1989 pp 20-21 1 Fig. 3 Tab.. AVAILABLE FROM: National Swedish Road & Traffic Research Institute Editor-in-chief S-581 01 Linkoeping Sweden

Different drivers choose their speeds along a road with regard to a number of factors. Among these, speed limits and the speed as indicated by the speedometer are naturally of great importance. In the PRO-NET project (which is part of the main Prometheus project) the VTI has performed computer simulations aimed at studying the possibilities of achieving both higher traffic efficiency (trafficability) and better traffic safety.

NSTRATION OF TRAF-NETSIM FOR TRAFFIC OPERATIONS MANAGEMENT. FINAL REPORT. Sulzberg, JD; sky, MJ. Virginia Transportation Research Council P.O. Box 3817, University Station Charlottesville Virginia 22903; Department of Transportation 1221 East Broad Street Richmond Virginia 23219; Federal Highway Administration h Street, SW Washington D.C. 20590. Aug 1991 73p 6 Fig. 11 Tab. 34 Ref. 6 App.. REPORT NO: FHWA/VA-92-R3; 92-R3. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

The utility of the simulation package TRAF-NETSIM to the traffic engineer is assessed and demonstrated by means of a case study. The methodology employed in performing the analysis is presented in a way that will aid future users of TRAF-NETSIM. The advantages and disadvantages of TRAF-NETSIM are documented along with the human resource requirements for a first-time application of the program. TRAF-NETSIM permits the engineer to compare alternative control and design strategies for a traffic intersection, corridor or network and allows the user to design and test within the office environment the simulation of many traffic options. TRAF-NETSIM attempts to be as realistic as possible. Lanes can be channelized for turns only or designated for carpool or bus activity. Pedestrian activity, long- and short-term events, and bus routes can be simulated as well. Creativity permits the engineer to evaluate unusual networks when required. The output of TRAF-NETSIM provides the user with a host of measures of effectiveness to compare traffic options. Delay time/vehicle, number of phase failures, speed, vehicle miles, stops/vehicle trip are some of the measures of effectiveness that can be used to evaluate networks.

RIVATION OF EQUATIONS FOR QUEUE LENGTH, STOPS, AND DELAY FOR FIXED-TIME TRAFFIC SIGNALS. nje, WB (Stellenbosch University, South Africa). Transportation Research Board. Transportation Research Record N905 83 pp 93-95 5 Fig.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, W Washington D.C. 20418

The existing methods for the calculation of queue length, number of stops, and delay for isolated traffic intersections are applicable either to undersaturated stationary conditions or to oversaturated conditions. As far as is known, no model exists that is applicable to all conditions. Equations are derived for the calculation of queue length, number of stops, and delay for isolated fixed-time signalized intersections that are applicable to undersaturated as well as to oversaturated conditions. In the derivation the macroscopic approach to traffic flow is used. This approach has been shown to be sufficiently accurate for practical purposes. Traffic flow at a signalized intersection is considered a Markov process. Equations are derived for expected queue lengths, expected number of stops, and expected total delay. These equations can also be used for the optimization of isolated fixed-time signalized intersections. (Author) This paper appeared in Transportation Research Record No. 905, Traffic Flow, Capacity, and Measurements.

DESIGN LENGTHS OF LEFT- OR RIGHT-TURN LANES WITH SEPARATE SIGNAL PHASES. Oppenlander, JC; Oppenlander, JE. Institute of Transportation Engineers. ITE Journal VOL. 59 NO. 7 Jul 1989 pp 23-26 Figs. 3 Ref.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024-2729

A study is described which applied a rational procedure to determine the design length for left-turn or right-turn lanes with separate signal control. For this type of intersection regulation, the arrival and service rate equations are reasonably accurate predictors for traffic operations of both left and right-turning lanes. The design criteria are applicable for those signalized intersections where special turning lanes are deemed to be warranted on one or more approaches. In any situation for turn lanes with separate-phase control, design tradeoffs between length of turning lane and ratio of green time to cycle length are readily achieved with the tabulated values. Any intersection design should be guided by geometric and/or control warrants in terms of the necessities for special turning lanes and for separate signal phases that are applicable for these turning-lane lengths.

DESIGN, PERFORMANCE AND PLANNING OF SIGNALIZED ARTERIAL TRAFFIC NETWORKS. Final rept. Rao-T.S.C.S. California Univ., Berkeley. Dept. of Civil Engineering. RAOTRAFFIC871, Dec 87. 398p.

The report presents the study of an arterial (signalized) traffic net-work analysis using TRANSYT-7F computer software program. The performance of the system is evaluated in terms of performance index, average delay per vehicle, percent stops, rate of fuel spent and speed of the system on the whole. Several alternative schemes for the improvement of the system have been studied and the results are presented. Extensive study has been conducted on the influences of various parameters on the system performance. Field data has been collected since 1963 using the FORECAST PLUS computer software package forecasts for the year 2010 have been derived.

DETERMINING PARAMETERS OF THE CONGESTED PART OF THE FUNDAMENTAL DIAGRAM. Botma, H; Detma, H, DJ (Delft University Of Technology; Studiecentrum Verkeerstechniek). Werkdagcommissie. Bijdragen Verkeerskundige Werkdagen 1983 Apr 1983 pp 799-814 6 Fig. 3 Tab. 5 Ref. Dutch. AVAILABLE FROM: Werkdagcommissie P.O. Box 163 Driebergen-rijsenbur Netherlands

In many traffic stream models the role of the fundamental diagram is of great importance. Using measurements on queues at roadblocks it is possible to determine parameters of the level of service F region of the diagram: viz saturation flow, mean speed at saturation flow, jam concentration and the speed of the starting wave. A description of the method and some results of data from one-lane traffic are presented. Special attention is given to the problem of the influence of lorries. (Author/TRRL) Conference papers of the Working Days on Traffic Engineer 1983.

DEVELOPMENT AND APPLICATION OF A MODEL TO INVESTIGATE THE TECHNICAL REQUIREMENTS FOR SIGNALS TO DESIGN INTERSECTIONS. Myrrhe, R; Schnuell, R. Bundesminister fuer Verkehr, Abteilung Strassenbau Lennestrasse 30 D-5300 Bonn West Germany. Mar 1986 56p German. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

The traffic flow in signalized intersections is determined by various structural measures such as the arrangement of separating strips and the location of crossings as well as controls via cycle time and number of phases. To quantify these measured individually and in combination with one and another within the reported work a model has been developed which calculates the parameters of traffic flow quality and combined evaluation criteria from the entered elements of design and the calculated signal timing plan, taking obstructed streams of traffic into consideration. The application of the model shows that because of the widening of the intersection area a definite increase of the decisive intergreen times has to be accepted when shifting the crossings as well as when arranging separating strips. However, when allowing obstructed streams of traffic this disadvantage is more than compensated for and shorter cycle times are achieved. One can deduce from the results the recommendation to use the shift of the crossings as a relatively unproblematic means to improve the quality of the traffic flow. This takes on more importance as the traffic at the intersection increases.

DEVELOPMENT AND APPLICATION OF THE SSTOP TRAFFIC SIGNAL OPTIMIZATION PROGRAM. Lam, JK; Ugge, AJ; Allen, BL (Delcan Limited; Ontario Ministry of Transportation & Communic, Can; McMaster University, Canada). Wyllie and Ufnal Limited 1 Greensboro Drive, Suite 300 Rexdale Ontario Canada. 1982 pp 495-513 2 Fig. 3 Tab. 5 Ref.

An efficient offline traffic signal system optimization program called sstop has been developed. The development and underlying theory of the sstop program is described. The program has been extensively tested and evaluated in several Canadian cities. As part of testing and evaluation, sstop has been compared with the transyt program. The results indicate that the signal timings generated by sstop compare favorably with those generated by transyt. Input preparation for sstop is easier and faster than for transyt. Computer requirements and running costs are much lower for sstop. Subsequently, the sstop program has been successfully applied and the results implemented in several Canadian cities. Suggestions for further improvements of the program are presented. For the covering abstract of the conference see TRIS 378581. (Author/TRRL) Proceedings of the 7th Annual Conference on Cost Effective Measures for Transport Improvements, Chelsea Inn, Toronto, Canada, May 30 to June 2, 1982.

DEVELOPMENT AND APPLICATIONS OF TRAFFIC SIMULATION MODELS AT THE KARLSRUHE INSTITUT FUR VERKEHRWESEN. LEUTZBACH, W; WIEDEMANN, R. TRAFFIC ENGINEERING & CONTROL VOL 27 NO. 5 May 1986 PP 270-278 ENGLISH

BY WILHELM LEUTZBACH AND RAINER WIEDEMANN ILLUSTRATED BIBLIOGRAPHY: P. 278

DEVELOPMENT OF A FREEWAY CORRIDOR EVALUATION SYSTEM - PASSER IV. FINAL REPORT. Cunagin, WD; Borchardt, D; Chang, ECP. Texas Transportation Institute Texas A&M University College Station Texas 77843; Texas State Department of Highways & Public Transp Transportation Planning Division, P.O. Box 5051 Austin Texas 78763; Federal Highway Administration Office of Research and Development, 400 7th Street, SW Washington D.C. 20590. Aug 1986 85p. REPORT NO: FHWA/TX-86/63+281-2F. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

This report describes and presents the results of a study to develop a system of freeway corridor evaluation and improvement tools to be known by the acronym PASSER IV. This effort resulted in the production of several computer programs implementing its findings. The first stage of this research involved a detailed appraisal of the existing technology for: the evaluation of the effects of changes in the characteristics of facilities in a freeway corridor upon the traffic flow in the corridor; and improving the timing of traffic signals in a freeway corridor such that the total throughout the corridor is enhanced. The study also included close contact with transportation professionals in Dallas/Fort Worth, Houston, and San Antonio to ensure that the research was directed toward solving problems of importance to practitioners. Procedures and computer programs were developed to quickly analyze urban freeway corridor alternatives. A simple, easy-to-use, progression-based, signal optimization algorithm was developed and implemented as a computer program.

ELOPMENT OF A NEW HIGHWAY TRAFFIC NOISE PREDICTION MODEL. VOLUME 3: INDOOR VALIDATION TEST ULTS. Lawther, JM. Pennsylvania State University Applied Research Laboratory, P.O. Box 30 State College sylvania 16804; Federal Highway Administration Turner Fairbank Hwy Res Cntr, 6300 Georgetown Pike McLean nia 22101. Mar 1985 141p. REPORT NO: FHWA-TS-85-203; FCP 3322-418. AVAILABLE FROM: National Technical mation Service 5285 Port Royal Road Springfield Virginia 22161

This volume discusses an experimental investigation of noise propagation and compares experimental results to predictions. The experiment entailed a simulation of highway noise radiation from sources on a roadway, to microphones mounted above selected ground covers. In some instances the roadway was screened by a vertical noise barrier. The experimental setup was assembled in a large gymnasium so as to minimize changes in environmental parameters and to assure wind-free sound propagation. Source frequencies were scaled up five-to-one over real highway emissions, so that received levels could be converted properly to those that would prevail at distances five times the actual gymnasium distances. Predictions were made of screened and unscreened L sub eq values at 16 microphone locations for each four types of floor covering and for two source line heights, representing car and truck source lines. The Penn State University Highway Transportation Noise prediction model (PSUHTRAN) was used to generate the predictions. PSUHTRAN predictions were in good-to-fair agreement with measurements. Measurement repeatability was excellent. The measured data pointed the way for improvements in the prediction model. See also Volume 1 - Executive Summary (TRIS 461878), Volume 2 - Final Report (TRIS 461879), Volume 4 - Highway Traffic Testing of PSUHTRAN Validity (TRIS 461881), Volume 5 - Basis for PSUHTRAN Highway Traffic Noise Prediction Model (TRIS 461882), and Volume 6 - PSUHTRAN/INDATA User's Manual (TRIS 461883).

EVELOPMENT OF A NEW HIGHWAY TRAFFIC NOISE PREDICTION MODEL. VOLUME 4: HIGHWAY TRAFFIC ESTING OF PSUHTRAN VALIDITY. Lawther, JM. Pennsylvania State University Applied Research Laboratory, P.O. Box 0 State College Pennsylvania 16804; Federal Highway Administration Turner Fairbank Hwy Res Cntr, 6300 Georgetown Pike McLean Virginia 22101. Mar 1985 188p. REPORT NO: FHWA-TS-85-204; FCP 3322-418. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

This volume describes the full-scale experiments that have been done to facilitate the development of the new highway traffic noise prediction model, PSUHTRAN, and to establish the validity of that model. Full-scale experiments have been conducted at three general locations. The first was a research site along a rural highway near Penn State University. The second was a set of freeway sites in the vicinity of Washington, DC, and the third was another set of sites in New Jersey. PSUHTRAN predictions are compared with available measurements and also, in some cases, with the predictions of the Federal Highway Administration (FHWA) Level 1 and 2 program, STAMINA. Attempts were made in the rural highway testing to establish procedures for defining the distribution of vehicle source intensity with vertical position on the vehicle. These were unsuccessful. The comparisons of predictions and measurements, though insufficient in scope to fully validate PSUHTRAN, were good enough to suggest that FHWA begin a second evaluation phase on the model. See also Volume 1 - Executive Summary (TRIS 461878), Volume 2 - Final Report (TRIS 461879), Volume 3 - Indoor Validation Test Results (TRIS 461880), Volume 5 - Basis for PSUHTRAN Highway Traffic Noise Prediction Model (TRIS 461882), and Volume 6 - PSUHTRAN/INDATA User's Manual (TRIS 461883).

DEVELOPMENT OF A NEW HIGHWAY TRAFFIC NOISE PREDICTION MODEL. VOLUME 5: BASIS FOR PSUHTRAN HIGHWAY TRAFFIC NOISE PREDICTION MODEL. Lawther, JM. Pennsylvania State University Applied Research Laboratory, P.O. Box 30 State College Pennsylvania 16804; Federal Highway Administration Turner Fairbank Hwy Res Cntr, 6300 Georgetown Pike McLean Virginia 22101. Mar 1985 140p. REPORT NO: FHWA-TS-85-205; FCP 3322-418. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

This volume provides the analytical basis for the PSUHTRAN highway traffic noise prediction model. The predicted value of L sub eq at a roadside location is written in terms of adjustments to a source-dependent reference level just as analyses of previous Federal Highway Administration model developments have done. Th model, however, computes some of the adjustments by accumulating the effects on a frequency band band basis. The reference level for PSUHTRAN in each frequency band is a free field level, deduced than directly taken from, the measured data. The effect of the ground is regarded as an intervention the effect of a noise barrier, and its computation is incorporated in a computation of an overall shielding whether a noise barrier is present or not. The report defines the computations involved at a given reflection factors, barrier diffraction factors, and distance correction factors. Complex vector notation facilitate coherent summation of sound propagation over the multiple paths between a source point and See also Volume 1 - Executive Summary (TRIS 461878), Volume 2 - Final Report (TRIS 461879), Indoor Validation Test Results (TRIS 461880), Volume 4 - Highway Traffic Testing of PSUHTRAN Va 461881), and Volume 6 - PSUHTRAN/INDATA User's Manual (TRIS 461883).

DEVELOPMENT OF A NEW HIGHWAY TRAFFIC NOISE PREDICTION MODEL. VOLUME 1: EXECUTIVE S Lawther, JM. Pennsylvania State University Applied Research Laboratory, P.O. Box 30 State College Pennsylvan Federal Highway Administration Turner Fairbank Hwy Res Cntr, 6300 Georgetown Pike McLean Virginia 22101 5p. REPORT NO: FHWA-TS-85-201; FCP 3322-418. AVAILABLE FROM: National Technical Information Service Royal Road Springfield Virginia 22161

This executive summary provides a quick look at the work done by the Pennsylvania State University development and testing of a new digital computer oriented highway traffic noise prediction model PSUHTRAN. This volume is the first of six telling the story of the development. The new model permits to account for a larger number of site parameters to which the values of received traffic noise levels are The source of the development work included indoor research experiments and outdoor field evaluation as the model design work itself. The model has now been delivered to the Federal Highway Administration, where a second extensive phase of model test and evaluation is anticipated. See also Volume 2 - Final Report (TRIS 461879), Volume 3 - Indoor Validation Test Results (TRIS 461880), Volume 4 - Highway Traffic Testing of PSUHTRAN Validity (TRIS 461881), Volume 5 - Basis for PSUHTRAN Highway Traffic Noise Prediction Model (TRIS 461882), and Volume 6 - PSUHTRAN/INDAT User's Manual (TRIS 461883).

DEVELOPMENT OF A NEW HIGHWAY TRAFFIC NOISE PREDICTION MODEL. VOLUME 2: FINAL REPORT. Lawther, JM. Pennsylvania State University Applied Research Laboratory, P.O. Box 30 State College Pennsylvania 16804; Federal Highway Administration Turner Fairbank Hwy Res Cntr, 6300 Georgetown Pike McLean Virginia 22101. Mar 1985 106p. REPORT NO: FHWA-TS-85-202; FCP 3322-418. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

This report, Volume 2 of a 6 volume series, is the final report on the development and partial validation of a new highway traffic noise prediction model called PSUHTRAN (for the Penn State University Highway Transportation Noise Model). The new model accounts for the effects of coherence and wavefront curvature in noise reflection from the ground. It also incorporates a more complete barrier attenuation algorithm than do previous models developed for the Federal Highway Administration (FHWA), and it provides for approximately defining the ground surface in terms of plane polygons. The surface covering of the ground, as characterized by its complex specific impedance and the dependence of that impedance on frequency, is used by PSUHTRAN in modeling the ground reflections. The report summarizes the model features and outlines both the scale model and the full scale freeway experiments that have been conducted to test the model. Other volumes of the report cover these topics in detail. See also Volume 1 - Executive Summary (TRIS 461878), Volume 3 - Indoor Validation Test Results (TRIS 461880), Volume 4 - Highway Traffic Testing of PSUHTRAN Validity (TRIS 461881), Volume 5 - Basis for PSUHTRAN Highway Traffic Noise Prediction Model (TRIS 461882), and Volume 6 - PSUHTRAN/INDATA User's Manual (TRIS 461883).

DEVELOPMENT OF A NEW HIGHWAY TRAFFIC NOISE PREDICTION MODEL. VOLUME 6: PSUHTRAN/INDATA USER'S MANUAL. Welz, JP. Pennsylvania State University Applied Research Laboratory, P.O. Box 30 State College Pennsylvania 16804; Federal Highway Administration Turner Fairbank Hwy Res Cntr, 6300 Georgetown Pike McLean Virginia 22101. Mar 1985 188p. REPORT NO: FHWA-TS-85-206; FCP 3322-418. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

This volume explains how to use a new computer highway noise model. The input data for the new model is described in detail. The manual also describes an interactive data entry program used in conjunction with the model. An example problem is included complete with a listing of a terminal session and program output. See also

Volume 1 - Executive Summary (TRIS 461878), Volume 2 - Final Report (TRIS 461879), Volume 3 - Indoor Validation Test Results (TRIS 461880), Volume 4 - Highway Traffic Testing of PSUHTRAN Validity (TRIS 461881), and Volume 5 - Basis for PSUHTRAN Highway Traffic Noise Prediction Model (TRIS 461883).

VELOPMENT OF COMPACT MICROSIMULATION FOR ANALYZING FREEWAY OPERATIONS AND DESIGN. Bullen, R (Pittsburgh University, Pittsburgh). Transportation Research Board. Transportation Research Record N841 1982 pp 18 4 Fig. 6 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW shington D.C. 20418

The development of the freeway microsimulation FOMIS is described and an example of the kind of analysis possible with it is given. The model uses the vehicle-behavior algorithms of the freeway component of the simulation INTRAS, which is the corridor microsimulation developed for the Federal Highway Administration. The integration of these algorithms into a revised model structure overcomes some traffic operations difficulties experienced with INTRAS, greatly improves model speed, and provides a simulation model that can run on computers of very limited capacity. As an example of its application, a weaving section on I-95 in Dade County, Florida, is analyzed. The resulting analyses indicate operating patterns not generally derivable with existing methods. Varied and unusual design solutions emerge from the analyses. A model of this kind, which uses the particular traffic algorithms of INTRAS, has a potential as a supplemental tool to established procedures for applied freeway design problems. It could also assist in research into weaving and merging behavior in complex situations. (Authors) This paper appeared in Transportation Research Board Record No. 841, Freeway Operations, Railroad-Highway Grade Crossings, and Evaluating Highway Improvements, 1982.

DEVELOPMENT OF GRAPHICS DISPLAYS FOR THE INTEGRATED TRAFFIC DATA SYSTEM. Santiago, AJ; Chin, S-M. Transportation Research Board. Transportation Research Record N1112 1987 pp 140-143 1 Fig.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

The development of interactive graphics displays for the Integrated Traffic Data System (ITDS) is described, and technical details on the hardware and software considerations, which, to a large extent, influenced the end product are provided. ITDS is a user-friendly, data base-driven interface to various traffic simulation and signal timing optimization programs. Although very useful and effective, ITDS relies extensively on the user's capability to load and maintain traffic data from queuing menus. By adding the graphics display interface, users are now able to efficiently load and maintain the data base, draw schematic displays of the data stored, efficiently determine their integrity, and significantly improve the quality of the data used as input to traffic models. This paper is oriented towards individuals who are, or will be, users of ITDS and traffic models, and individuals who are involved in the development of graphics software for transportation applications. This paper appeared in Transportation Research Record No. 1112, Highway Capacity and Flow Theory and Characteristics.

DEVELOPMENTAL STUDY OF IMPLEMENTATION GUIDELINES FOR LEFT-TURN TREATMENTS. Lin, H-J; Machemehl, RB (Texas University, Austin). Transportation Research Board. Transportation Research Record N905 1983 pp 96-105 13 Fig. 8 Tab. 10 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

At signalized intersections, the common treatment for improving left-turn bay or a separate left-turn phase. However, under given traffic conditions and geometric configurations, there have been no universally accepted guidelines for ascertaining the need for a left-turn treatment. In this research, the TEXAS traffic simulation model is employed to study the capacity and performance of left-turn movements at signalized intersections in order to devise warrants for left-turn treatments. Since left-turn performance is germane to left-turn capacity, existing methods for estimating left-turn capacity are thoroughly reviewed and a new method that can yield reasonable estimates for left-turn capacity under general conditions of left-turn movements is proposed. Furthermore, different measures of effectiveness are used to evaluate the performance of left-turn movements under various traffic conditions. With a set of delay criteria, critical conditions of left-turn movements are identified. Finally, a new capacity-based warrant is derived from the relationship between the critical left-turn volume and left-turn capacity. (Author) This paper appeared in Transportation Research Record No. 905, Traffic Flow, Capacity, and Measurements.

DIRECTIONAL WEIGHTING FOR MAXIMAL BANDWIDTH ARTERIAL SIGNAL OPTIMIZATION PROGRAMS. VOLUME 1. TECHNICAL REPORT. FINAL REPORT. Chang, ECP; Messer, CJ. Texas Transportation Institute Texas A&M University College Station Texas 77843; Federal Highway Administration Turner Fairbank Hwy Res Cntr, 6300 Georgetown Pike McLean Virginia 22101. Jul 1985 86p. REPORT NO: FHWA/RD-86/20. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

The maximizing progression bandwidth concept has been used to calculate optimal offsets in arterial signal systems for approximately 60 years. This study developed an algorithm for determining the best directional weighting for arterial bandwidth optimization programs, such as MAXBAND or PASSER II, to improve design and operation decisions especially with heavily directional arterial street movements during peak-hour conditions.

DIRECTIONAL WEIGHTING FOR MAXIMAL BANDWIDTH ARTERIAL SIGNAL OPTIMIZATION PROGRAMS. Chang, EC-P; Messer, CJ; Cohen, SL. Transportation Research Board. Transportation Research Record N1057 1986 pp 10-19 8 Fig. 6 Tab. 20 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

The concept of maximizing two-way progression to compute signal-timing plans for signalized arterials has been used for 60 years. One of the unknown questions that exists is how the available two-way band should be apportioned between the two directions of traffic flow. Until now, the two directions have been weighted in proportion to the ratio of the average volume in each direction. However, preliminary studies have indicated that it would be better to apportion the two-way progression bandwidths than to use the volume-ratio criterion alone. Described is a bandwidth weighting algorithm that is based on delay. A simple delay model developed for the PASSER II program was used to estimate delay. Through extensive testing, using the NETSIM model on nine real-world arterial data sets, it was found that three different expressions for the bandwidth ratio should be used; which expression was to be used depended on whether the directional volume ratio was less than 0.45, between 0.45 and 0.55, or more than 0.55. All three expressions involve the ratio of delay in the two directions. A blind test was performed by using six scenarios based on two real-world arterials that were not included in the nine test arterials used for preliminary testing. Based on comparisons using the NETSIM model, the result of this blind test indicated that the weighting algorithm developed in this research generally performed better than both the arbitrary equal-weighting and the MAXBAND average volume-ratio criteria, which have been used up to now. This paper appeared in Transportation Research Record N1057, Traffic Signal Systems.

DYNAMIC ANALYSIS OF LANE CLOSURE STRATEGIES. Mahmassani, HS; Jayakrishnan, R. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 114 NO. 4 Jul 1988 pp 476-496 Figs. Tabs. Refs. Apps.. REPORT NO: ASCE Paper 22622. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017

A dynamic simulation model is extended to represent traffic system disruptions in the form of lane closures. The model has two components: a macroparticle traffic simulator, and a user decisions component which comprises behavioral mechanisms governing the daily departure time decisions of commuters. The model is applied to the analysis of six alternative lane closure strategies associated with planned repair activities. Examples of model results are described, highlighting the tradeoffs between the performance of the system during the perturbation period and the final equilibrium state, as well as the trade-off between the schedule delay and the travel time experienced by system users during those periods.

DYNAMIC MODEL OF PEAK PERIOD CONGESTION. Ben-Akiva, M; Cyna, M; De Palma, A (Massachusetts Institute of Technolog Ministry of Transport, France; McMaster University, Canada). Pergamon Press Limited. Transportation Research. Part B: Methodological VOL. 18B NO. 4/5 1984 pp 339-355 17 Fig. 14 Ref.

This paper examines the problem of peak period traffic congestion and the analysis of alternative congestion relief methods. It presents a dynamic model of the queues and delays at a single point of traffic congestion because there is ample evidence to suggest that the major delays to users occur at bottlenecks. The model consists of a deterministic queuing model and a model of arrival rate as a function of travel time and schedule delay. A dynamic simulation model also describes the evolution of queues from day to day. The model is used to study the impacts of changes in capacity, total demands, flexibility of work start time and traffic control. Among the numerical results is a demonstration that additional capacity always significantly reduces the duration of the congestion period, but may result in a less significant improvement in maximum delays. (Author/TRRL)

NAMIC MODELS OF COMMUTER BEHAVIOR : EXPERIMENTAL INVESTIGATION AND APPLICATION TO THE ALYSIS OF PLANNED TRAFFIC DISRUPTIONS. MAHMASSANI, HS (UNIVERSITY OF TEXAS AT AUSTIN). ANSPORTATION RESEARCH PART A NV199N6 Nov 1990 PP 465-484 ENGLISH

CHOICE OF ROUTE AND DEPARTURE TIME BASED ON TRAFFIC SIMULATION INCORPORATING CONGESTION AND DELAY HANI S. MAHMASSANI (UNIVERSITY OF TEXAS AT AUSTIN)

YNAMIC TRAFFIC CONTROL SYSTEM SCOOT - FURTHER DEVELOPMENTS. Bretherton, RD. ENGINEERING OUNDATION. TRAFFIC CONTROL METHODS. PROCEEDINGS OF THE FIFTH 1990 337-9

The SCOOT (Split Cycle and Offset Optimization Technique) urban traffic control system is now operational at over 30 sites in the UK and in overseas cities, including Beijing (Peoples Republic of China), Hong Kong and Red Deer (Canada). SCOOT has been shown to reduce the delay to vehicles by an average of 12 percent compared to up-to-date TRANSYT fixed time plans and by 20 percent compared to fixed time plans which are about 3 years old. SCOOT is a fully adaptive system which collects data from vehicle detectors and then calculates and implements the settings which reduce delay and stops. The SCOOT computer program contains a traffic model of each section of road in the network and knows at any time the flow, queue, congestion and spare capacity throughout the network. This 'knowledge' of SCOOT can be used for purposes other than traffic control and research has been continuing to exploit its potential in two main areas: traffic management and traffic information.(A) For the covering abstract of the conference see IRRD 832076.

DYNEMO: A MODEL FOR THE SIMULATION OF TRAFFIC FLOW IN MOTORWAY NETWORKS. Schwerdtfeger, T (Technical University of Karlsruhe, West Germany). VNU Science Press Bv P.O. Box 2073 Utrecht Netherlands 90-6764-008-5. 1984 pp 65-87 12 Fig. 18 Ref.

The paper presents the simulation model dynemo which has been designed for the development, evaluation and optimization of traffic control systems for motorway networks. A new traffic flow model included with the simulation package combines the advantages of a macroscopic model (computational simplicity) with the advantages of a microscopic model (output statistics relating to individual vehicles). For each stretch in the network, the model needs as input a relationship between traffic density and mean speed and the distribution of free flow speeds. The new traffic flow model is validated by use of an example. The simulation package is implemented on a 16-bit microcomputer. A real network with a traffic control system has been simulated with the model. (Author/TRRL) Papers presented during the Ninth International Symposium on Transportation and Traffic Theory held in Delft the Netherlands, 11-13 July 1984.

EFFECT OF BUS TURNOUTS ON TRAFFIC CONGESTION AND FUEL CONSUMPTION. Cohen, SL (Federal Highway Administration). Transportation Research Board. Transportation Research Record N901 1983 pp 33-38 4 Fig. 3 Tab. 13 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

The NETSIM simulation model was employed to determine the energy impacts of using bus turnouts. Two sets of computer runs were made. The first one consisted of 80 runs of a single intersection with different values of independent variables. The second consisted of six runs of three different networks. The result was that bus turnouts were found to have some potential for improving the fuel efficiency of the general traffic stream but only at high values of volume-to-capacity ratios, high bus volumes, and long bus-loading times. (Author) This paper appeared in Transportation Research Record No. 901, Energy Impacts of Geometrics--A Symposium.

EFFECT OF CLEARANCE INTERVAL TIMING ON TRAFFIC FLOW AND CRASHES AT SIGNALIZED INTERSECTIONS. Zador, P; Stein, H; Shapiro, S; Tarnoff, P. Institute of Transportation Engineers. ITE Journal VOL. 55 NO. 11 Nov 1985 pp 36-39 9 Ref.. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

The timing of traffic signal clearance intervals (yellow and all-red phases) can affect accident rates at signalized intersections. When clearance intervals are not properly timed some drivers may be forced to choose between abruptly stopping or losing the cross-street red-light protection while crossing the intersection. Abrupt stopping can cause rear-end crashes, and the loss of cross-street red-light protection can cause right-angle crashes. Although driver response to yellow onset has been extensively researched, the effect on the rate of intersection crashes caused by departures from the recommended signal timing practice has not been systematically assessed. This article presents the highlights of a more extensive examination of this relationship.

EFFECT OF LEFT-TURN BAYS ON FUEL CONSUMPTION ON UNCONTROLLED APPROACHES TO STOP-SIGN-CONTROLLED INTERSECTIONS. Dvorak, DV; McCoy, PT (Nebraska University, Lincoln). Transportation Research Board. Transportation Research Record N901 1983 pp 50-53 4 Fig. 7 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

> Associated with the reductions in delay and stops that result from the provision of left-turn bays is a reduction in fuel consumption. Less delay and fewer stops mean less fuel consumed by vehicle idling and speed-change cycles. The objective of this research was to estimate the effect of the provision of left-turn bays on fuel consumption on uncontrolled approaches to stop-sign-controlled intersections over a range of volumes, approach speeds, and truck percentages on two-way, two-lane roadways. A series of paired computer simulation runs was conducted by using the NETSIM traffic simulation model to evaluate the fuel consumption of the traffic on the uncontrolled approaches with and without left-turn bays. A pairwise comparison of the NETSIM fuel-consumption output from these runs provided the measure of fuel savings due to left-turn bays. Over the range of conditions studied, the fuel savings varied from zero to more than 20 gal/h for traffic on the approach. The amount of the fuel savings was a complex function of approach volume, opposing volume, left-turn percentage, free-flow approach speed, and truck percentage. Graphs and adjustment factors were developed to describe this relation and provide a means of estimating the fuel savings associated with left-turn bays. (Author) This paper appeared in Transportation Research Record No. 901, Energy Impacts of Geometrics--A Symposium.

EFFECTIVENESS OF RELEASE TIME MODIFICATION IN ROAD NETWORKS WITH LIGHT SIGNAL SYSTEMS. PT. C. APPENDICES. Schlabbach, K. Technische Hochschule Darmstadt Germany. Jan 1990 202p German. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

> The objects of the research project are control processes for road networks, which consist of a combination of coordinated fixed time controls ('green wave') with release time modification depending on the traffic, as this combination makes a promising synthesis of the two control principles 'guiding the traffic' and 'matching to the traffic' possible. The method of investigation includes an extensive evaluation of the literature by which the process of designing 'green waves' and the many possibilities of modification of the release time were checked. In the second part of the investigations, the control processes of green wave with/ without release time modification were thoroughly tested in a suitable road network. In motorized individual traffic, distinct improvements in waiting times were obtained; speeds of travel and the number of stops were also favorably influenced by the use of release time modification. There were slight effects for the aspects of energy and harmful emitted substances. The OPNV also profited from the reduction in travel times. Pedestrians and cyclists also benefit from release time modification due to reduced waiting times. This part C of the final report contains the Appendices. There is also part B, with pictures and a volume of the text. In German.

EFFECTS OF ARTERIAL PLATOON PROGRESSION ON CAPACITY. Todd, K. Printerhall Limited. Traffic Engineering and Control VOL. 29 NO. 9 Sep 1988 pp 468-470 Figs. Refs.

> Platoon progression aims at reducing stops and delays in undersaturated conditions. Numerous factors militate against its effectiveness. Unfavorable intersection spacing, turning vehicles and platoon dispersion - the latter abetted by midblock friction, lane changes, unbalanced lane use and differences in vehicle and driver characteristics - all restrict the successful operation of progression to comparatively moderate traffic volumes, and they all tend to lower system capacity. Transferring green signal time to the arterial in order to maintain uninterrupted progression reduces cross flow capacity, while a split adjustment to increase cross flow capacity interferes with satisfactory progression on the arterial. Designed to minimize stops and delays, progression does not maximize system capacity as well; the two goals of minimum delay and maximum capacity are in conflict. The problems of traffic in free-flowing and in congested conditions, it has been said, are so different that different methods have to be employed in their solution: more efforts should be directed at capacity improvements and towards staving off the onset of congestion. Geometric improvements rather than signal timing strategies are the proper answer to capacity limitations.

EFFECTS OF DESIGN ELEMENTS ON MERGING CAPACITY. Skabardonis, A; McDonald, M. Institution of Highways and Transportation. Highways and Transportation VOL. 32 NO. 11 Nov 1985 pp 14-18 11 Fig. 4 Tab. 11 Ref.. AVAILABLE FROM: Institution of Highways and Transportation 3 Lygon Place, Ebury Street London SW1 England

> A microscope model was developed to simulate traffic behavior at grade separated interchanges. The model was calibrated and validated from a large UK data base and applied to assess the validity of current ramp entry designs.

The significance of design elements such as acceleration lane length, slip road length and gradient was estimated, and it was found that current design practice for ramp entries is generally inadequate. However, some designs would seem to be "more adequate" than others and the results explore the effects of changes in key parameters. (TRRL)

EFFECTS OF PROGRESSION QUALITY AND TRAFFIC FLOW NON-STATIONARITY IN DELAYS MODELS AT SIGNALIZED INTERSECTIONS. HIGHWAY CAPACITY AND LEVEL OF SERVICE. PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON HIGHWAY CAPACITY, KARLSRUHE, GERMANY, 24-27 JULY 1991. Chodur, J; Tracz, M. Balkema (AA) P.O. Box 1675 3000 BR Rotterdam Netherlands 90 5410 011 7. 1991 pp 91-97 3 Fig. 5 Tab. Refs.. AVAILABLE FROM: Balkema (AA) Publishers Old Post Road Brookfield Vermont 05036

> To allow for the effect of platooned vehicle arrivals on delays at signalized intersections, the 1985 Highway Capacity Manual (HCM-85) uses progression factors. Results of empirical validation studies of the HCM-85 delay model have shown that the modified model is more accurate and its calibration gave an expression similar to one presented in the NCHRP report. Based on results of simulation studies of the effects of non-stationary flow demands on traffic conditions, a modified form of Akcelik's delay expression is suggested.

EFFECTS OF PROHIBITING LEFT-TURNS AT SIGNALIZED INTERSECTIONS. FINAL REPORT. Habib, P; Thornhill, W; Kaplan, W. Polytechnic Institute of New York 333 Jay Street Brooklyn New York 11201 Federal Highway Administration Turner Fairbank Hwy Res Cntr, 6300 Georgetown Pike McLean Virginia 22101. Jul 1984 54p. REPORT NO: FHWA/RD-84/083; FCP 31A2-022. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

> This report presents the results of analyses conducted to determine the effects of prohibiting of left-turns at intersections on two-way streets without turning bays. The principal focus of the project was the development of a delay-prediction tool to describe the effect of left turns on through and right turn traffic. This required field measurements to calibrate NETSIM, the traffic simulation model, which was then used to generate results for a variety of traffic volumes, approach widths and other traffic variables. The report contains an assessment of the safety value of turn prohibitions as well as the best methods to control the prohibited turn under a variety of physical conditions.

EMERGING TECHNOLOGICAL TOOLS FOR DETAILED FREEWAY DESIGN AND OPERATIONAL ANALYSIS: TRAF-FRESIM, FSMTUTOR, AND FEDIT. Mekemson, J. and Kanaan, A. (VICOR Associates, Manassas, Va.). Proceedings of the 1991 Annual Meeting of the Institute of Transportation Engineers, Washington, D.C.

> This paper introduces the Federal Highway Administrations microscopic freeway simulation program (TRAF-FRESIM), FRESIM Tutorial program (FSMTUTOR), and input editor (FEDIT).

EMPIRICAL STUDY OF ON-THE-STREET OPERATION OF LRT AND BUSES IN CALGARY. Babalola, A; Morrall, JF (Calgary University, Canada). Institute of Transportation Engineers 9803 102A Avenue, 12th Floor Edmonton Alberta Canada. 1983 20p 7 Fig. 4 Tab. 6 Ref.

> Without careful engineering design, the operation of surface LRT may be characterized by delays due to other traffic and signal lights, and a high accident potential. In order to have a better understanding of the mixed-traffic behavior, an empirical study was conducted on the transit operation on Seventh Avenue, Calgary, Alberta. The objectives of this study were to highlight and measure some dominant factors that influence the behavior of buses and LRT; and to collect and analyze some relevant data pertaining to the system. This paper presents the approach used to accomplish these objectives. Although this comprehensive study only shows the present operating characteristics, the potential behavior due to changes in operating policies is still unknown. In view of this, a simulation model is currently being developed to use the result of this study to replicate the existing traffic condition and to ultimately forecast the potential behavior of surface LRT under various operating strategies, such as train length policy, various mix of bus and train, traffic signal plans and dwell times. (TRRL)

ENERGY AND EMISSION CONSEQUENCES OF IMPROVED TRAFFIC SIGNAL SYSTEMS. Kahng, SJ; May, AD (California University, Berkeley). Transportation Research Board. Transportation Research Record N881 1982 pp 34-41 11 Fig. 3 Tab. 23 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

The primary objective of this study was to evaluate the impacts of selected strategies for improvement of traffic signal systems and to develop policy guidelines for the strategies in light of current realities such as increasing passenger delay on surface streets, high costs and scarcity of fuels, and concern about the environment. The existing simulation and optimization model, TRANSYT6C, was applied to a selected study arterial, San Pablo Avenue in Berkeley, California. Two basic categories of traffic signal timing improvement strategies were evaluated: (a) splits and offsets optimization and (b) optimal cycle length selection. A series of sensitivity analyses was conducted to determine variations in the impact effects of the strategies under different operational environments in terms of changed levels of traffic flow. The effects of different objective functions were also investigated and included. The major findings of this investigation include the following. For a given cycle length, optimization of splits and offsets based on either the minimization of passenger delay or fuel consumption also led to near-minimum value for all other measures of effectiveness. Passenger delay and vehicle emission were further reduced by shorter cycle lengths; however, total stops were further reduced by longer cycle lengths. Fuel consumption was relatively less sensitive to changes in cycle length. As the level of traffic flow increased, a moderate cycle length rather than a short cycle length was preferred in order to minimize fuel consumption. Trade-offs between passenger hours saved per gallon of fuel consumed were identified for different cycle lengths and flow levels. (Author) This paper appeared in Transportation Research Record No. 881, Traffic Control Devices and Traffic Signal Systems.

ENERGY SAVINGS THROUGH SIGNAL TIMING OPTIMIZATION AND COORDINATION. McGill, JA; Degroot, P; Ugge, A (Ontario Ministry of Transportation & Communic, Can; Delcan Canada Limited). Wyllie and Ufnal Limited 1 Greensboro Drive, Suite 300 Rexdale Ontario Canada. 1982 pp 236-256 4 Fig. 4 Tab. 8 Ref.

The primary purpose of the research study described in this paper was to examine the potential impacts of properly timed and coordinated traffic signals on the energy efficiency of road and street networks and to provide a very simple practical method for evaluating fuel savings. Since traffic signal timing does not directly reduce the distance travelled, it has been assumed that excess fuel consumption is a product of unnecessary stops and delays. A number of off-line traffic signal optimization procedures have been developed which attempt to optimize traffic signal operations by minimizing network stops and delays. As one such program stop has proven to be both efficient and effective and was selected for use in this study. For the covering abstract of the conference see TRIS 378581. (Author/TRRL) Proceedings of the 7th Annual Conference on Cost Effective Measures for Transport Improvements, Chelsea Inn, Toronto, Canada, May 30 to June 2, 1982.

ENGINEERING STRATEGIES FOR MAJOR RECONSTRUCTION OF URBAN HIGHWAYS. VOLUME 2. APPLICATION TO THE I-5 RECONSTRUCTION PROJECT. FINAL REPORT. Recker, WW; Waters, CD; Leonard, JD. California University, Irvine Institute of Transportation Studies Irvine California 92717; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590; California Department of Transportation 1120 N Street Sacramento California 95814. Dec 1985 291p. REPORT NO: FHWA/CA/UCI/ITS/RR-1. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

The research is directed toward developing a consistent methodology to assess the impacts of traffic disruption due to major transportation reconstruction/rehabilitation projects during the period of implementation. The approach taken in the research uses state-of-the-art traffic simulation models to: (1) estimate the performance of the transportation system during the construction phases, and (2) evaluate alternate construction and traffic redirection strategies to minimize both the direct and indirect losses associated with the construction/rehabilitation. The research results in the development of a convenient tool to assist both the traffic engineer and the transportation planner in selection of reasonable reconstruction/rehabilitation schedules. See also Volume 1, PB88-230883.

ENHANCED FREFLO: MODELING OF CONGESTED ENVIRONMENTS. Rathi, AK; Lieberman, EB; Yedlin, M. Transportation Research Board. Transportation Research Record N1112 1987 pp 61-71 5 Fig. 9 Tab. 7 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

Preliminary work with the FREFLO macroscopic freeway traffic simulation model has revealed some limitations in the model's ability to realistically simulate some congested flow conditions. The formulation and implementation of an approach that modifies FREFLO so as to address these limitations is described. This approach yields realistic simulation results for moderate, as well as severe, congested flow conditions. The basic formulation of FREFLO and the modifications under this approach are presented. The problems observed under congested flow conditions are described and simulation results from test networks are shown. This paper appeared in Transportation Research Record No. 1112, Highway Capacity and Flow Theory and Characteristics.

ENTERING HEADWAY AT SIGNALIZED INTERSECTIONS IN A SMALL METROPOLITAN AREA. Lee, J; Chen, RL. Transportation Research Board. Transportation Research Record N1091 1986 p 117-126 1 Fig. 13 Tab. 7 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

The entering headway is a parameter of fundamental importance to traffic engineers. It has major applications in intersection capacity and signal timing. However, the attention given to this matter appears to be inadequate. It was indicated by a literature review that past efforts tended to be infrequent, fragmented, and limited in scope. No studies were found using data from small cities or investigating factors that affect entering headways. This study, aimed at measuring entering headways in a small city and examining six factors, was conducted on sites in Lawrence, Kansas. Entering headway values from a total of 1,899 traffic queues were recorded by using video camera equipment. From the data, mean entry headways of vehicles 1 through 12 were found to be 3.80, 2.56, 2.35, 2.22, 2.16, 2.03, 1.97, 1.94, 1.94, 1.78, 1.64 and 1.76. Of the six factors studied, the following were also found: the signal type and the time of day have little influence on vehicular entering headways; vehicles in the inside lane of an intersection approach have lower entering headways than vehicles in the outside lane; vehicles in an intersection approach with lower speed limits have higher entering headways; vehicles in intersection approaches of streets with lower functional classifications have higher entering headways; and longer queue lengths appear to produce shorter entering headways for vehicles. However, because of data limitations, findings on the factors studied shall be viewed as only preliminary. This paper appeared in Transportation Research Record N1091, Traffic Flow Theory, Characteristics, and Highway Capacity.

ESTIMATING TIME-DEPENDENT TRIP MATRICES FROM TRAFFIC COUNTS. Willumsen, LG (University College, London). VNU Science Press Bv P.O. Box 2073 Utrecht Netherlands 90-6764-008-5. 1984 pp 397-411 1 Tab. 15 Ref.

The analysis of dynamic congestion problems in urban areas often requires the use of trip matrices estimated for different consecutive time periods, typically 15-20 minutes. The paper describes an extension of an entropy maximizing model to estimate trip matrices from traffic counts to cover this requirement. The new model was implemented and tested in combination with Contram, a traffic management simulation model developed at the Transport and Road Research Laboratory. The results from these tests were very encouraging as the matrices obtained were more accurate than those resulting from using simpler approaches. A further extension to the basic model to incorporate variable accuracy of traffic counts is also discussed. (Author/TRRL) Papers presented during the Ninth International Symposium on Transportation and Traffic Theory held in Delft the Netherlands, 11-13 July 1984.

ESTIMATION OF LEFT-TURN TRAFFIC PARAMETERS. Lin, FB; Nadratowski, TT (Clarkson College of Technology). American Society of Civil Engineers. ASCE Journal of Transportation Engineering VOL. 109 NO. 3 May 1983 pp 347-362 11 Ref.. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

This study examines whether signal setting effects are significant enough to warrant modifications of existing models. It analyzes relationship of the left-turn movement to signal settings and the presence of one and two opposing lanes on the basis of existing understanding and computer simulation.

ESTIMATION OF ROAD USER COST FACTORS BY ROAD TRAFFIC SIMULATION. GYNNERSTEDT, G. PRESSES DE L'ECOLE NATIONALE DES PONTS ET. COLLOQUE INTERNATIONAL SUR LES ROUTES ET LE VOL. 1 1984 PP 349-353 ENGLISH

G. GYNNERSTEDT ILLUSTRATED NOTE: SOURCE IS MONOGRAPHIC, NOT A SERIES PRESSES DE L'ECOLE NATIONALE DES PONTS ET CHAUSSEES COLLOQUE INTERNATIONAL SUR LES ROUTES ET LE DEVELOPPEMENT 1984 : PARIS, FRANCE ROUTES ET DEVELOPPEMENT

EVALUATING TRAFFIC CAPACITY AND IMPROVEMENTS TO ROAD GEOMETRY. Hoban, CJ. International Bank for Reconstruction & Development 1818 H Street, NW Washington D.C. 20433 0-8213-0965-X. 1987 157p. REPORT NO: TP-74. AVAILABLE FROM: International Bank for Reconstruction & Development 1818 H Street, NW Washington D.C. 20433

The geometric standards of a road, such as width, minimum curve radius, and maximum grades, can have a major effect on the costs of road construction and maintenance and on the speed, safety, and vehicle operating costs experienced by those who travel on the road. The report investigates methods for evaluating traffic capacity and improvements to road geometry in order to determine economically justified levels of investment in road geometry. A number of models are available for predicting speeds and operating costs for isolated vehicles as a function of road geometry. Of these the World Bank's Highway Design and Maintenance Standards Model (HDM-III) was found to have some advantages. The report concentrates on the development of simple models for incorporating the effects of increasing traffic flow into the road evaluation process. Also available in microfiche only from NTIS as PB88-140629/WTS.

EVALUATION OF 1984 LOS ANGELES SUMMER OLYMPICS TRAFFIC MANAGEMENT. FINAL REPORT. Giuliana, G; Haboian, K; Rutherford, K; Prashker, J; Recker, W. California University, Irvine Institute of Transportation Studies Irvine California 92717. Apr 1987 156p Figs. Tabs. Refs. 1 App.. AVAILABLE FROM: California University, Irvine Institute of Transportation Studies Irvine California 92717

The analysis of the Transportation System Management plan employed during the 1984 Los Angeles Summer Olympics shows that the program was a success and that satisfactory conditions were maintained during the event. The study reported here consisted of 3 parts. First a descriptive analysis of highway system performance was made in which traffic volumes, congestion, truck traffic, vehicle occupancy, and traffic accidents were investigated. Truck traffic was evaluated on the basis of visual counts at selected freeway screenlines. The second part of the research analyzed the commuter travel behavior during the Olympics. The analysis was based on a survey of employees at four downtown Los Angeles work sites. The third part of the research was a simulation study of traffic conditions during the Olympics. Highway system performance during the Olympics is discussed, and the results are presented of the downtown employee travel survey conducted in order to document work trip travel behavior during the olympics. Details of the simulation study are described, as well as that of the calibration procedures and case study. The study results are summarized and policy implications are discussed. Prepared under research contract RTA 13945-55B579

EVALUATION OF BUS LANES. Hounsell, NB; McDonald, M. TRANSPORT AND ROAD RESEARCH LABORATORY. TRRL CONTRACTOR REPORT NCR 8 1988 216P. REPORT NO: 7

This study relates to the evaluation of bus lanes. It has concentrated on deriving methods for predicting the principal effect of bus lanes, which is on the journey times of priority and non-priority vehicles, although all impacts are considered. This was undertaken by initially collecting data at 22 with-flow and 3 contra-flow bus lanes throughout the UK, covering parameters such as traffic flows and journey times for priority and non-priority vehicles. Such measurements allowed estimates to be made of the maximum journey time (and associated cost) savings for priority vehicles due to the bus lane. However, the prediction of the effects of the bus lanes on non-priority traffic required an assessment to be made of the suitability of three computer-based traffic models, trafficq, contram and blamp, and their application to all or a sample of the study sites. This application involved initial 'calibration' of the models to reflect existing traffic conditions at each site followed by further modelling with the bus lane(s) removed to obtain predictions of 'without' bus lane journey times. These results have enabled predicted economic benefits/disbenefits of each bus lane to be determined. A step-by-step procedure for evaluating bus lanes, using either modelling or non-modelling techniques as appropriate, has also been developed and is described in the report. This procedure is illustrated using data from two bus lanes recently introduced in London, where 'before-and-after' surveys were carried out which have also allowed elements of the evaluation procedure to be validated. For other studies undertaken as part of the review of bus priority measures see contractor reports nos 88 and 89 (IRRD 816384 and 816385 respectively).

EVALUATION OF COMPUTER PROGRAMS FOR PREDICTING THE PERFORMANCE OF SIGNALIZED INTERSECTIONS. Rao, TSCS. California University, Berkeley Department of Civil Engineering Berkeley California 94720. Jan 1988 193p. REPORT NO: RAO/TRAFFIC-88/02. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

The study evaluated several computer software packages for capacity and traffic-performance analysis of signalized intersections. For this purpose an extensive inventory has been set-up consisting of several computer software packages and four important programs have been selected. The evaluation is based on applying the four computer programs to four intersection data sets for which extensive input data are available. Cost related and effectiveness-related criteria have been established in order to evaluate the four programs. The cost related criteria included time needed to learn the method, input requirements, clarity and completeness of methodology and time needed to apply the method. The effectiveness-related criteria included degree of disaggregation, capacity performance outputs, flexibility of use and user friendliness.

EVALUATION OF CONTROL STRATEGIES FOR BUS PREEMPTION OF TRAFFIC SIGNALS. Smith, MJ. New Jersey Department of Transportation Bureau of Transportation Systems Research, 1035 Parkway Ave Trenton New Jersey 08625; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Mar 1985 Final Rpt. 53p 5 Fig. 2 Tab. 3 App.. REPORT NO: FHWA-NJ-RD-85-003. AVAILABLE FROM: New Jersey Department of Transportation Bureau of Transportation Systems Research, 1035 Parkway Ave Trenton New Jersey 08625

An algorithm which allows signal preemption by buses was developed for the NETSIM model. It was programmed into this model by FHWA. Subsequently, this algorithm was tested by comparing the results generated by the NETSIM model with results obtained from a manual implementation of bus preemption at one intersection in the field. (Author)

EVALUATION OF DYNAMIC FREEWAY FLOW MODEL BY USING FIELD DATA (DISCUSSION). Derzko, NA; Ugge, AJ; Case, ER; Payne, HJ (Ontario Ministry of Transportation & Communic, Can). Transportation Research Board. Transportation Research Record N905 1983 pp 52-60 12 Fig. 1 Tab. 14 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

An attempt to calibrate and validate a dynamic freeway model by using real data from Queen Elizabeth Way in Ontario, Canada, is described. The model used in this research is the one developed by H. Payne; one of the Phillips kinetic models was also applied for comparison purposes. The overall conclusion is that the models exhibit instabilities in their behavior and do not track real road data correctly. (Author) This paper appeared in Transportation Research Record No. 905, Traffic Flow, Capacity, and Measurements.

EVALUATION OF FREEWAY IMPROVEMENT ALTERNATIVES USING CORFLO. Liu, C. (AEPCO, Rockville, Md.) and Kanaan, A. (VIGGEN Corporation, Reston, Va.). Proceedings of the American Society of Civil Engineers Microcomputers in Transportation Conference, 1992.

This paper describes the application of the CORFLO simulation model on a section of the I-70 freeway in Columbus, Ohio. CORFLO is an integrated traffic simulation system for corridors and is a part of the TRAF system developed by the Federal Highway Administration.

EVALUATION OF ROADWAY SITES FOR QUEUE MANAGEMENT. Final rept. Miller-H.J.; Demetsky-M.J. Virginia Transportation Research Council, Charlottesville. Federal Highway Administration, Richmond, VA. Virginia Div. Virginia Dept. of Transportation, Richmond. VTRC92R5, FHWAVA92R5. Dec 91. 126p.

The study addresses the problem of queueing on highway facilities, wherein a large number of computerized methods for the analysis of different queueing situations are available. A three-tier classification system of the methodologies was used with the following categories: dedicated techniques, classical queueing theory, and simulation. A knowledge base for selecting an appropriate technique for a specific facility and problem is provided. The utilization of the video camera to capture queueing data in the field is described and applied to evaluate alternative methods to analyze queueing at signalized intersections. The evaluation revealed three distinct approaches from the respective categories for the evaluation of queueing at signalized intersections: the HCM method, the vacation-server queueing model, and TRAF-NETSIM. It was found that the queueing model and simulation methods offer flexibility over the more structured, dedicated HCM method and should be considered in the analysis of other situations as well as of signalized intersections.

EVALUATION OF SIGNAL TIMING AND COORDINATION PROCEDURES: VOLUME II: FIELD MANUAL. Arnold, ED, Jr. Virginia Highway & Transportation Research Council P.O. Box 3817, University Station Charlottesville Virginia 22903; Virginia Department of Highways and Transportation 1221 East Broad Street Richmond Virginia 23219 Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Sep 1985 62p 19 Fig. 6 Tab. 13 Ref.. REPORT NO: FHWA-VA-86-08-09; VHTRC 86-R9. AVAILABLE FROM: Virginia Highway & Transportation Research Council P.O. Box 3817, University Station Charlottesville Virginia 22903

Based on a review of available literature, recommended procedures for timing the various types of signals are provided. Specifically, procedures are included for both pretimed and vehicle-actuated control-system. Simplicity and ease of use are emphasized as the targeted users are field technicians and those responsible for signals in small cities and towns. This Field Manual has been prepared to provide a concise and easily applied set of procedures. Detailed theory and logic behind the procedures are provided in a companion document entitled Technical Report, as are brief descriptions of current computer programs which provide timing information. The Technical Report also presents the results of a questionnaire survey which had the objective of determining the types of signal equipment used in Virginia. (Author)

EVALUATION OF SIGNAL TIMING VARIABLES BY USING A SIGNAL TIMING OPTIMIZATION PROGRAM. Mao, ACM; Messer, CJ; Rogness, RO (Texas State Department of Highways & Public Transp; Texas Transportation Institute; North Dakota State University). Transportation Research Board. Transportation Research Record N881 1982 pp 48-52 12 Fig. 11 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

This paper presents the results of a limited study to evaluate the effects of signal timing variables on the selection of the signal timing plan and the resulting measures of effectiveness from a signal timing optimization program. The TRANSYT computer program was used for the evaluation. Several series of sensitivity tests were performed to study the interrelations among number of signalized intersections, signal spacing, cycle length, and traffic flow conditions. The evaluation showed varying effects of the signal timing variables on the results. There appeared to be consistency in results for different signal system configurations (number of signals). With fixed signal spacing and number of signals, the measure of effectiveness (performance index) increased with volume level and cycle length. The effect of signal spacing illustrated differences in the behavior of the performance index. These results show the trade-offs between signal spacing and cycle length for a fixed number of signals and traffic volume level. As the cycle length was increased, the performance index also increased (although sometimes only slightly). This may suggest the use of the shortest practical cycle length for a progressive operation. (Author) This paper appeared in Transportation Research Record No. 881, Traffic Control Devices and Traffic Signal Systems.

EVALUATION OF THE DYNAMIC ARTERIAL-RESPONSIVE TRAFFIC SYSTEM (DARTS). Lee, CE. Texas University, Austin Center for Transportation Research Austin Texas 78712 243-1F; Texas State Department of Highways & Public Transp Transportation Planning Division, P.O. Box 5051 Austin Texas 78701. Aug 1982 Final Rpt. 67p. REPORT NO: FHWA/TX-82/25+243-1F. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

DARTS is an auxiliary solid-state electronic timing and switching device which can be connected directly to any modern (NEMA Standards) full-actuated traffic signal controller for the purpose of coordinating the timing of pairs of such controllers at adjacent intersections in such a way that progressive movement is provided for platoons of traffic traveling along an artery. No modification of the basic controller installation nor timing is required, and only one pair of conductors is needed to transmit the necessary platoon identification information from the upstream intersection. Functioning of the platoon identification and progression timing sequence provided by DARTS is described in the report along with functions which monitor traffic on conflicting phases in order to preclude excessive delays and queue buildups from occurring on these approaches. The results of field observations made in San Antonio while two early versions of DARTS were being evaluated are presented. Measurements of traffic volume, delay, number of stops, and speed on the arterial were recorded at four intersections during the Bandera Road study, and volume and delay observations of traffic on conflicting signal phases were also noted. Compared to normal individual intersection actuated control, there was no pronounced effect on any of these parameters either when DARTS was operated for the outbound direction only or when both outbound and inbound platoon progression was attempted simultaneously. Delay to traffic on signal phases which conflicted with artery progression was slightly higher when DARTS was operated, but not excessive. Additional features have been incorporated into later models of DARTS, and further application of the system in appropriate situations is recommended. Proper setting of the several timers is critical; therefore, more experience is needed in order to realize the full potential of this new concept. A postscript refers to two recent installations in Texas where improved traffic performance is reported.

EVALUATION OF THE OPTIMIZED POLICIES FOR ADAPTIVE CONTROL STRATEGY. FINAL REPORT. Farradyne Systems, Incorporated 3206 Tower Oaks Boulevard Rockville Maryland 20852; Federal Highway Administration Turner Fairbank Hwy Res Cntr, 6300 Georgetown Pike McLean Virginia 22101. May 1989 130p. REPORT NO: FHWA-RD-89-135; NCP 3B1e 1022. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

The OPAC strategy is an on-line traffic signal control algorithm designed to optimize the performance of traffic signals at isolated intersections using delay as the performance criterion. OPAC-RT is a traffic signal control system which implements the OPAC strategy in real time. The system uses traffic data collected from detectors located well upstream (400 to 600 ft) of the stop bar on all approaches to an intersection. Optimum signal timing is determined using minimum and maximum green constraints and does not require a fixed cycle length. This report describes three field tests of the on-line OPAC strategy. The results indicate that OPAC performs better than well timed actuated signals, particularly at greater demand levels.

EVALUATION OF VEHICLE ACTUATED SIGNAL CONTROL IN URBAN STREET NETWORK. Joubert, HS; Lockwood, DN. National Institute for Transport & Rd Res, S Af P.O. Box 395 Pretoria 0001 Transvaal South Africa. Aug 1986 18p. REPORT NO: CSIR-RR-468. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

Vehicle actuated signal control is generally accepted as the optimum signal control strategy at isolated intersections. The paper describes recent research on defining isolated intersections and recommends minimum distances from upstream signals for independent signal control in various operating environments. The timing of vehicle actuated signals is discussed, based on the results of a simulation analysis. The results for a field validation study on the NETFLO traffic network simulation program are described. Based on the results it is concluded that the program can be used with confidence in the evaluation of vehicle actuated signal networks. Pub. in Proceedings of the Annual Transportation Convention (ATC 1986), Pretoria, South Africa, Paper 3C/2, v3C 15p Aug 86.

EVALUATION TOOLS OF URBAN INTERCHANGE DESIGN AND OPERATION. Radwan, AE; Hatton, RL. Transportation Research Board. Transportation Research Record N1280 1990 pp 148-155 6 Fig. 5 Tab. 11 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

Urban interchanges are a means of facilitating traffic movements between arterial streets and freeway ramps. The single point diamond interchange (SPDI) and the conventional diamond interchange are two specific interchange designs. Essentially, both designs can be treated as signalized intersections. Deviation from the standard signalized intersection operation can be attributed to factors such as longer clearance interval, larger turning radii, different phasing schemes, and different signal offsets between adjacent intersections. Available computer software was reviewed to determine its ability to simulate the operation of the urban diamond interchanges. Data collected at two sites in the Phoenix metropolitan area were used. Five programs were chosen: PASSER II-87, PASSER III-88, TRANSYT-7F, TRAF-NETSIM, and TEXAS. An assessment of each program was conducted to determine its ability to simulate both the SPDI and the conventional diamond interchange. It was concluded that the PASSER III-88 and the TEXAS models simulated the SPDI fairly well. All models except the TEXAS model were able to simulate the conventional diamond design. This paper appears in Transportation Research Record No. 1280, Transportation Management, HOV Systems, and Geometric Design and Effects 1990.

EVIPAS: A COMPUTER MODEL FOR THE OPTIMAL DESIGN OF A VEHICLE-ACTUATED TRAFFIC SIGNAL. Bullen, AGR; Hummon, N; Bryer, T; Nekmat, R. Transportation Research Board. Transportation Research Record N1114 1987 pp 103-110 8 Tab. 11 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

The EVIPAS model described is a computer program designed to analyze and optimize a wide range of intersections, phasing, and controller characteristics of an isolated fully actuated traffic signal. It will evaluate almost any phasing combination available in a 2- to 8-phase NEMA type controller and similar phasing structures for a Type 170 controller. The model will provide optimum timing settings for pretimed, semi-actuated, fully actuated, or volume-density control using a variety of measures of effectiveness chosen by the user. A wide range of geometric features, phasing alternatives, and detector layouts can be evaluated. EVIPAS combines a user friendly input module with a multivariate gradient search optimization module and an event-b... microsimulation. It has been field-tested and validated and replicates well-observed vehicle and... The model is programmed in Fortran 77 and currently can run on VAX 8600 and IBM 3080 mainfra... appeared in Transportation Research Record No. 1114, Traffic Control Devices and Rail-Highway G...

EXPERT SYSTEM FOR TRAFFIC SIGNAL SETTING ASSISTANCE. Zozaya-Gorostiza, C; Hendrick... Society of Civil Engineers. Journal of Transportation Engineering VOL. 113 NO. 2 Mar 1987 pp 108-12... App.. REPORT NO: ASCE Paper 20590. AVAILABLE FROM: American Society of Civil Engineers 345 Ea... York New York 10017

An experimental knowledge-based expert system to assist in traffic signal setting for isolated... presented. In contrast to existing computer aids, the system can be applied to intersections of... geometries. Algorithmic processes to evaluate signal settings and decision tables to identify tra... are invoked by the expert system; phase distribution of flows is performed by applying heuristic ru... was written in the OPS5 expert system environment. Advantages and disadvantages of the... programming approach relative to conventional algorithmic processes in the traffic engineerin... described.

FEDIT USER INTERFACE FOR FHWA'S TRAF-FRESIM MODEL. Mekemson, J. (VICOR Associates, Inc.)... Proceedings of the 1992 American Society of Civil Engineers Microcomputers in Transportation Conferen...

This paper presents the FEDIT Data Input Preprocessor for FHWA's soon-to-be-released micro... simulation program - FRESIM. An efficient method of preparing the input data, while minimizing da... and the typical "code-execute-debug" cycle, is through the use of the FRESIM Freeway EDITor prog...

FHWA-SPONSORED PROJECT PROVES COST EFFECTIVENESS OF SIGNAL TIMING OPTIMIZATION... Schoene, GW (Federal Highway Administration). Transportation Research Board. Transportation Research Ne... 1982 pp 2-4 2 Tab. 1 Phot.. AVAILABLE FROM: Transportation Research Board Publications Office 2101... Avenue, NW Washington D.C. 20418

The recently completed National Signal Timing Optimization Project, initiated by the Federal Highway Ad... (FHWA) in 1979 as a fuel conservation effort, is part of an overall effort to encourage states and mu... undertake traffic signal timing optimization projects to improve the quality of urban driving and thereby ... consumption. In order to accomplish these objectives, two primary activities were undertaken: (a) dev... the TRANSYT-7F signal timing optimization program and User's Manual, and provision of training in the... program; and (b) application of the program in 11 cities nationwide to evaluate the effectiveness of the... signal timing plans and to collect data on the needed resources. The FHWA estimates that just by opti... signal timing (without considering signal system hardware improvements) at the 130,000 intersections th... of coordinated signal systems nationwide and at most of the other 110,000 noncoordinated signalized inte... 2 million gallons of gasoline per day could be conserved. Assuming an average gasoline cost of $1.35 per... this represents a daily saving of $2.7 million in direct fuel costs to consumers. When needed signal ... hardware improvements at all of the nation's 240,000 intersections are also considered, these estimates ... to daily savings of 5 million gallons of gasoline and $6.75 million in direct fuel costs. Ray A. Barnhart, FHWA... Administrator, noted that "this project proved that signal timing optimization is a very cost-effective, and painless... way of conserving fuel." (Author)

FIRST-GENERATION UTCS SIMULATION. Eiger, A; Chin, S-M (Rensselaer Polytechnic Institute). Transportation Research Board. Transportation Research Record N906 1983 pp 57-60 5 Fig. 5 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

The development of an urban traffic control system (UTCS) simulation program that comprises the first-generation UTCS software (extended version) and a network traffic simulation model (NETSIM/ICG) is described. The simulator provides pseudo-real-time graphic displays of surveillance data and system performance measures in addition to the printed outputs of both the UTCS software and the NETSIM model. It can simulate both automated and manual modes of control. The development of the simulator supports current and future research in urban traffic control systems, provides a tool for evaluation before implementation of these systems, and is potentially useful as a training aid for UTCS operators. This paper appeared in Transportation Research Record No. 906, Urban Traffic Systems.

FLASHING SIGNALS IN PEAK PERIODS. DEMETSKY, MJ; MORENO, LE (VIRGINIA HIGHWAY AND TRANSPORTATION RESEARCH; COUNCIL). TRANSPORTATION QUARTERLY VOL. 39 JAN19 1985 ENGLISH. REPORT NO: 85

CONTENTS: NETSIM TRAFFIC SIMULATION COMPARING MEASURES OF EFFECTIVENESS UNDER REGULAR AND FLASHING SIGNAL OPERATIONS DURING PEAK TRAFFIC MICHAEL J. DEMETSKY AND LUIS E. MORENO (VIRGINIA HIGHWAY AND TRANSPORTATION RESEARCH COUNCIL)

FLOW AT ROUNDABOUT ENTRIES. Chin, HC; McDonald, M (Universities Of Singapore And Southampton; Southampton University, England). PTRC Education and Research Services Limited. Planning & Transport Res & Comp, Sum Ann Mtg, Proc 1984 pp1-11 3 Fig. 2 Tab. 10 Ref.

Hitherto the entry/circulating flow relationship at roundabout entries has been studied by either a semi-empirical or an empirical approach. A new approach which involves simulating traffic at roundabouts on a computer is now considered. The simulation has been applied to study the interaction between the entry and circulating flows at five entry sites. Comparison of results from the simulation model with observed data shows that the simulation represents reality fairly well. The simulation also predicts as well as, if not better than, two of the generalized relationship established by the former approaches. For the covering abstract of the seminar see TRIS 450556. (Author/TRRL) Proceedings of Seminar L, Traffic Operation and Management; Held at the 12th PTRC Summer Annual Meeting, University of Warwick, England, From 10-13 July 1984, Volume P, 254.

FLOW PROFILE COMPARISON OF A MICROSCOPIC CAR-FOLLOWING MODEL AND A MACROSCOPIC PLATOON DISPERSION MODEL FOR TRAFFIC SIMULATION. Mekemson, J., VICOR Associates, Manassas, Va. and Gantz, D. George Mason University, Fairfax, Va. 1990 Winter Simulation Conference Proceedings.

A comparison of the underlying models of traffic flow in a Federal Highway Administration microscopic traffic simulation program and macroscopic traffic signal optimization/simulation program was conducted. The original objective was the parameter calibration of a macroscopic platoon dispersion flow model of a simulated "group" of vehicles discharging from a traffic signal controlled intersection approach. The basis of the calibration was to be the observed platoon dispersion flow resulting from the microscopic simulation of "individual" vehicles departing from a similarly modelled traffic signal controlled intersection approach. In generating the data needed for such a calibration and subsequent comparison, a deficiency in the microscopic traffic simulation program was found that needs to be eliminated before such a calibration can be deemed beneficial.

FREESIM: A MICROSCOPIC SIMULATION MODEL OF FREEWAY LANE CLOSURES (ABRIDGMENT). Rathi, AK; Nemeth, ZA. Transportation Research Board. Transportation Research Record N1091 1986 p 21-24 1 Tab. 12 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

Development of a model to simulate traffic operations at freeway lane closures is described. The model logic is based on a rational description of the behavior of the drivers in a freeway lane-closure situation. The simulation program is written in SIMSCRIPT II.5 programming language. An application of the model is given with evaluation of potential safety impacts of reduced speed zones in freeway lane closures at different levels of assumed driver compliance. This paper appeared in Transportation Research Record N1091, Traffic Flow Theory, Characteristics, and Highway Capacity.

FREEWAY CAPACITY AND FLOW RELATIONSHIPS. HIGHWAY CAPACITY AND LEVEL OF SERVICE. PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON HIGHWAY CAPACITY, KARLSRUHE, GERMANY, 24-27 JULY 1991. Wemple, EA; Morris, AM; May, AD. Balkema (AA) P.O. Box 1675 3000 BR Rotterdam Netherlands 90 5410 011 7. 1991 pp 439-455 14 Fig. 3 Tab. Refs.. AVAILABLE FROM: Balkema (AA) Publishers Old Post Road Brookfield Vermont 05036

Currently the Institute of Transportation Studies (ITS) at the University of California is in the process of developing a freeway lane model which will predict flows by lane in the vicinity of ramp junctions and major weaves. To provide information for this model, ITS has studied certain characteristics of straight pipe sections of freeway (away from the influence of ramps) for two, three and four lane sites as described in this paper. These characteristics include lane distribution vs. flow, lane changing vs. flow, and speed vs. flow data for three different sites. One site has a wealth of data points near capacity and the occupancy, mean flow and standard deviation for these data have been determined. Additionally, this research further demonstrates the difference between the value of capacity of a freeway lane cited in the Highway Capacity Manual (HCM) and actual values at these sites, and compares the speed flow curves developed at these sites to the 1985 HCM curve and the JHK curve.

FREEWAY SIMULATION AND CONTROL. Babcock, PS, IV; May, AD; Auslander, DM; Tomizuka, M. California University, Berkeley Institute of Transportation Studies Berkeley California 94720; California Department of Transportation 1120 N Street Sacramento California 95814; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Dec 1982 Final Rpt. 469p. REPORT NO: UCB-ITS-RR-82-13. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

A macroscopic freeway simulation model is developed to evaluate and compare various freeway control strategies. The resulting model, FRECON, is a properly discrete extension of the dynamic FREFLO model. The discretization enables the model to realistically simulate all traffic conditions, including bottlenecks and congestion. It is performed internally in the model and adapts to minimize simulation costs while maintaining accuracy. True point detectors and performance measures are available. The model is calibrated and validated on five days of data from the Santa Monica Freeway. Control Strategies are divided into three configurational groups: pretimed, local traffic responsive, and segment-wide traffic responsive. Simulation evaluations, without vehicle diversion or priority treatment, are performed for one pretimed strategy (Linear Programming) and two local strategies (Percent Occupancy and Demand-Capacity). By not responding to daily variations in the traffic demands, the quality of the pretimed strategy's performance is limited. The local view of freeway conditions used by the local traffic responsive strategies limits their ability to control the freeway. A preliminary analysis of segment-wide traffic responsive strategies is also made. (FHWA)

FREEWAY SIMULATION MODELS REVISITED. May, AD. Transportation Research Board. Transportation Research Record N1132 1987 pp 94-99 89 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

The purpose of this paper is to update and assess the continued development and application of freeway simulation models in the 1980s. Several activities were undertaken to meet this objective. First, literature searches were undertaken utilizing the University of California Institute for Transportation Studies library and the author's personal library. Second, the identified references were classified by freeway simulation model family and placed in an historical perspective. The references were then carefully studied to identify and assess new developments and applications. Finally, identified authors were contacted to determine omissions and to confirm the current status of their freeway-modeling efforts. This paper appeared in Transportation Research Record No. 1132, Freeway Management and Operations.

FREEWAY SPEED-FLOW-CONCENTRATION RELATIONSHIPS: MORE EVIDENCE AND INTERPRETATIONS (WITH DISCUSSION AND CLOSURE). Banks, JH; Furth, PG. Transportation Research Board. Transportation Research Record N1225 1989 pp 53-60 5 Fig. 11 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

In this paper, recent Canadian work challenging long-held theories about speed-flow-concentration relationships in freeway traffic is verified and extended using data from San Diego. Major conclusions of these studies regarding near-constant free-flow speeds and flow-concentration relationships resembling an inverted V are confirmed; other past findings related to the effect of queuing on downstream free-flow speeds and the effect of secondary bottlenecks on flow-concentration relationships are not confirmed. When data are averaged across all lanes (both upstream and downstream of a bottleneck), speed-flow and flow-concentration relationships are found to be consistent with those predicted by queuing and shock wave theory. The functioning of the bottleneck studied is more complicated than had been assumed, however, and this creates further problems in the interpretation of the data. Finally, the inverted-V model of the flow-concentration relationship is shown to imply a simple and plausible model of driver behavior in which speeds and spacings are adjusted to keep the average front-to-back time gaps approximately constant until some desired maximum speed is reached. This paper appears in Transportation Research Record No. 1225, Highway Capacity, Flow Measurement, and Theory.

FREEWAY SURVEILLANCE AND CONTROL SYSTEM USING SIMULATION MODEL. Ju, R-S; Maze, TH. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 115 NO. 4 Jul 1989 pp 425-437 Figs. Tabs. Refs. 1 App. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017-2398

The development is described of the FREQ8PE, a macroscopic traffic flow simulation model, primarily used to aid in making decisions regarding priority entry and normal entry control on a directional freeway. The model can be used to evaluate design improvements with or without freeway entry control. It has been shown that FREQ8PE can be used to evaluate the design of freeway surveillance systems. To illustrate its use, FREQ8PE is applied to the Taiwan Freeway. It is shown that the model may be used to evaluate either an existing or hypothetical freeway surveillance and control system (FSCS). Also, it is reliable and requires short CPU times for its execution.

SIM - A FREEWAY SIMULATION MODEL FOR ANALYZING OPERATIONAL AND GEOMETRIC ALTERNATIVES. ti, A; Torres, J; JFT & Associates, Pacific Palisades, Ca. and Cohen, S; Federal Highway Administration, McLean, Va. er submitted to Transportation Research Board for 1991 Annual Meeting.

A microscopic, interval scanning, freeway traffic simulation model, termed FRESIM, is able to simulate realistically most prevailing freeway geometrics including multiple freeways with one to three lane ramps, freeway-freeway connectors, lane adds and drops, auxiliary lanes, and changes in grade, radius of curvature, and superelevation. It also features representation of freeway incident blockages, ramp metering, and the representation of freeway surveillance systems. The model generates comprehensive tables of measures of effectiveness, such as travel time, speed, and traffic flow, which enable a meaningful evaluation of operational test situations.

EL AND TIME IMPLICATIONS OF MERGING TRAFFIC AT FREEWAY ENTRANCES. Lyons, TJ; Rainford, H; worthy, JR; Newman, PWG. Murdoch University South Street Murdoch Western Australia Australia. N8/84 1984 nograph 52p 19 Fig. 4 Tab. 14 Ref.

A microscopic traffic model is used to simulate the fuel and time penalties associated with merging traffic on a freeway system. Merging traffic forces a merge with the inside lane freeway traffic through a series of individual vehicle interactions. The model is validated both statistically and at an individual vehicle level by comparison of model results with speed time traces recorded in a research vehicle undergoing merging in Perth freeway traffic. Statistics of model parameters are calculated to estimate the overall penalties associated with merging on both a lane and system basis. These illustrate the dependence of the merging penalty on traffic volumes in both the merging lane and the freeway. The simulation results are compared with a simple Main Roads Department model based on observed delays at traffic signals and illustrate similar functional form but differing magnitudes. (Author/TRRL)

UEL CONSUMPTION ANALYSES FOR URBAN TRAFFIC MANAGEMENT. Bowyer, DP; Akcelik, R; Biggs, DC. Institute f Transportation Engineers. ITE Journal VOL. 56 NO. 12 Dec 1986 pp 31-34 Figs. Tabs. 9 Ref.. AVAILABLE FROM: nstitute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

This article describes the background and major features of the Australian Road Research Board's "Guide To Fuel Consumption Analyses." The article also considers its relevance to urban traffic management decision, and summarizes the technical audit of studies relating to energy consumption in traffic and transport systems on which the guide is based. The forms of four interrelated fuel consumption models of the guide are described and their likely transferability to various situations is indicated. Each traffic and fuel consumption model is appropriate to a particular scale of traffic system. This link is shown for several selected traffic models. The importance of accurate fuel consumption estimates for the case of priority control at a particular intersection is discussed.

FUEL CONSUMPTION AND EMISSION VALUES FOR TRAFFIC MODELS. FINAL REPORT. McGill, R. Oak Ridge National Laboratory Post Office Box X Oak Ridge Tennessee 37830. May 1985 93p. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

The report documents the methodologies used in the development of fuel consumption and emission maps for 15 passenger vehicles representative of 64% of the 1980-1982 population. From the results of the study, the Federal Highway Administration is currently updating the fuel consumption and emission estimation algorithms in traffic models such as NETSIM and TRANSYT-7F. These results include tables and graphs that relate fuel consumption and emissions to vehicle speed and acceleration. The major achievement of this study was the capability of combining laboratory (dynamometer) testing with on-road testing to assess the energy and environmental characteristics of passenger vehicles as they operate in real-world conditions.

FUEL CONSUMPTION AND EMISSION VALUES FOR TRAFFIC MODELS. McGill, R. Oak Ridge National Laboratory Post Office Box X Oak Ridge Tennessee 37830 ; Federal Highway Administration Turner Fairbank Hwy Res Cntr, 6300 Georgetown Pike McLean Virginia 22101. May 1985 Final Rpt. 90p 20 Fig. 18 Tab. 7 Ref. 5 App.. REPORT NO: FHWA/RD-85/053. AVAILABLE FROM: Federal Highway Administration Turner Fairbank Hwy Res Cntr, 6300 Georgetown Pike Washington D.C. 20590

This report documents the methodologies used in the development of fuel consumption and emission maps for 15 passenger vehicles representative of 64 percent of the 1980-1992 population. From the results of this study, the Federal Highway Administration is currently updating the fuel consumption and emission estimation algorithms in traffic models such as NETSIM and TRANSYT-7F. These results include tables and graphs which relate fuel consumption and emissions to vehicle speed acceleration. The major achievement of this study was the capability of combining laboratory (dynamometer) testing with on-road testing to assess the energy and environmental characteristics of passenger vehicles as they operate in "real-world" conditions.

FUEL CONSUMPTION MODELS: AN EVALUATION BASED ON A STUDY OF PERTH'S TRAFFIC PATTERNS. Pitt, DR; Lyons, TJ; Newman, PWG; Kenworthy, JR. Murdoch University South Street Murdoch Western Australia. 1984 40p 9 Fig. 12 Tab. 26 Ref.. REPORT NO: 3/84

A range of mathematical models currently used to predict urban traffic fuel consumption have been evaluated utilizing data from an instrumented four speed manual vehicle. All of the models were calibrated and tested over a data set especially collected to eliminate such factors as vehicle tune, gradient, gear changing inconsistencies and uncontrollable environmental factors as well as a larger, more general data set typical of Perth urban driving conditions but without these controls. The evaluation highlights the predictive capacity of each of the models and illustrates that the best models involve the use of pke and pip terms which are difficult to measure by normal traffic engineering techniques. Hence traffic modellers must choose between greater predictive accuracy in their fuel models by more expensive data collection or sacrifice accuracy through the limitations of models based on normal traffic data collection methods. (Author/TRRL)

FUEL EFFICIENT TRAFFIC SIGNAL OPERATION AND EVALUATION: GARDEN GROVE DEMONSTRATION PROJECT. Wagner-McGee Associates 4660 Kenmore Avenue, Suite 825 Alexandria Virginia 22304; California Energy Commission 1516-19th Street Sacramento California 95814. Feb 1983 76p. REPORT NO: P-400-83-004

The procedures and results of a case study of fuel efficient traffic signal operation and evaluation in the City of Garden Grove, California are documented. Improved traffic signal timing was developed for a 70-intersection test network in Garden Grove using an optimization tool called the TRANSYT Version 8 computer program. Full-scale field testing of five alternative timing plans was conducted using two instrumented vehicles equipped to measure traffic performance characteristics and fuel consumption. The field tests indicated that significant improvements in traffic flow and fuel consumption result from the use of timing plans generated by the TRANSYT optimization model. Changing from pre-existing to an optimized timing plan yields a network-wide 5 percent reduction in total travel time, more than 10 percent reduction in both the number of stops and stopped delay time, and 6 percent reduction in fuel consumption. Projections are made of the benefits and costs of implementing such a program at the 20,000 traffic signals in networks throughout the State of California.

FUEL EFFICIENT TRAFFIC SIGNAL TIMING PROGRAM. CITY OF LOS ANGELES DEPT OF TRANSPORTATION LOS ANGELES. Feb 1984 ENGLISH

CITY OF LOS ANGELES, DEPARTMENT OF TRANSPORTATION OTHER PHYS. DESCRIPTION: 41 MAPS COVER TITLE FUNDED BY THE CALIFORNIA ENERGY COMMISSION UNDER GRANT NO.: 326-82-014 FEBRUARY, 1984 ADDL CORP. AUTHOR INFO: LOS ANGELES CALIF.. DEPT. OF TRANSPORTATION ADDL CORP. AUTHOR INFO: CALIFORNIA ENERGY COMMISSION

FUEL SAVING POTENTIALS OF ISOLATED TRAFFIC SIGNAL INSTALLATIONS. Edholm, S; Buren, H. Royal Institute of Technology, Sweden. Rapport 1982 Monograph 40p 16 Fig. 14 Tab. 18 Ref. Swedish. REPORT NO: TRITA-TRL-82-05-17

In this project an investigation was conducted to determine whether vehicle fuel could be saved by changing the time setting of isolated traffic signal installations. Fuel consumption was defined as the total extra consumption of fuel by vehicles at the intersection, caused by stopping and waiting. Data for a number of intersections were calculated in a computer using a simulation model. A large number of time settings were tested with the objective of finding an optimum setting. Combinations of several altered time settings have normally concerned optimum settings. At most of the intersections one or more of the following measures were applied: (1) measures which increase the traffic signal changing frequency, e.g. shorter maximum green times, (2) measures which give the main road extra priority, e.g. extended gap time, (3) removal of the automatic green signal for pedestrians. At the intersection where this was applied, pedestrian waiting time was reduced owing to smoother adaptation of the traffic signal system to actual conditions. The estimated fuel saving comprises only 0,2% of the country's total road traffic consumption. All the same, the introduction of measures of this kind should be a matter of immediate interest for several reasons, e.g. the total delay of the road user is reduced, the exhaust emissions would be reduced and as distinct from many other measures, these measures produce immediate results. (Author/TRRL)

GAP ACCEPTANCE AND TRAFFIC CONFLICT SIMULATION AS A MEASURE OF RISK. McDowell, MRC; Wennell, J; Storr, PA; Darzentas, J (Royal Holloway College). Transport and Road Research Laboratory Old Wokingham Road Crowthorne RG11 6AU Berkshire England 0305-1315. N776 1983 Monograph 19p 4 Fig. 16 Tab. 17 Ref. Apps.

A new method of measuring gap acceptance behavior of drivers is described. It has been used to study the behavior of turning drivers at a selection of priority controlled t-junctions outside urban areas. The data thus obtained are used in a simulation model to predict conflict rates in turning maneuvers. It is found that the ranking by frequency of conflict of such junctions given by this model agrees well with that obtained from five-year recorded injury accident data. The effect of various parameters, including age and sex of driver on gap-acceptance behavior is discussed. A new model of headway distributions on major roads is given. (Author/TRRL)

GENERAL APPROACH TO RELATIVE OFFSET SETTINGS OF TRAFFIC SIGNALS. Al-Khalili, AJ. Institute of Electrical & Electronics Engrs, Inc. IEEE Transactions on Systems, Man and Cybernetics 1985 pp 587-594 15 Ref.. REPORT NO: VSMC-N4. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

A generalized approach for simulating relative offset of traffic signals in an urban traffic network is presented. It is shown that it is possible to optimize relative offset settings of signals for various criteria. A general criterion is proposed by which either delays, stops, fuel consumption, or carbon monoxide can be selected by a proper choice of constants. When these criteria are minimized, it was found that the best criterion to be selected for offset setting is the minimization of fuel consumption, since this in turn nearly minimizes the delays, stops, and carbon monoxide emission, and it has the effect of minimizing stops at low saturation and minimizing delays as the degree of saturation increases. Further analysis of the criterion function has shown that the functions minimized are uneven around their optimum offset value and in each case an early switching is favored. The expression to determine optimum offset is updated to calculate optimum offsets that minimize fuel consumption or carbon monoxide emission.

GENERATION AND ASSESSMENT OF INCIDENT MANAGEMENT STRATEGIES. SUMMARY REPORT. Mannering, F; Jones, B; Garrison, DH; Sebranke, B; Janssen, L. Washington University, Seattle 4507 University Way, NE, Corbet Bldg, Suite 204 Seattle Washington 98105; Washington State Department of Transportation Building, KF-10 Olympia Washington 98504-5201 ; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Jan 1990 25p 1 Fig.. REPORT NO: WA-RD 204.1. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

This summary report describes a study of freeway incidents and incident management strategies in the Seattle area. The study statistically analyzed the frequency and duration of freeway incidents on sections of I-5 and SR 520 in Seattle. In addition, a traffic simulation model was operationalized to assess the traffic related impacts of incidents. The findings show that Seattle-area incident management currently responds well to inclement weather and special events (e.g., major sporting games) but has problems with severe accidents. The ongoing operationalization of accident investigation sites and incident equipment storage sites can be expected to improve severe accident management, but response personnel training and the addition of more dedicated tow truck service are also needed. Finally, the study shows that, from a traffic impact perspective, the section of I-5 in downtown Seattle is in need of the most incident management attention. See also WA-RD 204.2, Volume I: Management, Surveillance, Control, and Evaluation of Freeway Incidents--A Review of Existing Literature; WA-RD 204.3, Volume II: Analysis of Freeway Incidents in the Seattle Area; WA-RD 204.4, Volume III: Seattle-Area Incident Impact Analysis--Microcomputer Traffic Simulation Results; and WA-RD 204.5, Volume IV: Seattle-Area Incident Management--Assessment and Recommendations.

GENERATION AND ASSESSMENT OF INCIDENT MANAGEMENT STRATEGIES. VOLUME I: MANAGEMENT, SURVEILLANCE, CONTROL, AND EVALUATION OF FREEWAY INCIDENTS--A REVIEW OF EXISTING LITERATURE. Mannering, F; Jones, B; Garrison, DH; Sebranke, B; Janssen, L. Washington University, Seattle 4507 University Way, NE, Corbet Bldg, Suite 204 Seattle Washington 98105; Washington State Department of Transportation Building, KF-10 Olympia Washington 98504-5201 ; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Jan 1990 45p 4 Tab. Refs.. REPORT NO: WA-RD 204.2. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

This four-volume technical report describes a study of freeway incidents and incident management strategies in the Seattle area. The study statistically analyzed the frequency and duration of freeway incidents on sections of I-5 and SR 520 in Seattle. In addition, a traffic simulation model was operationalized to assess the traffic related impacts of incidents. The findings show that Seattle-area incident management currently responds well to inclement weather and special events (e.g., major sporting games) but has problems with severe accidents. The ongoing operationalization of accident investigation sites and incident equipment storage sites can be expected to improve severe accident managemENT, but response personnel training and the addition of more dedicated tow truck service are also needed. Finally, the study shows that, from a traffic impact perspective, the section of I-5 in downtown Seattle is in need of the most incident management attention. See also WA-RD 204.1, Summary Report; WA-RD 204.3, Volume II: Analysis of Freeway Incidents in the Seattle Area; WA-RD 204.4, Volume III: Seattle-Area Incident Impact Analysis--Microcomputer Traffic Simulation Results; and WA-RD 204.5, Volume IV: Seattle-Area Incident Management--Assessment and Recommendations.

GENERATION AND ASSESSMENT OF INCIDENT MANAGEMENT STRATEGIES. VOLUME II: ANALYSIS OF FREEWAY INCIDENTS IN THE SEATTLE AREA. Mannering, F; Jones, B; Garrison, DH; Sebranke, B; Janssen, L Washington University, Seattle 4507 University Way, NE, Corbet Bldg, Suite 204 Seattle Washington 98105; Washington State Department of Transportation Building, KF-10 Olympia Washington 98504-5201 ; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Jan 1990 85p 1 Fig.. REPORT NO: WA-RD 204.3. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

This four-volume technical report describes a study of freeway incidents and incident management strategies in the Seattle area. The study statistically analyzed the frequency and duration of freeway incidents on sections of I-5 and SR 520 in Seattle. In addition, a traffic simulation model was operationalized to assess the traffic related impacts of incidents. The findings show that Seattle-area incident management currently responds well to inclement weather and special events (e.g., major sporting games) but has problems with severe accidents. The ongoing operationalization of accident investigation sites and incident equipment storage sites can be expected to improve severe accident management, but response personnel training and the addition of more dedicated tow truck service are also needed. Finally, the study shows that, from a traffic impact perspective, the section of I-5 in downtown Seattle is in need of the most incident management attention. See also WA-RD 204.1, Summary Report; WA-RD 204.2, Volume I: Management, Surveillance, Control, and Evaluation of Freeway Incidents--A Review of Existing Literature; WA-RD 204.4, Volume III: Seattle-Area Incident Impact Analysis--Microcomputer Traffic Simulation Results; and WA-RD 204.5, Volume IV: Seattle-Area Incident Management--Assessment and Recommendations.

GENERATION AND ASSESSMENT OF INCIDENT MANAGEMENT STRATEGIES. VOLUME III: SEATTLE-AREA INCIDENT IMPACT ANALYSIS--MICROCOMPUTER TRAFFIC SIMULATION RESULTS. Mannering, F; Jones, B; Garrison, DH; Sebranke, B; Janssen, L. Washington University, Seattle 4507 University Way, NE, Corbet Bldg, Suite 204 Seattle Washington 98105; Washington State Department of Transportation Building, KF-10 Olympia Washington 98504-5201 ; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Jan 1990 145p 28 Fig. 13 Tab. Refs. 4 App.. REPORT NO: WA-RD 204.4. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

This four-volume technical report describes a study of freeway incidents and incident management strategies in the Seattle area. The study statistically analyzed the frequency and duration of freeway incidents on sections of I-5 and SR 520 in Seattle. In addition, a traffic simulation model was operationalized to assess the traffic related impacts of incidents. The findings show that Seattle-area incident management currently responds well to inclement weather and special events (e.g., major sporting games) but has problems with severe accidents. The ongoing operationalization of accident investigation sites and incident equipment storage sites can be expected to improve severe accident management, but response personnel training and the addition of more dedicated tow truck service are also needed. Finally, the study shows that, from a traffic impact perspective, the section of I-5 in downtown Seattle is in need of the most incident management attention. See also WA-RD 204.1, Summary Report; WA-RD

204.2, Volume I: Management, Surveillance, Control, and Evaluation of Freeway Incidents--A Review of Existing Literature; WA-RD 204.3, Volume II: Analysis of Freeway Incidents in the Seattle Area; and WA-RD 204.5, Volume IV: Seattle-Area Incident Management--Assessment and Recommendations.

ENERATION AND ASSESSMENT OF INCIDENT MANAGEMENT STRATEGIES. VOLUME IV: SEATTLE-AREA CIDENT MANAGEMENT--ASSESSMENT AND RECOMMENDATIONS. Mannering, F; Jones, B; Garrison, DH; Sebranke, Janssen, L. Washington University, Seattle 4507 University Way, NE, Corbet Bldg, Suite 204 Seattle Washington 98105; ashington State Department of Transportation Transportation Building, KF-10 Olympia Washington 98504-5201 ; Federal ghway Administration 400 7th Street, SW Washington D.C. 20590. Jan 1990 25p 4 Fig. 2 Tab.. REPORT NO: WA-RD 04.5. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

This four-volume technical report describes a study of freeway incidents and incident management strategies in the Seattle area. The study statistically analyzed the frequency and duration of freeway incidents on sections of I-5 and SR 520 in Seattle. In addition, a traffic simulation model was operationalized to assess the traffic related impacts of incidents. The findings show that Seattle-area incident management currently responds well to inclement weather and special events (e.g., major sporting games) but has problems with severe accidents. The ongoing operationalization of accident investigation sites and incident equipment storage sites can be expected to improve severe accident management, but response personnel training and the addition of more dedicated tow truck service are also needed. Finally, the study shows that, from a traffic impact perspective, the section of I-5 in downtown Seattle is in need of the most incident management attention. See also WA-RD 204.1, Summary Report; WA-RD 204.2, Volume I: Management, Surveillance, Control, and Evaluation of Freeway Incidents--A Review of Existing Literature; WA-RD 204.3, Volume II: Analysis of Freeway Incidents in the Seattle Area; and WA-RD 204.4, Volume III: Seattle-Area Incident Impact Analysis--Microcomputer Traffic Simulation Results.

GENERATION AND ASSESSMENT OF INCIDENT MANAGEMENT STRATEGIES. VOLUME 4: SEATTLE-AREA INCIDENT IMPACT ANALYSIS: MICROCOMPUTER TRAFFIC SIMULATION RESULTS. Mannering, FL; Garrison, DH; Sebrenke. B. TransNow, Transportation Northwest Washington Univ, Civil Engineering Dept, 135 More Hall FX-10 Seattle Washington 98195. Feb 1990 v.p. Figs. Tabs. Refs. Apps.. REPORT NO: TNW90-13.4. AVAILABLE FROM: TransNow, Transportation Northwest Washington Univ, Civil Engineering Dept, 135 More Hall FX-10 Seattle Washington 98195

This volume discusses the application and evaluation of a traffic simulation model, XXEXQ. This model was applied to a network of freeways and arterials, the primary commuting routes, in the central Puget Sound region of Washington State. The evaluation of XXEXQ was based on the reasonableness of the model's results and the extent to which these results described actual traffic behavior. The authors' conclusions and recommendations for use and further development of the model are also presented.

GETTING TRAFFIC SYSTEM SOLUTIONS WITH TRAF-FAMILY MODELS. Byun, J., Wong, S., and Stephens, B., (Federal Highway Administration). Institute of Transportation Engineers, ITE 1991 Compendium of Technical Papers, pp 485-491.

This paper presents an assessment of the models' features, required computer environment, and appropriate applications of these models. This paper reports on the progress made on each TRAF family software model and the prospect for their wide-scale implementation in the near future.

GETTING STARTED: SELECTING AND USING COMPUTERIZED TRAFFIC MODELS. MORALES, JM. PUBLIC ROADS VOL. 53 NO. 1 Jun 1989 PP 6-11 ENGLISH

BY JUAN M. MORALES ILL. SOME COL BY JUAN M. MORALES ILL. SOME COL

GRAPHICAL REPRESENTATION OF THE EFFECT OF SIGNAL TIMINGS ON DELAY AT 2-STAGE JUNCTIONS USING COMPUTER GRAPHICS. Saavedra, A (Comision De Transporte Urbano). PTRC Education and Research Services Limited. Planning & Transport Res & Comp, Sum Ann Mtg, Proc 1984 pp217-237 7 Fig. 9 Ref.

Allsop (1971) has shown that if delay at a road junction controlled by fixed-time traffic signals is estimated by the simpler form of Webster's expression (1958), the calculations of delay-minimizing signal settings can be expressed as a mathematical optimization problem having a unique solution (Allsop, 1972). In calculating the signal settings, a maximum can be specified for the lengths of time for which particular sets of traffic streams have right of way. These are the constraints which often have to be imposed on signal settings. In simple cases the constraints imposed can be represented diagrammatically, and the way in which the estimated delay per unit time to all the traffic passing through the junction varies with the signal timings can be shown in the same diagram. The minimum-delay and maximum-capacity points can also be included. Within this framework the paper describes the process of working out the above mentioned diagrams orientated to develop a computer program with graphics capabilities which enable the user, in an interactive way, to draw the diagrams. A review and summary of the mathematics, the basis for the algorithms, an example and finally an indication of scope for future work are presented in the paper. For the covering abstract of the seminar see TRIS 450556. (Author/TRRL) Proceedings of Seminar L, Traffic Operation and Management; Held at the 12th PTRC Summer Annual Meeting, University of Warwick, England, From 10-13 July 1984, Volume P, 254.

GUIDE TO FUEL CONSUMPTION ANALYSES FOR URBAN TRAFFIC MANAGEMENT. Bowyer, DP; Akcelik, R; Biggs, DC. Australian Road Research Board. Australian Road Research Report N32 Oct 1985 98p 33 Fig. 25 Tab. 29 Ref.. AVAILABLE FROM: Australian Road Research Board P.O. Box 156, Bag 4 Nunawading Victoria 3131 Australia

A substantial set of analysis techniques exist for the consideration of fuel consumption in urban traffic management. This report provides a guide to assist the traffic manager in selecting techniques which are appropriate to the various traffic management contexts. It is structured into two parts. Part a presents easy to use functions and graphs for estimating fuel consumption for a typical car. Part b provides a comprehensive guide to the use of techniques for fuel consumption analysis in urban traffic systems. The information requirements for the different phases of the traffic management process (ie, diagnosis, design, implementation and evaluation) are briefly discussed. The primary interest in this guide is in the design phase, and traffic models which incorporate a fuel consumption model are the only practical means of considering fuel consumption in this phase. Fuel consumption models of four levels of detail are described and numerical examples are given to illustrate their use. The traffic models and associated fuel consumption models are presented as an hierarchy and the scale of traffic system to which each is appropriate is shown. These fuel consumption models are inter-related, forming part of the same modelling framework and the vehicle parameters are explicit at all model levels. Case studies are presented to demonstrate the choice, use and cost-effectiveness of selected traffic models in the design of particular management schemes. The ISBN of the microfiche version is 0-86910-221-4. (Author/TRRL)

GUIDEBOOK FOR IMPROVING TRAFFIC SIGNAL TIMING. SKABARDONIS, A. INSTITUTE OF TRANSPORTATION STUDIES UNIVERSITY OF. RESEARCH REPORT INSTITUTE OF TRANSPORTATION N--8 Nov 1986 ENGLISH. REPORT NO: 6-10

SERIES ALEXANDER SKABARDONIS OTHER PHYS. DESCRIPTION: CA. 150 LEAVES IN VARIOUS FOLI CHARTS RESEARCH REPORT INSTITUTE OF TRANSPORTATION STUDIES, UNIVERSITY OF CALIFORNIA, UCB-ITS-RR-86-10 , ISSN:0192-4095 -UNTRACED SERIES NOVEMBER 1986 INCLUDES BIBLIOGRAPHICAL REFERENCES ADDL CORP. AUTHOR INFO: UNIVERSITY OF CALIFORNIA, BERKELEY. INSTITUTE OF TRANSPORTATION STUDIES INSTITUTE OF TRANSPORTATION STUDIES UNIVERSITY OF CALIFORNIA

GUIDELINES FOR LEFT-TURN TREATMENTS AT SIGNAL CONTROLLED INTERSECTIONS. Nemeth, ZA; Mekemson. Ohio State University Engineering Experiment Station, 2070 Neil Avenue Columbus Ohio 43210; Ohio Department of Transportation P.O. Box 899 Columbus Ohio 43216-0899; Federal Highway Administration Washington D.C. 20590. Jun 1983 Final Rpt. 284p Figs. Tabs. Refs. 4 App.. REPORT NO: FHWA-OH-83-003

The main objective of this research was to identify a procedure by which the impact of left turns and left turn control method on performance of the whole intersection can be quantified. A step by step procedure was developed for: 1) Field data collection at intersections; 2) Evaluation of the need for left turn bays; 3) Evaluation of the need for left turn phasing. The same procedure, of course, will help the traffic engineer to recognize the capacity problem that requires the consideration of left turn control prohibition. This research involved both computer simulation studies and field studies. The field studies produced results which clearly established that very significant site to site variations exist in the operational performance of seemingly similar signalized intersections. It is, therefore, suggested that a comprehensive field study is needed in order for the traffic engineer to fully understand the complex interaction of geometrics and signal timing with the traffic streams. It is recommended that the guidelines, which include instructions for field data collection, and assume the application of a signal operation analysis program, such as SOAP, be followed in the evaluation of left turn control needs at fully actuated signalized intersections. (Author)

EURISTIC PROGRAMMING APPROACH TO ARTERIAL SIGNAL TIMING. Rogness, RO; Messer, CJ. Transportation esearch Board. Transportation Research Record N906 1983 pp 67-75 3 Fig. 6 Tab. 25 Ref.. AVAILABLE FROM: ransportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

A heuristic programming approach to minimum-delay arterial street signal timing plan optimization is presented. The selection of a good heuristic solution for phasing sequence, cycle length, and green splits is demonstrated. The approach demonstrates a procedure for use by the traffic engineer in selecting the phase sequence, cycle length, and offsets for an arterial street for developing a minimum-delay signal timing plan from existing computer programs. The heuristic procedure is to use the PASSER II computer program for maximum bandwidth progression optimization to select the phasing sequence and the initial starting point for use in the TRANSYT 6 computer program to develop a minimum-delay performance index solution. This permits all signal timing variables to be optimized. Comparisons are made between this heuristic solution and the best signal timing plan developed (considering all possible combinations a priori) by the TRANSYT program. An evaluation of use of the PASSER II green split routine versus the TRANSYTSTAR1 routine on the program solution was performed. The heuristic procedure, when restricted to the minimum-delay cycle length, resulted in at least a good solution versus a TRANSYT best solution that used a measure index. A comparison of the PASSER II green splits and the TRANSYTSTAR1 routine produced mixed results. This paper appeared in Transportation Research Record No. 906, Urban Traffic Systems.

IDENTICAL TRAFFIC STREAMS IN THE TRAF-NETSIM SIMULATION PROGRAM. Rathi, AK; Santiago, AJ. Printerhall Limited. Traffic Engineering and Control VOL. 31 NO. 6 Jun 1990 pp 351-355 3 Fig. 1 Tab. 6 Ref.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London W1P 3PE England

This paper describes an enhancement to the TRAF-NETSIM simulation model which provides users with the ability to simulate, with traffic streams exhibiting identical routing patterns, driver-vehicle characteristics and other operational characteristics through a series of runs. The paper describes the generation of stochastic (random) behavior in the simulation model and discusses the need for generation of identical traffic streams. The two approaches considered in implementing this feature, and the program modifications necessary to implement the selected approach, are described. Some representative simulation results are presented and the applications and limitations of the identical traffic streams feature are discussed.

IMPACT OF ARTERIAL LANE OBSTRUCTIONS. VOLUME 2: RESEARCH REPORT. FINAL REPORT. Torres, JF; Halati, A; Danesh, M. JFT Associates 5555 Inglewood Boulevard, Suite 102 Culver City California 90230; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Feb 1986 119p. REPORT NO: FHWA/RD-86/139. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

In response to a need to develop simple and accurate methods for estimating the impacts of lane obstructions on arterial streets, the NETSIM model was applied to this purpose. First, however, the lane obstruction logic in the model had to be modified and calibrated to better represent the corresponding field conditions. This modification and calibration was achieved by using newly collected and other existing time-lapse photography data. The enhanced NETSIM model was then applied to the development of a set of curves that represent the dollar costs and the level of service resulting from lane obstructions for various street geometric and traffic conditions. The curves are parameterized in terms of the duration of the lane obstruction, location of the obstruction, length of the block, and the v/c ratio. This developed set of curves form the basis for a relatively simple method for estimating the impacts of lane obstructions. See also Volume 1 - User's Guide for Controlling Lane Obstructions (TRIS 461925) and Volume 3 - Lane Blockage Logic Changes in NETSIM (TRIS 461928).

IMPACT OF ARTERIAL LANE OBSTRUCTIONS. VOLUME 3: LANE BLOCKAGE LOGIC CHANGES IN NETSIM. FINAL REPORT. Danesh, M; Halati, A; Torres, JF. JFT Associates 5555 Inglewood Boulevard, Suite 102 Culver City California 90230; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Feb 1986 25p. REPORT NO: FHWA/RD-86/140. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

A review and analysis was made of the lane obstruction logic in the TRAF/NETSIM simulation model. The performance of the model was evaluated against the corresponding vehicular performance observed in field situations. As a result of this study, logic corrections were found to be necessary. The changes that were required to be made in the model logic are described in this volume. See also Volume 1 - User's Guide for Controlling Lane Obstructions (TRIS 461925) and Volume 2 - Research Report (TRIS 462119).

IMPACT OF PASSING-CLIMBING LANES ON TRAFFIC FLOW ON UPGRADES. Polus, A; Reshetnik, I. Pergamon Press Limited. Transportation Research. Part A: General VOL 21A NO. 6 Nov 1987 14 Ref.. AVAILABLE FROM: Pergamon Press Limited Headington Hill Hall Oxford OX3 0BW England

This study evaluates a new approach for reducing delay, and consequently improving level of service and safety on long upgrades on two-lane rural roads. This is the systematic provision of overtaking lanes, termed passing-climbing lanes (pcl), to improve traffic flow, safety, and capacity. The traffic impact of such lanes is analyzed for various grades, traffic volumes, and lane configurations by means of a simulation model developed for this study. Results show that this concept could provide substantial flow benefits - reduction in delay and in passenger-car platooning - with implications for better safety. Although the reduction in delay is found to be more pronounced as volume increases, these results may be obtained even with a small percentage of passing-climbing lanes. A model predicting average relative delay, formulated and calibrated on the basis of the simulation output, explains 95% of the observed variability. The economic advantages of the concept in optimizing the distribution of a limited budget among several sites, in staging construction over several years, and in adapting highway investment to traffic-demand variations are also discussed. (Author/TRRL)

IMPLEMENTATION OF THE AUSTRALIAN ROUNDABOUT ANALYSIS METHOD IN SIDRA. HIGHWAY CAPACITY AND LEVEL OF SERVICE. PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON HIGHWAY CAPACITY, KARLSRUHE, GERMANY, 24-27 JULY 1991. Akcelik, R; Troutbeck, R. Balkema (AA) P.O. Box 1675 3000 BR Rotterdam Netherlands 90 5410 011 7. 1991 pp 17-34 9 Fig. 3 Tab. Refs.. AVAILABLE FROM: Balkema (AA) Publishers Old Post Road Brookfield Vermont 05036

Progress towards the development of a comprehensive Australian method for the analysis of capacity and performance of roundabouts is reported. The new Australian roundabout design guide to be produced during 1991 will include a significant revision of the current capacity analysis method by the incorporation of the results of Australian research. This method allows for the effects of circulating flows, entry flows and roundabout geometry on gap acceptance parameters. The new Australian roundabout analysis method will be implemented in the SIDRA package which was originally developed for signalized intersection analysis. As a computerized method, SIDRA will provide some significant advantages in the implementation of the capacity and performance analysis method for roundabouts. These include an iterative method to calculate circulating flows with capacity limitation for oversaturated approaches, and techniques for estimating entry lane flows, shared lane capacities and time-dependent delays.

IMPLEMENTATION OF TRAFFIC SIGNAL TIMING PLANS IN COORDINATED ARTERIAL SYSTEMS. Courage, KG. Florida University, Gainesville Transportation Research Center Gainesville Florida 32611. Jan 1990 25p. REPORT NO: UTC-UF-268-3. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

A procedure was developed for implementing traffic signal timing plans directly from the design and optimization programs which produced them. The report describes the procedure and presents operating instructions for a simple computer program which carried out the procedure automatically. The program called 'AAP2NEMA' converts the signal timing plans produced by two commonly used signal timing design programs, PASSER II and TRANSYT-7F, into the format of a standard NEMA controller.

IMPLEMENTING TRANSYT TRAFFIC SIGNAL TIMING. Dock, FC. Roads and Transportation Association of Canada 1765 St Laurent Boulevard Ottawa Ontario K1G 3V4 Canada. Sep 1984 pp B3-B29 8 Fig. 5 Tab. 12 Ref.. AVAILABLE FROM: Roads and Transportation Association of Canada 1765 St Laurent Boulevard Ottawa Ontario K1G 3V4 Canada

This paper presents a description of the TRANSYT traffic flow simulation model and a case study of an implementation where TRANSYT is used to generate signal system timing in four California cities. The report covers operational considerations necessary to adapt the TRANSYT model to use in timing networks of actuated multi-phase traffic signals under computer master control. Techniques are discussed for obtaining optimum use of the simulation model for different types of networks and various flow conditions. Calculations and data manipulations used to translate timing produced by TRANSYT into useable controller and master settings are presented and discussed. For the covering abstract of the conference see IRRD 286189. (TRRL) Proceedings of the International Transport Congress, Montreal, September 23-27, 1984, Volume 3: Vehicles and Tr.

IMPORTANCE OF SIMULATION IN TRAFFIC FLOW BEHAVIOR ANALYSIS, SURVEILLANCE AND TRAFFIC CONTROL. Stanojevic, M. Savez Inzenjera I Tehn Saobracaja I Veza Jugo. Zbornik III Jugo Savetovanje Tehn Regul Saobracaja Apr 1983 pp 173-188 14 Fig. 1 Tab. 23 Ref. Serbian

The paper discusses methods of traffic flow modelling. The use of stochastic simulation for traffic flow modelling, based on microscopic modelling, is described. The importance of simulation in the investigation of traffic flow, surveillance and traffic control is stressed. The paper presents an algorithm for the prediction of traffic space, speed and traffic flow density. It also presents a stochastic freeway merging simulation model of traffic flow based on digital simulation of event scanning. The results are illustrated. (TRRL)

IMPROVED CONTINUUM MODELS OF FREEWAY FLOW. Michalopoulos, PG; Beskos, DE (Minnesota University, Minneapolis). VNU Science Press Bv P.O. Box 2073 Utrecht Netherlands 90-6764-008-5. 1984 pp 89-111 6 Fig. 1 Tab. 15 Ref.

The problem of macroscopic modelling of freeway flow dynamics is addressed in this paper. Existing simple and high order continuum models are examined, modified and treated numerically. Subsequently they are implemented to a number of situations representing uninterrupted and interrupted flow conditions in order to assess their effectiveness. This is accomplished by comparing model results with a data base generated through a detailed microscopic simulation program recently developed by the FHWA. The problem of multilane dynamics is also addressed. A simple continuum formulation is presented in detail while two additional alternatives, a two dimensional one and a high order continuum, are briefly discussed. Test results of all alternatives are also presented. (Author/TRRL) Papres presented during the Ninth International Symposium on Transportation and Traffic Theory held in Delft the Netherlands, 11-13 July 1984.

IMPROVED GRAPHIC TECHNIQUES IN SIGNAL PROGRESSION. Wallace, CE; Courage, KG (Florida University, Gainesville). Transportation Research Board. Transportation Research Record N957 1984 pp 47-55 11 Fig. 12 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

The results of several research studies into graphic representations of traffic signal system settings and traffic flow are presented. The research began with the fundamental time-space diagram, which is universally understood by traffic engineers, and also with flow diagrams from the TRANSYT model. Three specific departures from these basic techniques are presented, which include time-location diagrams, forward progression opportunities, and platoon progression diagrams. All of these techniques apply to linear arterial systems or subsystems. Another graphic technique that applies to a network of coordinated signals is then discussed: signalized network animated graphics. Interpretation of signal timing-optimization strategies, namely maximal bandwidth optimization, is discussed using the platoon progression diagram technique. This analysis demonstrates the pitfalls of the maximal bandwidth approach, thus demonstrating the power of the analysis technique. This paper was published in Transportation Research Record Number 957, Urban Traffic, Parking and System Management.

IMPROVED SIGNAL TIMING PLAN SELECTION. Kessmann, RW; Ku, CS. Kessmann and Associates, Incorporated Houston Texas. Aug 1985 22p. REPORT NO: REPT-1502.02. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

The effect of the occupancy weighting factor upon the performance of UTCS First Generation traffic responsive operation was investigated. Six values of the occupancy weighting factor were tested in an empirical computer simulation approach. Version four of the TRANSYT-7F program was used to develop optimal timing plans for five unique sets of traffic flow conditions in a forty intersection, downtown Washington, DC, grid network. These timing plans, along with the associated reference volumes and occupancies, were input to the data base of a modified version of the NETSIM Q5 simulation program. These modifications allowed UTCS First Generation surveillance and control operations to be simulated. Input traffic flow conditions to the network were varied seven times over a simulation interval of 105 minutes for each candidate value of the occupancy weighting factor.

IMPROVING SIGNAL TIMING, VOLUME 1. ISOLATED INTERSECTIONS. Imada, T; May, AD. California University, Berkeley Institute of Transportation Studies, 109 McLaughlin Hall Berkeley California 94720. May 1984 103p. REPORT NO: UCB-ITS-RR-84-3; FHWA-CA-TO-84-3-1. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

The objective of this research was to test three different strategies for timing isolated, fully actuated intersections: with type III detectors, without type III detectors and with the optimized parameters from the Penn-DOT computer program. Three field experiments were designed and carried out on an intersection in Modesto, CA. The total system delay was used as the primary performance measure. See Also PB85-178945.

IMPROVING SIGNAL TIMING. VOLUME 2. PRETIMED ARTERIAL ROADWAYS. Vermeulen, MJ; Lermat, NP; May, AD. California University, Berkeley Institute of Transportation Studies, 109 McLaughlin Hall Berkeley California 94720. May 1984 204p. REPORT NO: UCB-ITS-RR-84-4; FHWA-CA-TO-83-3-2. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

The objective of this part of the research was to develop manual guidelines for pretimed arterial streets. Manual guidelines were first developed and tested in the laboratory. The TRANSYT simulation model was used for this purpose. Modifications were made to the model to facilitate the use of different cycle lengths within the same system. Next, the performance of the guidelines was evaluated in a detailed before-and-after field experiment involving 11 signals along State Highway 123 (a section of San Pablo Avenue in Berkeley and Oakland). The total system delay was used as the primary performance measure.

INCORPORATING FUEL CONSUMPTION MODELS INTO URBAN TRAFFIC ANALYSIS TECHNIQUES. NATIONAL ENERGY RESEARCH, DEVELOPMENT AND DEMONSTRATION PROGRAM; END OF GRANT REPORT. Bowyer, DP. Australian Dept of Primary Industries and Energy GPO Box 858 Canberra A.C.T. 2601 Australia 0811-9570 0-642-12708-5. Oct 1988 9p. REPORT NO: NERDDP Report 814

The NERDDP Project 1036, 'Incorporating Fuel Consumption Models Into Urban Traffic Analysis Techniques', has been conducted at ARRB over the period July, 1987 to November, 1988. The primary objectives of the project were to: (a) advance the knowledge of driver vehicle acceleration behavior; (b) incorporate truck fuel consumption models into several existing traffic analysis techniques; and (c) improve the fuel estimation procedures in the SATURN traffic analysis package. The major technical tasks and the associated findings are detailed in previous reports and in forthcoming documentation updates of the SATURN system. This is the final report to the NERDD Committee. It summarizes the primary findings from the technical tasks and demonstrates the value of the enhanced fuel consumption models. A more flexible acceleration time model has been developed, which should find use in micro simulation, traffic models. The previous hierarchy of car fuel consumption models has been generalized and now provides reliable estimates for a wide range of vehicle types. These models can be incorporated into a number of existing traffic models, and have been for the INSECT and SATURN models. A particularly important use of the new fuel consumption models is in estimating the effect of traffic control changes when there are heavy vehicles in the traffic stream. Stops are seen to have much more significant impacts on fuel consumption than was indicated by the previous car based fuel consumption models. The practical implication is that careful consideration should be given to all traffic performance variables (fuel consumption, safety, delay), when traffic system changes are being investigated.

INDO-SWEDISH TRAFFIC SIMULATION MODEL: A PROGRAM FOR THE MONTE CARLO SIMULATION OF HETEROGENEOUS VEHICLE TRAFFIC ALONG SINGLE LANE, INTERMEDIATE LANE AND NARROW TWO LANE ROADS. Brodin, A; Palaniswamy, SP. National Swedish Road & Traffic Research Institute Fack S-581 01 Linkoeping Sweden. 1985 124p. REPORT NO: VTI/MEDDELANDE-439A. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

The report deals with a simulation program which describes the dynamic sequence of heterogeneous vehicle traffic over defined stretches of road for given traffic volumes and compositions. Crossing sequence of vehicles moving in opposing directions is the unique feature of the program system. Also unique is the ability of the model to deal with road stretches with width varying from single lane (3.5 meters wide) with different types shoulders and auxiliary lanes to two lane roads (7.0 meters wide). Jackson Structured Programming technique (JSP) has been used in programming and the programming language is SIMULA 67.

INSECT WITH TRAFFIC SIGNALS: VALIDATION REPORT. RJ NAIRN AND PARTNERS PTY LTD 7 CENTENNIAL AVENUE Randwick New South Wales Australia. Jun 1986 61p

The development of the intersection simulation model INSECT has included the addition of the control software of a real time traffic signal controller interfaced to the traffic simulator. In its earlier form, INSECT modelled unsignalised intersections and roundabouts. This report presents the results of the comparison of the simulation of a signalized intersection with survey data. The comparison has been very pleasing. While it is expected that the results of the simulation could be made to appear closer to the survey by further adjusting the model parameters, the comparisons indicated that the model could be used with confidence for the range of conditions covered by the survey data. The results of the comparison show that, while there are many minor variations, the model provides a realistic and reasonable representation of the operation of a signalized intersection, and produces results which are, for most parameters, not significantly different from those of actual surveys. In addition, the trends exhibited by the model as key parameters (eg journey time, red per cent, signal timing, etc) were changed are in accordance with those experienced on street. It is concluded that INSECT provides a good test bed for examining the effects on traffic of changes made to a traffic signal controller.

INTEGRATED MODELING OF FREEWAY FLOW AND APPLICATION TO MICROCOMPUTERS (ABRIDGMENT). Michalopoulos, PG; Lin, J. Transportation Research Board. Transportation Research Record N1091 1986 p 25-28 1 Fig. 6 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

An interactive, menu-driven macroscopic freeway simulation program with graphic capabilities is summarized in this paper. In addition to the employment of personal computers, the program has some attractive features that allow simulation at various levels of complexity. Improved macroscopic modeling specifically developed for the program is used to describe complex phenomena, such as lane changing, merging, diverging, and weaving. The freeway is simulated in an integrated fashion; this implies that the coupling effects of ramps are considered in determining actual entering and existing flows as well as in following the simultaneous development of queues and propagation of congestion on both the freeway and its ramps. Input to the program is entered interactively and includes conventional traffic parameters, freeway and ramp characteristics (e.g., capacity, free flow speed, jam density), demands (including percentage of existing volumes at off ramps), and geometric information. Output includes estimation of delays, stops, energy consumption, pollution levels, and other important measures of effectiveness. In addition, two- and three-dimensional plots of speed flow and density are produced for dynamic description of these basic variables in time and space; additional graphics include visual review of the freeway operation during the simulation as well as description of the geometrics, demand patterns, and other input information. This paper appeared in Transportation Research Record N1091, Traffic Flow Theory, Characteristics, and Highway Capacity.

INTERSECTION, DIAMOND, AND THREE-LEVEL DIAMOND GRADE SEPARATION BENEFIT-COST ANALYSIS BASED ON DELAY SAVINGS. Rymer, B; Urbanik, T, II. Transportation Research Board. Transportation Research Record N1239 1989 pp 23-29 8 Fig. 2 Tab. 4 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

A method for determining when traffic flow should be grade separated would be an invaluable tool for the traffic engineer/planner. The results of this study facilitate choosing proposed grade separation improvements on the basis of an evaluation of the reduced delay benefits to the cost of a grade separation. This methodology can assist decision-makers in determining when grade separations are appropriate. The analysis is centered on the Federal Highway Administration's TRANSYT 7F model. An economic analysis that presents the benefit/cost methodology for ranking a grade separation project is included. This paper appears in Transportation Research Record No. 1239, Geometric Design and Operational Effects.

INTERSECTION SIMULATION MODEL: INSECT. Cotterill, PJ; Moore, SE; Tudge, R (Rj Nairn and Partners Proprietary Limited; New South Wales Department of Main Roads,Australia). Australian Road Research Board 500 Burwood Road Vermont South Victoria 3133 Australia 0572-1431. VOL. 12 NO. 4 1984 pp 171-182 9 Fig. 18 Ref.

INSECT is a computer suite for modelling unsignalised intersections. From a simple intersection description it produces estimates of delay, stops, fuel consumption, queue lengths and other measures of traffic operation. The model is based on a vehicle-by-vehicle simulation technique with vehicle movements governed by car-following principles. Conflict resolution is based on gap acceptance criteria. Lane changing is also modelled using a gap acceptance method with both strategic and tactical lane selection included. An innovative feature in INSECT is ability to construct intersection geometry from a minimum amount of data. However, if required, detailed specification of intersection geometry may also be specified by the user. This paper describes the principles and operation of INSECT. The number of covering abstract for the conference is TRIS No. 393385. (Author/TRRL) This paper was presented during the 12th Australian Road Research Board Conference, Hobart, Tasmania, 27-31 August 1984.

INTERSECTIONS. PROCEEDINGS: INSTITUTE OF TRANSPORTATION ENGINEERS DISTRICT 7 - CANADA - TWELFTH ANNUAL MEETING. Gillett, R; Teply, S; Babey, GM; Hunt, JD; Stephenson, B; Solomon, HL; Mah, M. Institute of Transportation Engineers RTAC, 1765 St Laurent Boulevard Ottawa Ontario K1G 3V4 Canada. 1987 pp 8.1-102 31 Fig. 16 Tab. 22 Ref.. AVAILABLE FROM: Institute of Transportation Engineers RTAC, 1765 St Laurent Boulevard Ottawa Ontario K1G 3V4 Canada

Papers presented at this session include: network traffic control systems (gillett,r); micro-record : a practical traffic signal coordination program (teply,s, babey,gm, hunt,jd and stephenson,b); evaluation of signal timings on Hamilton mountain using transyt 7-f (solomon,hl); side street capacity at unsignalized intersections (mah,m). For the covering abstract of the conference see IRRD 291074. (TRRL)

INTRODUCTION TO RURAL TRAFFIC SIMULATION. Hoban, CJ. Australian Road Research Board 500 Burwood Road Vermont South Victoria 3133 Australia 0 86910 127 7. 1983 pp 37-48 4 Fig. 11 Ref.

Some of the basic concepts of rural traffic simulation, with particular reference to the Australian Road Research Board model, TRARR are introduced. Simulation provides a method for generating random selections from known traffic distributions, and observing the progress of each vehicle along the road. Vehicle progress is governed by a set of decision rules which determine the response of the vehicle to various road and traffic situations. The reliability of a model depends on its complexity and the extent of calibration and testing. The main constraints on simulation model accuracy are the limits of our knowledge of the traffic flow process. (TRRL) Program and papers from Workshop on Rural Traffic Simulation, Vermont South, Victoria, June 2-3, 1983. This paper was presented in Session 1: Rural Traffic Simulation.

INVESTIGATION OF OPTIMAL TIME TO CHANGE ARTERIAL TRAFFIC SIGNAL-TIMING PLAN. Jrew, BK; Parsonson, PS; Chang, EC-P. Transportation Research Board. Transportation Research Record N1057 1986 pp 20-29 6 Fig. 10 Tab. 6 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

The objective of this study was to use several off-line computer programs to provide a technique for determining the optimal afternoon time during which to change the off-peak timing plan to the peak-period timing plan for a particular Atlanta arterial. The study made use of PASSER II-80 (an arterial-optimization model), TRANSYT-7F (a model for optimizing arterials or grids), and SOAP/M (an intersection-optimization model). An attempt to establish different optimal timing plans for the off-peak hour (1:00 to 2:00 p.m.) and the peak hour (5:00 to 6:00 p.m.) using PASSER was unsuccessful because it was found that both hours required the same cycle length. The TRANSYT optimization program produced different cycle lengths for the two hours. The authors adjusted these cycle lengths to 85 sec for the off-peak hour and 115 sec for the peak hour so that there would be a clear superiority of one over the other at each of the two times of day. Twenty TRANSYT simulation runs were then performed forward in time, from 1:00 to 6:00 p.m., by using the off-peak optimal timing plan and the volumes for each 15-min period. Another 20 TRANSYT simulation runs were performed backward in time, from 6:00 to 1:00 p.m., by using the peak-hour optimal timing plan and the volumes for each 15-min period. The two plots of performance index versus time of day intersected at 4:15 p.m., the optimal time to change plans. The TRANSYT-oriented procedure involved considerable effort and computer time. It was theorized that the TRANSYT procedure might be replaced by a relatively simple SOAP/M analysis of only the critical intersection. However, it was found that at all times during the afternoon the off-peak cycle length had a lower traffic performance index; therefore, the SOAP/M analysis failed to produce an optimal time to change the plan. This paper appeared in Transportation Research Record N1057, Traffic Signal Systems.

ITDS: A DATA BASE DRIVEN INTERFACE TO TRAFFIC MODELS USING A MICROCOMPUTER. Santiago, AJ. Federal Highway Administration, Office of R&D. Public Roads VOL. 49 NO. 4 Mar 1986 pp 122-126. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

The Federal Highway Administration (FHWA) and others have developed over the past 20 years a number of computer programs that can evaluate and/or optimize different traffic control strategies before committing the financial resources necessary to design the strategies and implement them in the field. This article describes the Integrated Traffic Data System (ITDS), a set of microcomputer programs that solves many of these problems by providing an easy-to-use interface to a wide range of existing traffic models. ITDS allows the user to maintain a local traffic data base and easily generate input data sets for various traffic models in a user-friendly manner.

ITDS: PAST, PRESENT, AND FUTURE. Rathi, AJ; Santiago, AJ; Valentine, DE; Chin, SM. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 116 NO. 6 Nov 1990 pp 799-808 Figs. Refs. 1 App. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017-2398

The paper describes the integrated traffic data system (ITDS), a microcomputer-based system designed to allow traffic engineers to store, maintain, and update traffic network information in a centralized data base. The information may be used to create input data files for widely used traffic simulation and network signal-timing optimization models. ITDS provides a friendly preprocessor to models such as TRAF-NETSIM and TRANSYT-7F. Interactive and static displays have also been added.

KNOWLEDGE BASE ON SEMI-ACTUATED TRAFFIC-SIGNAL CONTROL. Lin, F-B. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 117 NO. 4 Jul 1991 pp 398-417 Figs. Tabs. Refs. 2 App.. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017-2398

A microscopic simulation model is used to develop a knowledge base for the use of semi-actuated signal control at individual intersections. This base addresses semi-actuated operations that rely on presence detection of vehicles and that do not accommodate pedestrian timing. The paper focuses on the following aspects of semi-actuated operations: phasing plan; timing design; setting of call delay; choice of detector length; and choice between semi-actuated control and full-actuated control.

LABOR SAVING METHODS FOR IMPROVED OPERATION OF COMPUTER-CONTROLLED TRAFFIC SIGNAL SYSTEMS: 1.5 GENERATION SYSTEM FUNCTIONAL DESCRIPTION AND SOFTWARE DEVELOPMENT GUIDELINES. Kessmann, RW; Ku, CS; Cooper, DL. Kessmann and Associates, Incorporated 18333 Egret Bay Boulevard Houston Texas 77058. Mar 1985 106p. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

This report provides a functional description of the 1.5 Generation control system concept. The system described is the one which was found to be the most effective of several alternatives studied in the analyses of References 1 and 2. The material of this report serves as a basis for developing design specifications for the 1.5 Generation system applications software. The primary objective of the 1.5 Generation control system is to reduce the labor intensiveness of the task of developing pre-stored traffic signal timing plans used in the First Generation central computer controlled signal system. A secondary objective of the concept is to detect long term trends in the degradation of performance of the pre-stored timing plans used in a First Generation system. See also PB86-124500.

LABOR SAVING METHODS FOR IMPROVED OPERATION OF COMPUTER-CONTROLLED TRAFFIC SIGNAL SYSTEMS: EXECUTIVE SUMMARY. Kessmann, RW; Ku, CS; Cooper, DL. Kessmann and Associates, Incorporated 18333 Egret Bay Boulevard Houston Texas 77058. Mar 1985 38p. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

A key objective of the study summarized in this document is to investigate the feasibility of retrofitting existing and/or planned computerized traffic signal control systems with the capability to automatically compute optimal traffic signal timing plans for review and analysis by traffic engineering staff. The term 1.5 Generation has been applied to systems having this capability. The objective of such 1.5 Generation systems is to provide traffic engineering staffs with a labor-saving tool to be used to maintain optimal traffic signal timing. See also PB86-124492.

LEVEL OF SERVICE CONSIDERATIONS AT SIGNALIZED INTERCHANGES. HIGHWAY CAPACITY AND LEVEL OF SERVICE. PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON HIGHWAY CAPACITY, KARLSRUHE, GERMANY, 24-27 JULY 1991. Urbanik, T, II; Fambro, DB. Balkema (AA) P.O. Box 1675 3000 BR Rotterdam Netherlands 90 5410 011 7. 1991 pp 407-411 1 Fig. 1 Tab. Refs.. AVAILABLE FROM: Balkema (AA) Publishers Old Post Road Brookfield Vermont 05036

Capacity analysis of signalized interchanges is not adequately addressed by current Highway Capacity Manual (1985) procedures. Issues such as computer models, level of service, queue spill back, and phasing and timing that must be addressed in conducting an analysis of signalized interchanges are identified. Guidance is given on how to conduct an appropriate capacity and level of service analysis using available tools. Finally, limitations of the current procedures and recommendations for future research are presented.

LIMITATIONS ON THE OBJECTIVE OF ENERGY EFFICIENCY IN URBAN TRAFFIC MANAGEMENT. Akcelik, R. Society of Automotive Engineers (Australasia) 191 Royal Parade Parkville Victoria 3052 Australia. Nov 1982 p 81.1 3 Fig. 3 Tab. 6 Ref.. REPORT NO: SAEA 82081

The objective of reducing fuel consumption in urban traffic must be considered in the context of an overall traffic system management approach. This paper emphasizes the existence of conflicts among various traffic management objectives (safety, traffic performance, energy, air pollution, property access, intrusion into residential areas, etc) and among the needs of different road user groups (pedestrians, buses, cars, heavy vehicles, major and minor road traffic, etc). An elemental model of fuel consumption is described briefly, and its relevance to existing traffic modelling techniques is emphasized. The elemental model is then used as a basis for discussing the expected impacts of various short-term traffic management measures on traffic performance, fuel consumption, safety and other objectives. Theoretically, fuel consumption savings of about 5 to 10 per cent could be achieved from traffic control (at a local level) given the limitations imposed by other traffic system management objectives. However, considering time-dependent and location-specific characteristics of road traffic systems, it is concluded that, in order to achieve and maintain such levels of energy savings, continuous implementation of sophisticated traffic engineering techniques is required. Furthermore, the problem should be considered in the context of a wider transport system management approach which analyses relatively long term impacts on route choice, mode choice and travel demand levels. (Author/TRRL) Proceedings of the 19th International Fisita Congress, Melbourne, Australia, November 8-12, 1982.

LINSIG: A COMPUTER PROGRAM TO AID TRAFFIC SIGNAL DESIGN AND ASSESSMENT. Simmonite, BF. Printerhall Limited. Traffic Engineering and Control VOL. 26 NO. 6 Jun 1985 pp 310-315 9 Fig. 3 Ref.

The development of the microprocessor-based traffic signal controller for use at urban traffic control installations has enabled the engineer to design traffic-signalled intersections with a far greater degree of flexibility. There are a number of computer programs which will calculate the capacity of traffic-signalled intersections and these are usually adequate for dealing with stage-based controllers. However, in order to model a microprocessor controller, a more accurate computer model is required to enable any minor alterations in the controller design to be reflected in the capacity of the junction. In order to achieve this the junction has to be modelled in two different ways, using a controller model and a traffic model. This article describes a computer program (LINSIG) which allows the engineer an opportunity to design the controller to the MCE 0141 specification, test the design and then compute the junction capacity. By altering the controller model or the geometric parameters, various options can be tested. The two models and the way in which they interact are explained. (TRRL)

MACRO VS MICRO FREEWAY SIMULATION: A CASE STUDY. Liu, C. and Kanaan, A. (AEPCO, Inc., Rockville, Md.), Santiago, A. (Federal Highway Administration, Mclean, Va.), and Holt, G. (City of Columbus, Columbus, Oh.). Proceedings of the American Society of Civil Engineers Microcomputers in Transportation Conference, 1992.

This paper documents a case study on freeway improvements evaluations through the use of FREFLO, a macroscopic simulation model, and FRESIM, a microscopic simulation model. Both models are part of the Federal Highway Administration's TRAF simulation system. The case study involved a section of the I-70 freeway in Columbus, Ohio. Geometric and access control improvements were proposed to alleviate congestion on the freeway. The existing conditions, and the proposed improvements were modelled under current, as well as future, traffic scenarios.

MACROSCOPIC FREEWAY MODEL FOR DENSE TRAFFIC - STOP-START WAVES AND INCIDENT DETECTION. Kuehne, RD (Aeg-Telefunken Forschungsinstitut, W Germany). VNU Science Press Bv P.O. Box 2073 Utrecht Netherlands 90-6764-008-5. 1984 pp 21-42 13 Fig. 1 Phot. 19 Ref.

A continuum model for freeway traffic flow is described which includes relaxation of the equilibrium speed of the static speed-density relation ("fundamental diagram") and anticipation of traffic conditions downstream. Stability analysis shows that in light traffic the equilibrium solution given by the fundamental diagram is stable, while in dense traffic, jams with stop-start waves occur. The formation of stop-start waves is in full analogy to the creation of roll waves in inclined open channels with a suitable water height. The methods to derive such roll wave solutions from the basic hydrodynamic equations of shallow water theory are used to describe the stop-start waves in the freeway model. As in fluid dynamics, where the change from laminar flow to turbulent flow is announced by critical fluctuations, the change from steady traffic to traffic with jams and stop-start waves is indicated by large fluctuations. From theory and measurement of the broadening of the speed distribution due to the critical fluctuations an algorithm of traffic classification and incident detection is derived. On the basis of a simplified version of this algorithm using only local measurements of the speed distribution an automatic traffic jam warning system is developed. (Author/TRRL) Papers presented during the Ninth International Symposium on Transportation and Traffic Theory held in Delft the Netherlands, 11-13 July 1984.

MACROSCOPIC MODELS FOR OVERTAKING AND ONCOMING BICYCLE TRAFFIC. Van Laarhoven, AJM. Royal Dutch Touring Club ANWB. Verkeerskunde VOL. 33 NO. 7 Jul 1982 pp 388-392 2 Fig. 3 Phot. 10 Ref. Dutch

When designing bicycle facilities such as cycle paths the dimensions of the cross-section are very important. The author states that comfort and safety of cycle traffic are dependent on aspects like overtaking and meeting oncoming cyclists and moped riders. Computer simulations have been carried out and show that the models are useful in forecasting the process of overtaking and oncoming cycle traffic. (TRRL)

MACROSCOPIC SIMULATION FOR URBAN TRAFFIC MANAGEMENT. VOLUME 1: EXECUTIVE SUMMARY. Lieberman, E. KLD Associates Incorporated 300 Broadway Huntington Station New York 11746 TR-94; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Jan 1982 Final Rpt. 25p. REPORT NO: FHWA-RD-80-113. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

This volume is an Executive Summary describing the TRAFLO macroscopic traffic simulation model which is a system of integrated component traffic simulation submodels and an equilibrium traffic assignment model. Each component model is described. The input requirements for TRAFLO are indicated as are the statistical measures of effectiveness produced as output by the model. These measures describe, in detail, the traffic operation, emissions and energy consumed on a large system of roadways of general configuration. Selected validation results are presented and estimates of computer costs are described. Other volumes of this report are the following: Vol. 2 TRAFLO User's Guide. Vol. 3 Analytical Developments for TRAFLO. Vol. 4 Data Base and Structure Charts of TRAFLO Software. Vol. 5 Data Reduction, Calibration and Validation Study for TRAFLO. (FHWA)

MACROSCOPIC SIMULATION FOR URBAN TRAFFIC MANAGEMENT: VOLUME 2: TRAFLO USER'S GUIDE. Lieberman, E; Andrews, B; Davila, M; Yedlin, M. KLD Associates Incorporated 300 Broadway Huntington Station New York 11746 TR-92; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Jan 1982 Final Rpt. 214p. REPORT NO: FHWA-RD-80-114. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

This volume presents a guide for the user of the TRAFLO model. It details the following: general model characteristics; input formats; sample output reports; error message identification; computer operations; and computer resources. The other volumes of this report are as follows: Volume 1-Executive Summary, Volume 2-Analytical Developments for TRAFLO, Volume 3-Data Base and Structure Charts of TRAFLO Software, and Volume 4-Data Reduction. (FHWA)

MACROSCOPIC SIMULATION MODEL FOR FAST ROAD NETWORKS TAKING INDIVIDUAL VEHICLES INTO ACCOUNT (DYNEMO). Schwerdtfeger, T. Technical University of Karlsruhe, West Germany Fakultaet fuer Bauingenieur- und Vermessungswesen D-7500 Karlsruhe West Germany. Jul 1986 199p German. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

> A simulation model is developed, which is to act as a support for the design and evaluation of traffic control systems in fast road networks. The flow of traffic is shown in such models by macroscopic or microscopic methods. The DYNEMO model takes into account static and dynamic parameters (e.g., network structure, peripheral traffic conditions, density of traffic, the proportion of lorries, journey matrix, selection of alternative routes) and consists of a combination of microscopic and macroscopic procedures, which makes it possible to take into account individual vehicles. The simulation model worked out is validated and is used to assess the NIKOS traffic control system, which is already in use in the motorway network of the Rhine-Main area.

MACROSCOPIC TRAFFIC DELAY MODEL OF BUS SIGNAL PREEMPTION. Radwan, AE; Hurley, JW, Jr (Virginia Polytechnic Institute & State University; Memphis State University). Transportation Research Board. Transportation Research Record N881 1982 pp 59-65 4 Fig. 2 Tab. 17 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

> Productivity enhancement of public transportation is an essential goal, and bus signal preemption at intersections is one of the transportation system management strategies that strives for this goal. Improvements in bus speed and reductions in delay are the anticipated benefits accrued from such strategy. A macroscopic traffic delay model, which applies stochastic procedure, is presented to evaluate different bus preemption signal strategies at an isolated intersection. The model permits the user to evaluate a certain operational strategy provided for bus traffic on both main and cross streets. The signal controller modeled in this paper has a green extension and red truncation capabilities. A comparison between preemption on both main and cross street and preemption on main street only is provided to validate the model's logic. Sensitivity analyses were implemented and it was found that the delay savings due to signal preemption are sensitive to saturation flow rate and to bus passenger load. Potential applications and further enhancement are suggested. (Author) This paper appeared in Transportation Research Record No. 881, Traffic Control Devices and Traffic Signal Systems.

MAKING TRANSYT USAGE EASY WITH MICROS: A CASE STUDY. SESSION 4. Strong, DW; Eckols, RH (Barton-Aschman Associates, Incorporated). Institute of Transportation Engineers. Compendium of Technical Papers, 1984 pp 9-13 4 Fig. 8 Ref.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

> Microcomputers are now accepted as a basic tool for use in the traffic engineering profession. Currently, the profession is in the process of developing and refining the methodologies and techniques necessary to apply the power of the microcomputer to traffic engineering. One area where the microcomputer has already been used successfully is in the development of coordinated signal timing plans using the TRANSYT optimization model. This paper discusses specific experience with microcomputers in this field as applied to the California Energy Commission's (CEC) Fuel Efficient Traffic Signal Management Program. (3) As a part of this program, nearly 200 signals were timed using these techniques in four cities, San Francisco with 77 signals, San Jose with 51 signals, Richmond with 30 signals, and Redwood City with 34 signals. The techniques used and the results obtained are discussed in this paper. (Author) This paper was presented during the Institute of Transportation Engineers 54th Annual Meeting, San Francisco, California, September 23-27, 1984.

MAXBAND-86: PROGRAM FOR OPTIMIZING LEFT-TURN PHASE SEQUENCE IN MULTIARTERIAL CLOSED NETWORKS. Chang, EC-P; Cohen, SL; Liu, C; Chaudhary, NA; Messer, C. Transportation Research Board. Transportation Research Record N1181 1988 pp 61-67 1 Fig. 3 Tab. 16 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

> Four variables are available to the traffic engineer that can be used to optimize the flow of traffic in signalized urban networks. Three of these--green phase time, offset, and cycle length--are well know, and a number of computer programs are available to determine them. A fourth variable, left-turn phase sequence, is less well known and can be computed only for arterial networks by existing software. Recognizing that the left-turn parse sequence might be an important variable in multiarterial closed networks, the Federal Highway Administration (FHWA) contracted with Texas Transportation Institute (TTI) to extend the MAXBAND program, which was restricted to single arterials and triangular networks, to such general networks. The extensions made to the MAXBAND program resulted in

MAXBAND 86; these extensions are described in this paper. The application of MAXBAND 86 to a study of the effect of the left-turn phase sequence in 10 multiarterial closed networks is described also. The study included comparison of MAXBAND-produced timing plans with and without phase sequence optimization and an analysis of the effects of using phase sequence patterns given by MAXBAND in the TRANSYT program. The results indicate that optimization of the phase sequence can often provide a substantial benefit in terms of reduced delay and stops. This paper appears in Transportation Research Record No. 1181, Urban Traffic Systems and Parking.

MAXBAND PROGRAM FOR ARTERIAL SIGNAL TIMING PLANS. Cohen, SL; Little, JDC. Federal Highway Administration, Office of R&D. Public Roads VOL. 46 NO. 2 Sep 1982 pp 61-65 9 Ref.. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

This article discusses the MAXBAND model, a portable bandwidth optimization computer program written in FORTRAN IV that can be used to develop signal timing plans for signalized arterials and simple networks of three intersecting arterials. The program can optimize signal offset, cycle length, and left turn phase sequence.

MEASURES OF QUEUEING PERFORMANCE FOR A TRAFFIC NETWORK. Bell-M.C.. Newcastle upon Tyne Univ. (England). Transport Operations Research Group. TORGRR33. Oct 80. 29p. UNITED-KINGDOM.

A comprehensive study of vehicles queueing at traffic signalled junctions was carried out. The results showed that the variation in the length of the queue of a given number of vehicles was greater during the green compared with the red stage, although the variation was found to be randomly distributed about the mean queue in both cases. The traffic simulation model MULTSIM was used to generate over 40 thousand queues to assess the cycle by cycle variation in the number of vehicles queueing at a signalled junction based on 30 simulated cycles. Results of an on-site survey and the simulation modelling are used to derive measures of the cyclic variation in the spare capacity for vehicles queueing on a link in a traffic network during the effective green and red stages. The latter are then translated into a queueing performance indicator designed to be included as part of the delay performance index used by TRANSYT 7 to optimize traffic signal settings.

MEASURING AND ANALYZING CYCLIC FLOW PROFILES WITH A PORTABLE MICROCOMPUTER. Robertson, DI; Wood, K (Transport and Road Research Laboratory). Printerhall Limited. Traffic Engineering and Control VOL. 25 NO. 1 Jan 1984 pp 27-28 2 Fig. 4 Ref.

Traffic congestion in urban areas can often be reduced by coordinating the operation of the signals that control adjacent road junctions. Signal co-ordination timing "plans" can be calculated by had or by a computer-based method such as TRANSYT. The efficiency of a timing plan can be checked, and the plan improved, by measuring 'cyclic flow profiles'; the use of a portable microcomputer makes such measurements easy and helps unify theory and practice. (Author/TRRL)

MEASURING LEVEL OF SERVICE OF TWO-LANE HIGHWAYS BY OVERTAKINGS. Morrall, JF; Werner, A. Transportation Research Board. Transportation Research Record N1287 1990 pp 62-69 7 Fig. 3 Tab. 9 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

A level-of-service concept that is based on the supply of passing opportunities and demand for overtaking is presented. A driver is hypothesized to perceive level of service on a two-lane highway on the basis of his or her ability to overtake slower vehicles. The demand for overtaking is a function of volume and the speed distribution characteristics of the traffic stream. The supply of opportunities for vehicles to overtake is a function of the number of gaps adequate for safe overtaking maneuvers in the opposing traffic stream and the percentage of passing zones of the highway section under consideration. The relationship between supply and demand for overtaking forms the basis of a level-of-service measure defined by the overtaking ratio. The overtaking ratio is defined as the ratio of the achieved number of overtakings on a two-lane highway to the desired number (or to the total number of overtakings possible on a two-lane highway with continuous passing lanes and with vertical and horizontal geometry similar to the two-lane highway). Various level-of-service measures and procedures including the method of the 1965 and 1985 Highway Capacity Manuals, the percent-following count generated by simulation modeling, and the overtaking ratio, are compared. The overtaking ratio decreased much faster than the percentage of time delayed increased for those ranges of level of service to which motorists are most sensitive on two-lane highways. The overtaking ratio is suggested as another dimension of level of service to be considered for two-lane highways in addition to existing measures such as percentage of time delayed, capacity use, and speed. This paper appears in Transportation Research Record No. 1287, Traffic Flow, Capacity, Roadway Lighting, and Urban Traffic Systems 1990.

MEASURING SATURATION FLOW AT TRAFFIC SIGNALS USING A HANDHELD MICROCOMPUTER. Wood, K Printerhall Limited. Traffic Engineering and Control VOL. 27 NO. 4 Apr 1986 pp 174-175 2 Fig. 6 Ref.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London England

Traffic signal timings cannot be optimized unless the traffic engineer knows the saturation flows at the junction. This is true whether the signals are operating independently, or coordinated with other signals in the area. While methods of estimating saturation flows are available, it is usually better to measure the values directly. However, measuring saturation flow demands considerable concentration. In the standard method, the engineer must not only observe the traffic, but also continuously check the time on a stopwatch and record data every six seconds. To simplify this process, TRRL has written a program for a handheld microcomputer. With the program the engineer simply presses a key as each vehicle crosses the stop-line; there is no need to look at a watch or to write down data. Vehicles with different pcu values may be classified by using a different key for each class. At the end of the observations the computer calculates and prints out the saturation flow ready for immediate use. (Author/TRRL)

MEASURING SIGNAL PLATOON FLOW. VIRKLER, MR; MADSEN, RW; SUTTON, JH. JOURNAL OF URBAN PLANNING AND DEVELOPMENT VOL. 117 NO. 5 Oct 1991 PP 513-528 ENGLISH

BY MARK R. VIRKLER, RICHARD W. MADSEN, AND JOANNE H. SUTTON CHARTS INCLUDES BIBLIOGRAPHICAL REFERENCES

MELBOURNE ON-ROAD, HALF SECOND SPEED AND FUEL CONSUMPTION, PEAK DATA (1978), COLD-START DATA (1982) AND FUELS DATA (1982). Lansell, SR; Chittleborough, CC; Watson, HC. Melbourne University, Australia Department of Mechanical Engineering, Grattan Street Parkville Victoria 3053 Australia. 1984 Monograph 29p 1 Fig. 7 Tab. 5 Ref.. REPORT NO: TG1/84

As part of the NERDDP motor vehicle fuel conservation program, data collection exercise, fuel consumption and vehicle velocity data collected in 3 separate experiments have been compiled as files on magnetic tape for use by others. The 3 experiments were carried out using the Melbourne University instrumented car during the period 1978 to 1982. The main objective of the first two experiments was to produce drive cycles for vehicle testing, the data from which the Melbourne peak cycle and the Melbourne cold start cycle were developed. The last set is the fuels study data performed in co-operation with the Country Roads Board and contains additional information believed to be valuable in the validation of car following algorithms used to optimize traffic signal setting, and for other similar purposes. 3 modes of signal operation were employed in this experiment. This report is with "NERDDP Motor Vehicle Fuel Conservation Program-Driving Pattern add Fuel Consumption Data Collation: Final Report" (Author/TRRL)

METHODS OF EVALUATION USED IN ARRB SIMULATION STUDIES. Hoban, CJ. Australian Road Research Board 500 Burwood Road Vermont South Victoria 3133 Australia 0 86910 127 7. 1983 pp 133-154 5 Fig. 7 Tab. 25 Ref.

Rural traffic simulation models have been used in a number of studies at the Australian Road Research Board to investigate alternative road improvement options. The simulation models give an indication of the expected changes in traffic performance, and this may be supplemented with data on costs and accident effects. Four approaches to the evaluation of alternative options using this information are described. The four approaches are (a) relative traffic performance; (b) cost-effectiveness; (c) benefit-cost analysis; and (d) level of service. Examples are given from previous simulation studies, and some advantages and limitations of each approach are noted. The appendices provide further information which may be useful in benefit- cost analysis. The paper was presented in Session 4: Practical Application of Rural Traffic Simulation. (TRRL) Program and papers from Workshop on Rural Traffic Simulation, Vermount South, Victoria, June 2-3, 1983. This paper was presented in Session 4: Practical Application of Rural Traffic Simulation.

MICROCOMPUTER BASED INTEGRATED TRAFFIC SYSTEM: MARKET STUDY AND CONCEPTUAL DESIGN. Stewart, S; Sims, D; Quinn, M; Jang, K. Transport Canada Complexe Guy Favreau, 601 - 200 Dorchester Boulevard West Montreal Quebec Canada. Jul 1985 81p 13 Fig. 3 Tab. French. REPORT NO: E 6747. AVAILABLE FROM: Transport Canada Complexe Guy Favreau, 601 - 200 Dorchester Boulevard West Montreal Quebec Canada

Improved traffic control, such as optimized signal timing and the elimination of stop signs, offers the potential to save some 2% to 3% of the urban transportation energy consumption, or approximately 400,000,000 liters in Canada annually. With the considerable developments in microcomputers as well as traffic engineering application software, a microcomputer based traffic analysis system offers an effective and efficient approach to automating the time consuming tasks of traffic engineering. This study concludes that an integrated traffic system (i.t.s.) can offer significant benefits: reduced energy consumption, delay and congestion, and improved safety and staff utilization. The main functions of i.t.s. Would be accident analysis, traffic operations and inventory systems. The resulting its should be non-proprietary and designed to adapt to and evolve with new hardware and new application software. The report recommends that a demonstration of the system be undertaken in selected cities. (Author/TRRL)

MICROSCOPIC SIMULATION OF TRAFFIC IN NETWORKS: SUPERCOMPUTER EXPERIENCE. Mahmassani, HS; Jayakrishnan, R; Herman, R. American Society of Civil Engineers. Journal of Computing in Civil Engineering VOL. 4 NO. 1 Jan 1990 pp 1-19 Figs. Tabs. Refs. 2 App.. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017-2398

The results are given of recent computational experience with the NETSIM simulation model on a CRAY X-MP/24 supercomputer. The application of NETSIM to a large urban network is demonstrated, its computational performance on the supercomputer relative to conventional mainframes is compared, and the types of modifications to the NETSIM program that would be necessary to take better advantage of the parallelism present in the supercomputer architecture are identified. The paper reviews relevant background on supercomputing and CRAY, and the simulation experiments are described. Future modifications to NETSIM to enhance its performance in vector-processing environments are discussed, and comments are made on substantive questions in traffic theory and practical traffic problems that can benefit from enhanced computational capabilities.

MICROPROCESSOR AIDS TO OPTIMIZING UTC SIGNAL PERFORMANCE. Robertson, GD (West Yorkshire Metropolitan County Council). Printerhall Limited. Traffic Engineering and Control VOL. 26 NO. 1 Jan 1985 pp 4-8 6 Fig. 4 Ref.

In the urban traffic control (UTC) development offices of the West Yorkshire Metropolitan County Council a number of computer programs have been developed for use in UTC implementation and signal design. This article briefly describes the programs and indicates some of the ways in which these can improve signal performance. Time/distance diagrams can now be drawn using a microprocessor computer with a graphics VDU display. The computer program (called TD) allows 6 to 8 junctions to be displayed, has edit facilities on the input data and allows intermediate and final edited data to be stored. Co-ordination of traffic signals at complex networks can be achieved using the TD program to complement the delay calculations obtained from TRANSYT. The TD program is also useful for optimizing staging, finding the natural cycle time, deciding between alternative strategies and for evaluating new junctions. The TD screen display can be used to demonstrate many of the complex reasons for the co-ordination finally implemented. It is possible to point out advantages of existing signal timings and to show what would happen if alternative timings were implemented. Four other programs developed are briefly described, they are:-(1) drawing out phase timings within intergreens (INTGRN); (2) controller logic (LOGSIM); (3) pedestrian delays (PEDEL); (4) one in twenty queue length (1IN20Q). Programs (1) and (2) are used in connection with the MCE 0141 controller a microprocessor-based traffic signal controller for isolated linked and urban traffic control installation. (TRRL)

MICROSCOPIC SIMULATION OF ENERGY CONSUMPTION AND EXHAUST AS EMISSION IN ROAD TRAFFIC. Benz, T. Karlsruhe University, West Germany Kaiserstrasse 12 7500 Karlsruhe West Germany. Dec 1984 127p German. REPORT NO: NP-7770068. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

A simulation model was set up in order to fully account for chain of effects of: road traffic measures, driver behavior, vehicle, energy consumption, exhaust gas emission and traffic flow. Detailed description is given of the microscope simulation of the traffic flow, the determination of energy consumption and exhaust gas emission (basics of driving dynamics, engine parameters), and details of the model (program structure, various vehicle types, gearshift behavior, computing and print-outs). The model was then applied to a simple case of different coordination systems for traffic signals to road sections in residential quarters with a speed limit of 30 km/h resp. 50 km/h and to motorway conditions. The influence of traffic signal coordination on energy consumption and exhaust gas emission was determined. The model is then compared to other methods (drive cycles, driving process recording). It can be applied wherever traffic simulation has been successfully applied.

MICROSCOPIC SIMULATION OF FUEL CONSUMPTION AND EXHAUST EMISSIONS OF ROAD TRAFFIC (MISEVA). Benz, T. Karlsruhe University, West Germany Institut fuer Verkehrswesen Karlsruhe West Germany. 1985 128p German. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

A simulation model is introduced which, starting from simulation of traffic flow, permits information to be obtained on fuel consumption and exhaust emissions, from vehicles. In a survey of the literature, previously used processes are introduced and critically assessed. After a short introduction to simulation of traffic flow, the build-u of the model and procedure on a computer are described. For example, the model was applied to four actual situations. Three of them deal with inner city traffic and one with motorway traffic. Finally, by using this model, the problems of the previously described and used methods are shown.

MICROSCOPIC SIMULATION OF VEHICLES IN AN URBAN NETWORK. ADVANTAGES AND DISADVANTAGES OF THE EVENT-SCANNING METHOD. Aron, M (Institute for Rapid Transit). PTRC Education and Research Services Limited. Planning & Transport Res & Comp, Sum Ann Mtg, Proc 1984 pp13-24 6 Fig. 4 Ref.

The author describes the different aspects of an event-scanning method of simulating vehicle movements in a network: (1) general principles of the method, content of events and their interaction; (2) specific problems connected with the representation of traffic laws in an event-scanning context: the follow-up laws must be integrated, the propagation of disturbances must take a simple form, and the time of arrival of a vehicle at one point must be calculated in advance; (3) an attempt is made to show the advantages and disadvantages of the method, the aspects of the latter which remain to be solved, traffic laws or hypotheses, programming, comprehension and ease of use, and validation. For the covering abstract of the seminar see TRIS 450556. (TRRL) Proceedings of Seminar L, Traffic Operation and Management; Held at the 12th PTRC Summer Annual Meeting, University of Warwick, England, From 10-13 July 1984, Volume P, 254.

MODELING AND FILTERING OF FREEWAY TRAFFIC FLOW. Smulders, SA. Mathematisch Centrum Amsterdam Netherlands. 1987 22p. REPORT NO: CWI-OS-R8706. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

In the Netherlands a freeway control and signaling system has been installed on several freeways. One purpose of the system is to improve traffic flow and avoid the development of congestion. In the paper the first steps towards the aim are set in the development of a traffic model and of a filter that estimates the state of traffic at every time instant. The proposed model is simulated for various traffic situations and modified to achieve realistic performance. The filter is presented and its performance when applied to simulated traffic data shown.

MODELING OF QUEUE DISSIPATION FOR SIGNAL CONTROL. Lin, F-B; Cooke, D. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 112 NO. 6 Nov 1986 pp 593-608 11 Fig. 3 Tab. 6 Ref. 2 App.. REPORT NO: ASCE Paper 21040. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017

Simulation analysis of alternative signal control strategies requires a realistic queue dissipation model. Past efforts in modeling queue dissipation focus on queue discharge headways and neglect other aspects of queue dissipation. This results in models that produce misleading information for certain applications. To address this problem, this paper presents a simulation model that can realistically reproduce queue dissipation characteristics. The building block of this simulation model is a derived car-following model. Field data are used to illustrate the calibration and the application of the simulation model.

MODELING OF SHARED LANE USE IN TRANSYT-7F. Wallace, CE; White, FJ. Transportation Research Board. Transportation Research Record N1194 1988 pp 160-166 2 Fig. 13 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

The TRANSYT family of programs continues to be one of, if not the most, widely used computer programs in the world for traffic signal timing and traffic flow analysis. In the past this program was excellent for modeling protected or unopposed traffic movements from separate lanes; however, it did not have the capability to model several different movements, for example, unprotected left turns and through movements from a shared lane. A project to incorporate a model to explicitly deal with this condition in TRANSYT-7F is described. The model is based on the 1985 Highway Capacity Manual. Its implementation in TRANSYT-7F and the user interface are reviewed. This paper appears in Transportation Research Record No. 1194, Traffic Flow Theory and Highway Capacity.

MODELING THE BURLINGTON SKYWAY FTMS DURING RECURRING AND NON-RECURRING TRAFFIC CONGESTION. Van Aerde, M; Voss, J; Blum, Y. Printerhall Limited. Traffic Engineering and Control VOL. 30 NO. 5 May 1989 pp 228-241 Figs. Tabs. Refs.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London England

A model, called INTEGRATION, was developed to evaluate the operation of integrated freeway/traffic signal networks during periods of recurring and non-recurring congestion. This paper describes the application of the Burlington Skyway FTMS system near Hamilton, Ontario. The objective of the FTMS system is to monitor traffic conditions on the Skyway in order to determine when incidents and/or congestion due to other conditions warrant any diversion of traffic. At this time, appropriate changeable-message sign (CMS) legends must be selected, signal timings on the diversion arterial must be adjusted and the operation of the lift bridge must be closely monitored.

MODELLING THE DRIVING BEHAVIOR INFLUENCED BY INFORMATION TECHNOLOGIES. HIGHWAY CAPACITY AND LEVEL OF SERVICE. PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON HIGHWAY CAPACITY, KARLSRUHE, GERMANY, 24-27 JULY 1991. Reiter, U. Balkema (AA) P.O. Box 1675 3000 BR Rotterdam Netherlands 90 5410 011 7. 1991 pp 309-320 12 Fig. Refs.. AVAILABLE FROM: Balkema (AA) Publishers Old Post Road Brookfield Vermont 05036

It turned out to be useful to estimate possible effects of onboard information technologies on traffic flow before the start of introduction. One possibility for doing this is the simulation of traffic flow. Hence, a theoretical model has been developed, describing the influence of information technologies on driving behavior. This model has been integrated into a microscopic traffic simulation system. Described in this paper are human driving behavior with the driver supported by additional information, as well as automatic driving behavior, with special equipment controlling vehicle movement. Differences in traffic flow between not supported, partially supported and completely supported driving are shown, being a result of preliminary investigations.

MODELLING THE MOVEMENT OF VEHICLES IN PARKING FACILITIES. Young, W (Karlsruhe University, West Germany). Monash University, Australia Department of Civil Engineering, Wellington Road Clayton Victoria 3168 Australia 0156-2126. Apr 1985 Monograph 4p 1 Fig. 11 Ref.. REPORT NO: 85/9

This paper describes a model that simulates the movements of vehicles through a parking facility. The model's main application is to compare parking lot layouts to determine the most appropriate for a site. The model is still in the early state of development and requires a number of further developments before the model can reach its full potential. The first is the development of a computer graphics capability. This will aid in the verification of the model as well as enabling the designer to gain an idea of the workings of the facility. The second is the validation of the model using data from existing facilities. (Author/TRRL) The paper was prepared for presentation at the 11th IMACS World Congress, Oslo, Norway, 5-9 August, 1985.

MODELLING THE TRAFFIC BEHAVIOR AT GRADE-SEPARATED INTERCHANGES. Skabardonis, A. Printerhall Limited. Traffic Engineering and Control VOL. 26 NO. 9 Sep 1985 pp 410-415 7 Fig. 16 Ref.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London England

Grade separation is an essential feature of intersections between motorways and other high-capacity roads. This paper describes the development of a microscopic simulation model to investigate the interactions between traffic and geometric variables at such situations. The model has been integrated within a modular computer program and it has been calibrated and validated with a large data-base. Comparisons with measured data and information from other sources have shown that the model adequately describes the traffic behavior. (Author/TRRL)

MODELLING URBAN FUEL CONSUMPTION: SOME EMPIRICAL EVIDENCE. Ferreira, L (Australian National Railway, Keswick). Pergamon Press Limited. Transportation Research. Part A: General VOL. 19A NO. 3 May 1985 pp 253-268 17 Tab. 12 Ref.

This paper deals with the fuel consumed by cars for each element of an urban trip by drawing on the results of a survey conducted in Leeds with two instrumented vehicles. Those characteristics of urban car trips which are most likely to influence fuel consumption are identified, and the data obtained from the survey is used to quantify the importance of each element of an urban trip. The fuel consumed during a stop/start manoeuvre is analyzed, and this is followed by a comparison of the fuel consumption rate estimated when the Leeds results are applied on the standard European driving cycle and the corresponding manufacturer's published data. Finally, the results obtained are used to calibrate two fuel consumption expressions to be used with the output of traffic simulation and assignment models. (Author/TRRL)

MULTAM AND THE SEMARL PROJECT. 1. MODEL ESTIMATION AND VALIDATION. Taylor, MAP. Printerhall Limited. Traffic Engineering and Control VOL. 29 NO. 2 Feb 1988 pp 64-71 Figs. Tabs. 21 Refs.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London England

The article describes the use of the MULATM model to examine the likely impacts of the arterial road link (South-Eastern/Mulgrave Arterial Road Link, SEMARL) on traffic volumes and travel conditions in the study area in Melbourne, and to appraise the proposed traffic management measures for the protection of the local street network. MULTAM is an interactive traffic database package which offers powerful and accessible means for traffic analysis in dense street networks, in a microcomputer environment. It includes an equilibrium model based on an equilibrium assignment strategy, that offers the means to stimulate traffic flows in a study area and to study the impacts of different traffic management plans at the local level. Use of an assignment model requires the estimation of values of two route choice parameters, that may be specific to the study area. The model was found to reproduce the observed pattern of link flows to an acceptable degree of accuracy, and could thus be used for evaluating alternative traffic management plans in the area.

MULTIBAND--A VARIABLE-BANDWIDTH ARTERIAL PROGRESSION SCHEME. Gartner, NH; Assmann, SF; Lasaga, F; Hou, DL. Transportation Research Board. Transportation Research Record N1287 1990 pp 212-222 16 Fig. 3 Tab. 23 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

A new approach to arterial progression optimization was developed that incorporates a systematic traffic-dependent criterion. The method generates variable bandwidth progression schemes in which each directional road section is assigned an individually weighted band. The computer program for this method is named "MULTIBAND." Similar to MAXBAND, MULTIBAND uses mixed-integer linear programming for the optimization. The approach offers the traffic engineer a much wider range of design options than do existing arterial progression methods. In particular, the program provides a capability to adapt the progression scheme to the specific traffic flow pattern on each link of the arterial. Simulation results indicate that this method can produce considerable gains in performance when compared with traditional progression methods. This paper appears in Transportation Research Record No. 1287, Traffic Flow, Capacity, Roadway Lighting, and Urban Traffic Systems 1990.

MULTILANE TRAFFIC FLOW DYNAMICS. SOME MACROSCOPIC CONSIDERATIONS. Michalopoulos, PG; Beskos, DE; Yamauchi, Y (Minnesota University, Minneapolis; Patras University, Greece). Pergamon Press Limited. Transportation Research. Part B: Methodological VOL. 18B NO. 4/5 1984 pp 377-395 8 Fig. 1 Tab. 15 Ref.

The subject of macroscopic modelling and analysis of multilane homodirectional freeway flow is discussed in this paper. Two existing models are extended and treated numerically so that their simplifying assumptions are relaxed. Further, two new formulations are developed; the first is two dimensional with respect to space (ie in addition to the street length it includes the street width explicitly) while the second is one dimensional high order dynamic (ie it incorporates a momentum equation in order to take into account acceleration and inertia effects). All modelling alternatives are implemented into a few exemplary situations representing uninterrupted and interrupted flow conditions. Finally, comparisons with aggregate results obtained from microscopic simulation are presented. (Author/TRRL)

MULTPLAN: A COMPUTER SIMULATION MODEL OF A MULTI-LANE SIGNAL CONTROLLED ROAD DURING THE TRANSITION BETWEEN TWO FIXED-TIME SIGNAL-PLANS. Gault, HE; Taylor, IG. Newcastle upon Tyne University, England Transport Operations Research Group, Claremont Road Newcastle NE1 7RU Tyne and Wear England 0306-3402. Jan 1982 Monograph 37p 9 Fig. 4 Tab. 16 Ref.. REPORT NO: No. 41

Multplan is a computer program for the microscopic simulation of traffic in one direction on a multi-lane road which contains a linked system of up to six signalized intersections. The signalized intersections must be controlled by fixed-time signal plans; but up to five changes of plan, using any one of four plan-change strategies, may be simulated. The program has been developed from multsim, and this report is intended to serve as a users' manual. Detailed descriptions of the input and output of multplan are therefore provided. (TRRL)

NATIONAL SIGNAL TIMING OPTIMIZATION PROJECT. Institute of Transportation Engineers. ITE Journal VOL. 52 NO. 10 Oct 1982 pp 12-14. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

The article is the executive summary of a report by the Federal Highway Administration, Office of Traffic Operations and the University of Florida, Transportation Research Center.

NETSIM FOR MICROCOMPUTERS. Sibley, SW. Federal Highway Administration, Office of R&D. Public Roads VOL. 49 NO. 2 Sep 1985 pp 54-59 3 Ref.. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

Netsim, a computer model that simulates microscopic traffic flow on urban streets, is one of the most powerful traffic engineering and research tools available today. Netsim was developed in 1971 as UTCS-1 to evaluate the Urban Traffic Control System, a computer-based signal control system. Today, there are about 130 Netsim users in the United States and abroad. Over the years, the model has been enhanced to include fuel consumption and vehicle emissions data and other features requested by its users. The mainframe program was written in ANSI Fortran 66 and is portable to most mainframe computers.

NETWORK OPTIMIZATION WITH CONTINUOUS CONTROL PARAMETERS. Marcotte, P (Montreal University, Canada). Operations Research Society of America. Transportation Science VOL. 17 NO. 2 May 1983 pp 181-197 17 Ref. 2 App.. AVAILABLE FROM: Operations Research Society of America 428 East Preston Street Baltimore Maryland 21202

In this paper are considered two network optimization problems which have the following characteristics: control parameters vary continuously and network users behave according to Wardrop's first principle of traffic equilibrium ("user-optimization"). For each problem, we study an exact algorithm based on constraint accumulation and a heuristic algorithm previously proposed in the literature is studied. (Author) This paper was presented at the International Symposium, Frontiers in Transportation Equilibrium and Supply Models, Montreal University, November 11-13, 1981.

NEW ALGORITHM FOR SOLVING THE MAXIMUM PROGRESSION BANDWIDTH (WITH DISCUSSION AND CLOSURE). Tsay, H-S; Lin, L-T; Chang, EC-P. Transportation Research Board. Transportation Research Record N1194 1988 pp 15-30 9 Fig. 3 Tab. 14 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

Two popular computer programs, MAXBAND and PASSER II, are widely used in obtaining the maximal bandwidth. However, these bandwidths may not be realized or only be partly realized if the resultant signal timings are actually applied on the arterial. This phenomenon can be observed from field tests or from a time-space diagram. In this paper two examples demonstrate the problem. A new algorithm is proposed for solving the bandwidth problem and provides the user with a more realistic maximum progression bandwidth. The algorithm uses a general mixed-integer programming formulation, and a program BANDTOP based on this formulation has been developed to obtain the real progression bandwidth. It has been tested on street networks in Taiwan, where it has proved very effective. The major variation from traditional methods is that the bandwidth has a saw-toothed pattern in both directions instead of parallel and uniform. Any vehicle in the segment is allowed to travel through the entire section of an arterial with at most one stop. This paper appears in Transportation Research Record No. 1194, Traffic Flow Theory and Highway Capacity.

NEW DIRECTIONS FOR INTER-URBAN TRAFFIC MODELS?. KIRBY, HR. HIGHWAYS AND TRANSPORTATION VOL 36 NO. 7 Jul 1989 PP 6-11 ENGLISH

H.R. KIRBY ILL., PORT BIBLIOGRAPHY: P. 10-11 H.R. KIRBY ILL., PORT BIBLIOGRAPHY: P. 10-11

NORTH CAROLINA'S COMPREHENSIVE TRAFFIC SIGNAL TIMING OPTIMIZATION PROGRAM. MARTIN, RL OHIO TRANSPORTATION ENGINEERING CONFERENCE 1988 PP 106-112 ENGLISH

BY ROBERT L MARTIN OHIO TRANSPORTATION ENGINEERING CONFERENCE PROCEEDINGS

NORTH CAROLINA'S TRAFFIC SIGNAL MANAGEMENT PROGRAM FOR ENERGY CONSERVATION. 1987 TRANSPORTATION ENERGY CONSERVATION AWARD IN MEMORY OF FREDRICK A. WAGNER. Institute of Transportation Engineers. ITE Journal VOL 57 NO. 12 Dec 1987 pp 35-38. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

A unique traffic signal timing optimization program is described which consists of a 2-year effort to retime (optimize the timing of) a minimum of 750 traffic signal installations within all 14 highway divisions throughout the State of North Carolina. The program is designed to reduce energy consumption, reduce vehicle emissions, reduce traffic delays, reduce traffic congestion, increase annual energy savings, and increase annual total operating cost savings. The program will (1) provide additional personnel and their financial support to optimize the timing of the targeted 750 traffic signal installations, and (2) provide sufficient evidence of the program's benefits so that continuation of the work might be considered as another training program and/or as a permanently staffed function of the NCDOT Traffic Engineering Branch. Details are given of the program activities (personnel hiring, office space and equipment, personnel training and utilization, and traffic signal optimization). The current status of the program is also described. It is noted that the results of the first 20 months of this program are impressive. Comments are made on the future impact of the program. Article by the North Carolina Department of Transportation and the Institute for Transportation Research and Education.

OBJECT-ORIENTED PROGRAMMING IN TRAFFIC SIMULATION. Rodriguez-moscoso, JJ; Shin-miao CHIN; Santiago, A; Roland, R. ENGINEERING FOUNDATION. TRAFFIC CONTROL METHODS. PROCEEDINGS OF THE FIFTH 1990 177-90

Object-oriented programming has been referred to as a new style of computer programming that differs from conventional structured programming in that solutions to problems are obtained as a more "natural" activity. Current implementations of traffic simulation models lack explicit representations of the assumptions made about the real world. Thus, they have become increasingly more difficult to understand as new changes are added or new modifications are made. An object-oriented approach to traffic simulation modeling will overcome some of these problems, and promises to offer a new alternative solution. This paper introduces the concepts of object-oriented programming and provides some starting considerations necessary, by means of examples, to develop a general framework for building a traffic simulation tool based on the object-oriented paradigm of computer problem solving.(A) For the covering abstract of the conference see IRRD 832076.

OIL OVERCHARGE PROGRAM PROVIDES FUNDING FOR SIGNAL TIMING IMPROVEMENTS. Euler, GW; Wilbur, A. Institute of Transportation Engineers. ITE Journal VOL 56 NO. 10 Oct 1986 pp 19-22 15 Ref.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

This article describes programs that are a sampling of the signal timing improvement projects that are possible using oil overcharge funds. The diversity and size and thrust of these programs show that every state can benefit from programs to develop and maintain optimal signal timing plans on major arterial routes and in urban areas. Resolutions adopted by the American Association of State Highway and Transportation Officials recommends members to apply for oil company overcharge rebates for the purpose of creating or expanding programs to develop maximum efficiency operation of traffic signals or systems through maintenance and signal timing improvement. Transportation agencies are encouraged to apply to appropriate Federal and State agencies for PVEA (Petroleum Violation Escrow Account) funds for the purpose of implementing energy conserving transportation projects and programs.

ON-LINE CALCULATION OF SIGNAL INTERSECTION PERFORMANCE. FINAL REPORT. Pandya, SM; May, AD; Auslander, DM. California University, Berkeley Institute of Transportation Studies Berkeley California 94720; California Department of Transportation 1120 N Street Sacramento California 95814; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Jul 1987 68p Figs. Tabs. 17 Ref.. REPORT NO: FHWA-CA-UCB-ITS-WP-8. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

The objective is to develop a self-optimizing traffic controller capable of changing signal control parameters in response to changing traffic conditions. The controller uses pulses from detectors to estimate traffic performance on-line and then continuously search for optimum control parameters. This project attempts to demonstrate the feasibility of on-line performance estimation for the type III detector scheme used by Caltrans for the 170 controller.

ON-LINE OPTIMIZATION OF SIGNAL COORDINATION - THE SCOOT METHOD. Robertson, DI; Hunt, PB; Bretherton, RD; Bowen, GT. Council for Scientific & Industrial Res S Africa P.O. Box 395 Pretoria South Africa 0-7988-2505-7. 1982 12p 2 Fig. 2 Tab. 3 Ref.

Traffic signals in urban areas are often coordinated (linked) together on "fixed time" plans that are pre-set to suit average conditions. "SCOOT" (spilt, cycle and offset optimization technique) is a new method of coordination that adjusts the signal timings in frequent, small increments to match the latest traffic situation. Data from vehicle detectors are analyzed by an on-line computer which contains programs that calculate and implement those timings that are predicted to minimize congestion. SCOOT is designed for general application within computerized urban traffic control systems. The research and development of SCOOT has been carried out in the UK by the TRRL and the Department of Transport and industry in collaboration with the Ferranti, GEC and Plessey Traffic Systems Companies. As part of this work, scoot systems have been implemented in Glasgow and Coventry and traffic surveys have been conducted by TRRL on a total of 62 signals. It is concluded that SCOOT reduces vehicle delay by an average of about 12 per cent compared with up-to-date optimized fixed time plans; further substantial benefits are likely where, as is often the case, the fixed time plans are based on old traffic data. See also TRIS 385877. This paper was first presented at the International Conference on Road Traffic Signalling in London during April 1982. (Author/TRRL) This paper was presented during the Annual transportation convention held at CSIR Conference Centre, Pretoria, August 9-13, 1982, Volume 4.

ON THE KINEMATICS AND QUANTUM DYNAMICS OF TRAFFIC FLOW. Baker, RGV (New South Wales University, Australia). Pergamon Press Limited. Transportation Research. Part B: Methodological VOL. 17B NO. 1 Feb 1983 pp 55-66 13 Ref.

The hydrodynamic model of traffic flow is presented and interpreted. Traffic dimensions are defined for the dynamic entities of flow and the behavior of congestive and dispersive flow is discussed dependent on the value of the local traffic transfer number, r. The wave equation is one example of dispersive flow, where quantum numbers define the condition of free flow at the endpoints of the link. The schroedinger equation is defined and applied to the study of the cyclic work journey and the problem of traffic lights as an harmonic oscillator. (Author/TRRL)

ON THE MODELLING OF FLOWS IN TRANSPORT SYSTEMS. Taylor, MAP; Gipps, PG (Commonwealth Scientific & Indus Res Org, Australia). Society of Automotive Engineers (Australasia) 191 Royal Parade Parkville Victoria 3052 Australia. May 1982 pp 1-23 15 Fig. 4 Tab. Refs.. REPORT NO: Paper 23

Despite considerable research on the fuel consumption and emissions of individual vehicles in a traffic stream, little is known about the overall consumption and emissions of the traffic stream as an entity. Urban traffic is an example of a large- scale system with complex interactions between its components, and which is itself a sub-system within higher level systems. Thus models of urban traffic systems must be designed to operate within limits on data requirements and computational effort. This paper considers a hierarchy of model type, and illustrates the changing data needs and constraints for different models in the hierarchy. Some examples of particular models are given ranging from the micro-level simulation of individual vehicles on a road, through local area network models, to large- scale network models. The systems analysis of traffic flows shows that the benefits available from improved operations at a micro- level in one part of the system may only be taken as upper bounds or improvements for the whole system due to interaction effects. The integration of models from the various levels of the modelling hierarchy offers potential for improved environmental impact models, by providing a useful mechanism for linking micro-level models to general system-wide effects (a). The paper was presented as Paper 23-Session 7-Traffic Modelling (SAE 82153). The number of the covering abstract of the conference is TRIS no. 367871. (TRRL) Second Conference on Traffic, Energy and Emissions, Melbourne, May 1982. Program and Papers.

"ONE AND ONE-HALF GENERATION" TRAFFIC CONTROL SYSTEMS. Kessmann, RW; Ross, P (Kessmann & Associates, Houston). Institute of Transportation Engineers. ITE Journal VOL. 54 NO. 6 Jun 1984 pp 35-37 1 Ref.. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

The National Signal Timing Optimization Project has shown that maintaining optimal timing of traffic signals can result in an average savings of 4,500 gallons of gasoline per signal per year. Extrapolating these results to the estimated 130,000 interconnected signals nationwide yields an estimated annual fuel savings of 585 million gallons of gasoline. The labor intensiveness of the signal retiming activity arises as a result of the need to collect and reduce data for input to computer programs which calculate optimal signal timing.

OPAC: A DEMAND-RESPONSIVE STRATEGY FOR TRAFFIC SIGNAL CONTROL. Gartner, NH (Lowell University). Transportation Research Board. Transportation Research Record N906 1983 pp 75-81 7 Fig. 1 Tab. 25 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

Optimization Policies for Adaptive Control (OPAC) is a computational strategy for real-time demand-responsive traffic signal control. It has the following features: (a) It provides performance results that approach the theoretical optimum, (b) it requires on-line data that can be readily obtained from upstream link detectors, (c) it is suitable for implementation on existing microprocessors, and (d) it forms a building block for demand-responsive decentralized control in a network. Studies undertaken in the development of this strategy and the testing of its performance via the NETSIM simulation model are described. This paper appeared in Transportation Research Record No. 906, Urban Traffic Systems.

OPERATIONAL EFFECTIVENESS OF PASSING LANES ON TWO-LANE HIGHWAYS. PHASE II - TECHNICAL REPORT. Harwood, DW; St. John, AD. Midwest Research Institute 425 Volker Boulevard Kansas City Missouri 64110; Federal Highway Administration Turner Fairbank Hwy Res Cntr, 6300 Georgetown Pike McLean Virginia 22101. Jun 1986 42p. REPORT NO: FHWA/RD-86/195. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

This report presents an evaluation of the operational effectiveness of passing lanes on two-lane highways in level and rolling terrain. Passing lanes are defined as added lanes in one or both directions of travel on a two-lane highway to provide additional passing opportunities. Passing lanes at intervals on a two-lane highway are a lower-cost alternative to construction of extended sections of four-lane highway. The operational evaluation of passing lanes was performed with a computer simulation model of traffic operations on two-lane highways with and without passing lanes. This model, known as TWOPAS, was validated against traffic operational field data for passing lanes. The TWOPAS model was used to evaluate the effectiveness of passing lanes in improving traffic operations on two-lane highways. The evaluation found that the operational effectiveness of passing lanes is a function of traffic flow rate and passing lane length. Quantitative estimates in the reduction of traffic platooning due to provision of passing lanes are presented in the report. Passing lanes were found to impact traffic operations for effective lengths of 3 to 8 mi (5 to 13 km) of highway, including both the passing lane and the conventional two-lane highway downstream of the passing lane. A case study evaluation of alternative passing improvements was performed using the TWOPAS simulation model; this case study and a benefit-cost evaluation of the results are presented in the report.

OPTIMAL SIGNAL SETTINGS OVER TRANSPORTATION NETWORKS. Sheffi, Y; Powell, WB. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 109 NO. 6 Nov 1983 pp 824-839 16 Ref.. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

The paper deals with the procedure which iteratively sets signal timings at each intersection to minimize delay, holding flows constant. This paper reviews the shortcomings of this procedure and describes an algorithm for small networks, which overcomes these shortcomings. This new algorithm is used to quantify the errors in the simpler approach. Also, conditions under which both procedures would produce the same solution are discussed.

OPTIMAL TIMING SETTINGS AND DETECTOR LENGTHS OF PRESENCE MODE FULL-ACTUATED CONTROL. Lin, F (Clarkson University, New York). Transportation Research Board. Transportation Research Record N1010 1985 pp 37-45 12 Fig. 9 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

The operation of presence mode full-actuated signal control at individual intersections is governed primarily by the choice of detector length and the timing settings of vehicle interval and maximum green. The relationships between these control variables and the control efficiency vary with the flow pattern at an intersection. Based on the results of computer simulations, the optimal combinations of detector length, vehicle interval, and maximum green are identified for a wide range of flow conditions. The analyses performed in this study concern only intersections where vehicle approach speeds are less than 35 mph. This paper appeared in Transportation Research Record N1010, Traffic Control Devices and Rail-Highway Crossings.

OPTIMIZATION MODEL FOR ISOLATED SIGNALIZED TRAFFIC INTERSECTIONS. Cronje, WB (Stellenbosch University, South Africa). Transportation Research Board. Transportation Research Record N905 1983 pp 80-83 6 Fig. 5 Tab. 1 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

The existing methods for the optimization of isolated fixed-time signalized traffic intersections are applicable either to undersaturated stationary conditions or to oversaturated conditions. As far as is known, no model exists that is applicable to all conditions. A model is developed for the optimization of fixed-time signalized intersections that is applicable to undersaturated as well as to oversaturated conditions. In the model, the macroscopic approach to traffic flow is used. Although it is not so accurate as the microscopic approach, values are obtained for delay and number of stops that are accurate enough for practical purposes and that use much less computer time. Macroscopic simulation is then approximated by the geometric probability distribution. In this case also, values for delay and number of stops are obtained that are accurate enough for practical purposes and that use much less computer time. Consequently, the geometric probability distribution model is recommended for the optimization of fixed-time signalized traffic intersections. (Author) This paper appeared in Transportation Research Record No. 905, Traffic Flow, Capacity and Measurements.

OPTIMIZATION OF LEFT TURN PHASE SEQUENCE IN SIGNALIZED NETWORKS USING MAXBAND 86. FINAL REPORT. VOLUME 1: SUMMARY REPORT. Messer, CJ; Hogg, GL; Chaudhary, NA; Chang, ECP. Texas Transportation Institute Texas A&M University College Station Texas 77843; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Aug 1987 102p. REPORT NO: FHWA/RD-87/109. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

MAXBAND has been enhanced to provide optimal traffic signal timing plans for general grid networks, using bandwidth as the criterion. The program is user friendly and has several new features. Grid networks as large as 20 arterials with up to 20 signalized intersections per arterial could be solved, but present specifications limit the number of signals in the network to 50 until more operational experience with the system is obtained. Phase sequence optimization is provided together with NEMA, eight-phase numbering. MAXBAND 86 is written in FORTRAN 77. Volume 1 provides the basic model theory for calculating progression bandwidths in arterials. Additional material describes how the arterial model formulation is integrated into closed network analysis using closed loop equations. An overview of MAXBAND input, operational and output features is provided.

OPTIMIZATION OF LEFT TURN PHASE SEQUENCE IN SIGNALIZED NETWORKS USING MAXBAND 86. FINAL REPORT. VOLUME 3: MAXBAND PROGRAMMER'S MANUAL. Messer, CJ; Hogg, GL; Chaudhary, NA; Chang, ECP. Texas Transportation Institute Texas A&M University College Station Texas 77843; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Aug 1987 297p. REPORT NO: FHWA/RD-87/111. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

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OPTIMIZATION OF LEFT-TURN PHASE SEQUENCE IN SIGNALIZED CLOSED NETWORKS. Final rept. Cohen-S.L. Federal Highway Administration, McLean, VA. Traffic Systems Div. FHWARD88157, May 88. 38p.

The report is in two parts. Part 1 describes the effects of constraining the optimization of the TRANSYT-7F program so as to preserve the progression bands on one or more arterials within a network. Part 2 describes the effect of optimizing left turn phase sequence in signalized networks.

OPTIMIZATION OF LEFT TURN PHASE SEQUENCE IN SIGNALIZED NETWORKS USING MAXBAND 86. FINAL REPORT. VOLUME 2: MAXBAND USER'S MANUAL. Messer, CJ; Hogg, GL; Chaudhary, NA; Chang, ECP. Texas Transportation Institute Texas A&M University College Station Texas 77843; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Aug 1987 304p. REPORT NO: FHWA/RD-87/110. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

MAXBAND has been enhanced to provide optimal traffic signal timing plans for general grid networks, using bandwidth as the criterion. The program is user friendly and has several new features. Grid networks as large as 20 arterials with up to 20 signalized intersections per arterial could be solved, but present specifications limit the number of signals in the network to 50 until more operational experience with the system is obtained. Phase sequence optimization is provided together with NEMA, eight-phase numbering. MAXBAND 86 is written in FORTRAN 77. Volume 2 gives a detailed description of the features of the program and their use, including data entry, program control and optimal solution outputs. Four sample problems are included with examples of their input and output. Details of system enhancements and coding forms are provided in appendices.

OPTIMIZATION OF THE OFFSET PATTERNS OF ROAD NETWORKS THROUGH THE DECOMPOSITION PRINCIPLE. Hisai, M. Japan Society of Civil Engineers. Japan Society of Civil Engineers, Proceedings N347 Jul 1984 pp 69-76 12 Ref. Japanese. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

In this study, applying the Varaiya's decomposition principle to a road network made up of many closed loops, the offset patterns of traffic signals are optimized. The total delays of the networks are minimized subject to the closure constraints. It is supposed that the delays of the links are the functions of only the relative offsets, and that the delays are approximated by two parabolic curves. The networks are decomposed into the many subareas of single loops. At the lower level, these single loops are optimized independently of each other, and the coordination between the subareas is performed at the upper level. The offset patterns are obtained by repeating the two level computations. From some examples, it is found that the convergences to the solutions are achieved within reasonable CPU time.

OPTIMIZATION OF TRAFFIC SIGNAL CHANGE INTERVALS. FINAL REPORT. Wortman, RH; Fox, TC. Arizona University Transportation and Traffic Institute Tucson Arizona 85721; Arizona Department of Transportation 206 South 17th Avenue Phoenix Arizona 85007; Federal Highway Administration Office of Research and Development, 400 7th Street, SW Washington D.C. 20590. Jun 1986 69p. REPORT NO: FHWA/AZ-86/191. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

Utilizing data from field studies of intersections in Arizona and information from the literature, an in-depth examination of the traffic signal change interval was undertaken. This examination included a review of the traditional concept and theory on which the determination of the change interval has been based and an evaluation of the applicability of this theory. Because the majority of the first vehicles to stop after the onset of the yellow interval did not conform to a constant and uniform deceleration model, the last vehicles through the intersection were found to be more critical in the design of the change interval. Factors such as approach speeds, approach grades, and the duration of the yellow interval had little or no influence on driver behavior relative to decisions to stop or continue through the intersection. Based on analyses of the time distance of vehicles from the intersection at the onset of the yellow interval, the research suggests that a uniform yellow interval could be utilized.

OPTIMIZING TRAFFIC DIVERSION AROUND BOTTLENECKS. Hu, Y; Schonfeld, P (Taiwan National University, Taipei; Maryland University, College Park). Transportation Research Board. Transportation Research Record N957 1984 pp 22-27 10 Fig. 6 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

A traffic simulation and optimization model has been developed to analyze traffic flow in large networks with severe queuing. The model can be used to evaluate the impacts (e.g., travel time, operating costs, accidents, fuel consumption, and pollutant emissions) of any assignment over time and to minimize combinations of such impacts.

The influences on optimal assignment of traffic inflow rates and durations, relative route lengths and capacities, queue storage capacities, and other factors are shown for a simple network. A comparative analysis of route-diversion and capacity-expansion alternatives is given for the more complex network on Maryland's Eastern Shore. This paper was published in Transportation Research Record Number 957, Urban Traffic, Parking and System Management.

OSCADY: A COMPUTER PROGRAM TO MODEL CAPACITIES, QUEUES AND DELAYS AT ISOLATED TRAFFIC SIGNAL JUNCTIONS. Burrow, IJ. Transport and Road Research Laboratory. TRRL Research Report 1987 23p 15 Ref.. REPORT NO: RR 105. AVAILABLE FROM: Transport and Road Research Laboratory Old Wokingham Road Crowthorne RG11 6AU Berkshire England

A computer program, OSCADY, has been developed to model capacities, queues and delays at isolated traffic signal junctions. The program includes recently derived empirical formulae for saturation flow calculations, routines to optimize signal settings and time-dependent equations for queue and delay prediction. The user inputs include geometric characteristics of the junction, signal timing arrangements, and demand flow information. OSCADY is intended to model peak period operation, although longer periods can be considered. The program can model most staging arrangements at three- or four-arm junctions. OSCADY can either implement supplied timings or be used to calculate suitable ones. Queues and delays are calculated for each of a succession of short time segments (usually 10 or 15 minutes) within the modelled period. Both existing or proposed layouts can be assessed, and the effects of possible modifications examined. The program can be used on most types of computers (including micro-computers), and both batch and interactive versions are available. (TRRL)

OVERFLOW DELAY IN SIGNALIZED NETWORKS. Van As, SC. Pergamon Press plc. Transportation Research. Part A: General VOL. 25A NO. 1 Jan 1991 pp 1-7 Figs. Refs.. AVAILABLE FROM: Pergamon Press, Incorporated Maxwell House, Fairview Park Elmsford New York 10523

Traffic arrivals tend to be random at signals near to the perimeter of a network (or near to traffic generators in a network). Within the signal network, however, surges in traffic demand are reduced due to limitations on the amount of traffic passing through intersections imposed by signals, resulting in more uniform arrivals from cycle to cycle. Such uniformity is a desirable property at signals as underutilization of green periods may be reduced and levels of service improved. This may have serious implications within networks where it may be possible to improve the capacity of critical intersections by the strategic placing and timing of signals at less critical locations. The analysis of such options is, however, restricted by most, if not all, of the currently available evaluation methods. Relatively simple modifications of delay formulae are proposed to overcome these restrictions.

OVERSATURATION DELAY ESTIMATES WITH CONSIDERATION OF PEAKING. Rouphail, N., University of Illinois at Chicago and Akcelik, R., Australian Road Research Board, Victoria, Australia. Transportation Research Board Preprint for 71st Annual Meeting, Washington, D.C.

This paper describes a deterministic oversaturation queueing model which uses a generalization of the Peak Hour Factor concept of the U.S. Highway Capacity Manual as a simple variable demand model. The model is used to explore several issues related to oversaturation models. In particular, the relationship between the delay measurements methods (queue sampling and path trace) and the delay definitions used in the corresponding analytical delay models is investigated with a view to Level of Service assessments and performance prediction. Consideration is given to the average flow rates in the peak and non-peak flow periods and the choice of the duration of peak flow period.

PARAMETER ESTIMATION FOR THE PEAK TRAFFIC MODEL. Alfa, AS (Ahmadu Bello University, Nigeria). Gordon and Breach Science Publishers Limited. Transportation Planning and Technology VOL. 7 NO. 4 1982 pp 281-287 2 Fig. 5 Ref.

In a previous article a model was developed for predicting the temporal distribution of peak traffic demand, and the model is sensitive to the determining cost parameters whose values were not known. These costs are the cost to late and early arrivals at work and the cost to delays in the system while travelling. In this paper, using the method of least squares, representative values for these cost parameters are estimated for both the southbound and northbound traffic using the Sydney Harbour Bridge during the morning peak period. The resulting estimates show that a traveller tends to attach much higher cost to delays than to earliness or lateness to work; although the relative cost he attaches to lateness is higher than he attaches to earliness. (Author/TRRL)

PASSER II-84 MICROCOMPUTER ENVIRONMENT SYSTEM--PRACTICAL SIGNAL-TIMING TOOL. Chang, EC-P; Marsden, BG; Derr, BR. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 113 NO. 6 Nov 1987 pp 625-641 Figs. Tabs. Refs.. REPORT NO: ASCE Paper 21941. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017

The development of the PASSER II-84 microcomputer environment system is summarized. It was designed in research conducted jointly by the Texas Transportation Institute (TTI) and the Texas Department of Highways and Public Transportation (SDHPT) in cooperation with FHWA. Significant enhancements were made so traffic engineers at virtually any location could analyze traffic operation problems efficiently. The study combined microcomputer technology and newest PASSER II-84 for traffic engineering applications. This maximizes progression and reduces delay, stops, and fuel consumption in optimizing arterial operations. PASSER II-84 microcomputer environment system was developed for MS DOS- and PC DOS-based microcomputers. Program documentation and revised input and output management programs were also implemented in this system.

PASSER IV QUICK RESPONSE PROCEDURES. Research rept. Cunagin-W.D.; Lee-J.Y. Texas Transportation Inst., College Station. Federal Highway Administration, Austin, TX. Texas Div. Texas State Dept. of Highways and Public Transportation, Austin. TTI218802811, FHWATX85192811. May 85. 81p.

The report describes and presents a user's guide for the PASSER IV quick response procedures for analyzing urban freeway corridor alternatives. Estimates of traffic flow levels on individual parallel facilities in an urban freeway corridor are obtained, based on equilibrium traffic assignments. System travel time also is computed. The algorithm includes special features to handle route changing and nonhomogeneous routes. A FORTRAN computer program based on the procedures is provided.

PICADY2: AN ENHANCED PROGRAM TO MODEL CAPACITIES, QUEUES AND DELAYS AT MAJOR/MINOR PRIORITY JUNCTIONS. RESEARCH REPORT. Semmens, MC. Transport and Road Research Laboratory Old Wokingham Road Crowthorne RG11 6AU Berkshire England 0266-5247. 1985 32p Figs. Tabs. Refs.. REPORT NO: RR 36. AVAILABLE FROM: Transport and Road Research Laboratory Old Wokingham Road Crowthorne RG11 6AU Berkshire England

An enhanced version of PICADY, a computer program which models capacities, queues and delays at major/minor junctions, is described. The program uses empirical formulae as a basis for the calculation of capacities and time-dependent queuing equations for queue and delay predictions. The enhancements include the facility (I) to model four-arm junctions, i.e. Crossroads, left-right and right-left staggers, (II) to predict geometric delays and (III) to include the effects of pedestrian (zebra) crossings adjacent to the junction. Flared minor roads and the effects of major road right-turning traffic blocking through traffic are also dealt with. The enhancements result from recent empirical and analytical studies. Additionally, the flexibility of the program (now known as PICADY2) has been increased, with the availability of micro-computer and interactive versions. User inputs consist of various geometric characteristics of the junction, and traffic (and pedestrian) demand flow information (which may be specified in a number of ways). Peak periods are usually modelled and capacities, queues and delays are calculated for each non-priority traffic stream for each of a succession of short time segments (usually 10 or 15 minutes) within the period. The user is able to assess the performance of both planned and existing layouts in terms of queuing delay and geometric delay. Details of the required input parameters are given, the output is described and a full example is included. (Author/TRRL)

PLAN-CHANGE ALGORITHMS FOR AREA TRAFFIC CONTROL SYSTEMS. Bell-M.C.; Gault-H.E.; Taylor-I.G. Newcastle upon Tyne Univ. (England). Transport Operations Research Group. RR51, Apr 83. 49p. UNITED-KINGDOM.

Several algorithms exist to implement a change between fixed-time signal plans. These are reviewed and the constraints influencing the process of change are examined. A comparison of actual networks reveals the daily and cyclical variations in flow which prevail in practice and within which the plan-changing process must be seen. Studies using TRANSYT are reported and finally 5 plan-change algorithms are assessed against an 'ideal' plan-change, using Monte Carlo simulation techniques. The results suggest that significantly less delay (at the 5% level) and fewer stops are incurred when plan-changes are implemented at off-peak rather than at peak flows. The MODIFIED ABRUPT algorithm (commonly called CRASH), which is in common use, is found to generate no statistically significant (at the 5% level) additional stops or vehicular delay on main roads, irrespective of the level of flow at which the plan-change is made and whether the change is from off-peak to peak or vice versa. The variation in delay caused by implementing a plan-change with the MODIFIED ABRUPT method is found to be less

PASSER II-84 MICROCOMPUTER ENVIRONMENT SYSTEM--PRACTICAL SIGNAL-TIMING TOOL. Chang, EC-P; Marsden, BG; Derr, BR. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 113 NO. 6 Nov 1987 pp 625-641 Figs. Tabs. Refs.. REPORT NO: ASCE Paper 21941. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017

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PICADY2: AN ENHANCED PROGRAM TO MODEL CAPACITIES, QUEUES AND DELAYS AT MAJOR/MINOR PRIORITY JUNCTIONS. RESEARCH REPORT. Semmens, MC. Transport and Road Research Laboratory Old Wokingham Road Crowthorne RG11 6AU Berkshire England 0266-5247. 1985 32p Figs. Tabs. Refs.. REPORT NO: RR 36. AVAILABLE FROM: Transport and Road Research Laboratory Old Wokingham Road Crowthorne RG11 6AU Berkshire England

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PLATOON DISPERSION FACTOR IN TRANSYT FOR SWEDISH TRAFFIC CONDITIONS. Hammarstroem, U. National Swedish Road & Traffic Research Institute Fack S-581 01 Linkoeping Sweden. 1988 26p. REPORT NO: VTI/MEDDELANDE-569A. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

Platoon dispersion is a function of driving behavior, which may vary geographically and time-wise, although other conditions are similar. A correct description of platoon dispersion is of great significance for coordinating traffic signals. The report describes a routine in the TRANSYT computer program for calculating platoon dispersion.

POSSIBLE PASSER II ENHANCEMENTS. Rogness, RO (North Dakota State University). Transportation Research Board. Transportation Research Record N881 1982 pp 42-48 5 Fig. 6 Tab. 8 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

The PASSER II computer program for optimization of arterial signal timing has been accepted by usage. It has been used extensively during the last few years. The program's ability to select multiphase sequences for a maximum bandwidth progression solution has led to its increasing use and application. The PASSER II maximum bandwidth solution has been well accepted and implemented throughout this country. The theory, model structure, methodology, and logic in the PASSER II computer program has been evaluated and documented. An evaluation was undertaken to determine if several enhancements to the PASSER II program as related to a revised green split procedure, a minimum delay cycle length, and number of alternate optimal solutions could improve the utility of the solution and would be useful measures. The comparison was to the existing PASSER II computer program and comparison TRANSYT program runs. This evaluation showed, for the three scenarios considered, that a revision for the green split routine provided equal saturation splits. An advisory minimum delay cycle length calculation would provide useful guidance in the selection of the cycle length range to consider. Other measures, like a minimum delay performance measure, alternate optimal solutions, and improved delay measure, could provide useful results. (Author) This paper appeared in Transportation Research Record No. 881, Traffic Control Devices and Traffic Signal Systems.

POTENTIAL IMPACT OF SPEED REDUCTION AT FREEWAY LANE CLOSURES: A SIMULATION STUDY (ABRIDGMENT). Nemeth, ZA; Rathi, AK. Transportation Research Board. Transportation Research Record N1035 1985 pp 82-84 3 Tab. 3 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

The objective of this study was to evaluate the potential impact of reduced speed limits at temporary freeway lane closures at work zones at arbitrarily assumed levels of compliance. Although some transportation engineers prefer to reduce speeds at work zones to protect the working crew, others are hesitant to introduce such a disturbance to the traffic flow. The study approach involved simulation experimentation, using FREESIM, a microscopic, stochastic model. A fractional factorial design was developed for the analysis of three independent variables: two-lane volumes (800, 1,200, 1,500 and 1,800 vehicles per hour); speed limits (55, 50, and 45 mph); and assumed compliance with speed limit (33, 66, and 100 percent). The number of uncomfortable decelerations and the variance of the speed distribution were selected as the dependent variables. These two variables were offered as a measure of the internal friction created by the merging of two-lane traffic into a single lane. It was hypothesized that this internal friction is increased by the introduction of lower speed limits. The results of this simulation study indicate that compliance with reduced speed limits will have no significant impact on the number of uncomfortable decelerations but will reduce variance in speed distribution. These results, therefore, do not support the assumption that effective speed reduction at work zones would create a potentially hazardous disturbance in the flow of traffic. This paper appeared in Transportation Research Record N1035, Traffic Management in Highway Work Zones and Setting Optimal Maintenance Levels and Rehabilitation Frequencies.

PREDICTING AREA TRAFFIC CONTROL PERFORMANCE WITH TRANSYT/8 AND AN ELEMENTAL MODEL OF FUEL CONSUMPTION. Luk, JYK; Akcelik, R. Australian Road Research Board 500 Burwood Road Vermont South Victoria 3133 Australia 0572-1431. VOL. 12 NO. 4 1984 pp 87-101 2 Fig. 7 Tab. 10 Ref.

The traffic model of TRANSYT/8 is used to predict the journey time and number of stops in an area traffic control network. It is used to simulate the operation of the fixed- time (t) and isolated (i) control modes. The traffic flow and timing plans are identical to those employed in the Parramatta floating-car survey. The shared stop-line facility of TRANSYT is utilized to model traffic movements in more detail. The results previously obtained in the survey are used for comparison with the model predictions. It is found that TRANSTY/8 overestimates the journey time and stops in absolute values for both modes. However, the measured and predicted t/i comparison results differ by only 1 per cent in both journey time and number of stops when averaged over three time periods. An elemental model of fuel consumption is used to combine the total journey time and total stops to produce estimates of fuel consumption for two sub-areas of the Parramatta network, namely, the central business district and the Great Western Highway. A description of the experimental procedure to calibrate the parameters of the fuel consumption model is given. Based on measured journey time and stops, the elemental model is found to underestimate absolute levels of fuel consumption but to be accurate in predicting changes in fuel consumption. The underestimation in absolute levels of fuel consumption is 1 to 16 per cent, but the predicted differences are within 1 to 8 per cent of the measured differences. The absence of modelling detailed driving behavior affects the model accuracy. The predictions are found to be sensitive to the cruise speed adopted. The number of the covering abstract for the conference is TRIS No. 393385. (Author/TRRL) This paper was presented during the 12th Australian Road Research Board Conference, Hobart, Tasmania, 27-31 August 1984.

PREDICTION OF TRAFFIC FLOW BY AN ADAPTIVE PREDICTION SYSTEM. Lu, J. Transportation Research Board. Transportation Research Record N1287 1990 pp 54-61 10 Fig. 17 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

In a dynamic (real-time) traffic control system, the accuracy of the prediction of traffic characteristics such as flow, speed, and headway is one of the key factors affecting the performance of the system. Because the traffic characteristics can be described by stochastic processes, nonlinear and time-variate types of prediction models could be more adequate than linear or time-invariate prediction models. A traffic control system model for traffic flow is described, and the importance of the accuracy of the prediction model is emphasized. Then, the concept of adaptive prediction of traffic flow is introduced, and its mathematical derivation and the least-mean-square algorithm are described. As an experiment to validate the adaptive prediction system, a sine function is used to simulate traffic flow as input to the adaptive prediction system. Finally, the adaptive prediction system is applied to actual traffic flow data collected from a highway network. The predicted traffic flow is then compared with the real traffic flow. The performance of the model as to its dynamic response to a step function, convergence of the adaptive prediction system, and related matters are also discussed. This paper appears in Transportation Research Record No. 1287, Traffic Flow, Capacity, Roadway Lighting, and Urban Traffic Systems 1990.

PREFERENTIAL CONTROL WARRANTS OF LIGHT RAIL TRANSIT MOVEMENTS. Radwan, AE; Hwang, K (Arizona State University, Tempe; Virginia Polytechnic Institute & State University). Transportation Research Board. Transportation Research Record N1010 1985 pp 69-75 9 Fig. 1 Tab. 1 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

The goal of this paper is to demonstrate a method for evaluating a preferential treatment technique for light rail transit (LRT) in urban areas. A mathematical delay model, which uses probability expressions, is presented to evaluate two LRT preemption signal strategies in existing arterial medians. The model permits the user to evaluate three operational options: a two-phase signal plan, a three-phase signal plan with a separate LRT phase, and a three-phase signal plan with an exclusive left-turn phase for main arterial vehicles. The signal controller modeled in this paper has green extension and red truncation capabilities. Model testing and validation proved that the model parameters consistently produced reasonable results. Control warrant guidelines were developed for two operational options. This paper appeared in Transportation Research Record N1010, Traffic Control Devices and Rail-Highway Crossings.

PRELIMINARY TESTING AND EVALUATION OF NEW COMPUTER PROGRAMS FOR TRAFFIC ANALYSIS, TASK: EVALUATION OF SUPERCOMPUTER POTENTIAL. Parker-L.E.G. Ontario. Ministry of Transportation. Research and Development Branch, Regina. c1990. 135p. CANADA.

To evaluate the potential of supercomputers in traffic simulation/modelling, two representative traffic modelling packages were converted and run on two representative supercomputers. The models tested were TRANSYT-7F, a system developed for mainframe computers but now supported and available on PC systems, and INTEGRATION, a system developed to run on an 80386-based workstation at Queen's University in Kingston, Ontario. The computers used were a CRAY X-MP vector supercomputer and a MYRIAS SPS-2 massively parallel supercomputer. The project determined the relative degree of difficulty of converting existing models to run on representative supercomputers; the immediate and potential performance improvements realizable; overall design considerations for revisions to existing models or new models to fully exploit existing architectures; and operational considerations in using existing supercomputer facilities for ongoing research or proposed production use.

PROGRESS WITH RURAL TRAFFIC SIMULATION. Hoban, CJ; McLean, JR (Arrb). Australian Road Research Board 500 Burwood Road Vermont South Victoria 3133 Australia 0572-1431. 1982 pp 23-33 1 Fig. 4 Tab. 29 Ref.

This paper reviews progress in rural traffic simulation, with particular reference to the Australian Road Research Board Model, TRARR. A number of major simulation packages are identified which have been applied to practical studies of rural traffic performance in at least eight countries around the world. These models have many common features, as well as common areas requiring further research and validation. In this context, the current status of TRARR is discussed. Recent studies have applied the model to investigations of specific road improvement proposals and general concepts such as level of service. The model provides detailed comparisons of the changes in traffic performance which result from changes in road or traffic conditions. While further calibration and validation are required, tests have shown that errors in simulation results are quite small, especially when compared with uncertainties in other estimates required for road evaluation. In applying TRARR to specific studies, the procedures for data input have been refined to enable easier use of the model by unfamiliar users. The simulation package is now in a form which may be used by road authorities to compare alternative strategies (a). The number of the covering abstract of the conference is TRIS No. 368448. (TRRL) Proceedings of the Eleventh Australian Road Research Board Conference, held at the University of Melbourne, August 23-27, 1982.

PROGRESSION ADJUSTMENT FACTORS AT SIGNALIZED INTERSECTIONS. Rouphail, NM. Transportation Research Board. Transportation Research Record N1225 1989 pp 8-17 12 Fig. 3 Tab. 10 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

This paper presents a set of analytical models for estimating progression adjustment factors (PAFs) to delays at signalized, coordinated intersection approaches. The derived models are sensitive to the size and flow rate of platoons, which in turn are affected by the travel time between intersections. The procedure requires data that are readily available from time-space diagrams and flow counts. A comparison of the factors estimated in this study and their Highway Capacity Manual (HCM) counterparts reveals the limitations of the HCM method in predicting levels of service for coordinated approaches, especially under excellent or very poor progression scenarios. Finally, an interactive, computerized procedure is presented that carries out the necessary PAF calculations with minimal input requirements. This paper appears in Transportation Research Record No. 1225, Highway Capacity, Flow Measurement, and Theory.

PROGRESSION THROUGH A SERIES OF INTERSECTIONS WITH TRAFFIC ACTUATED CONTROLLERS. VOLUME 1: TECHNICAL REPORT. FINAL REPORT. Skabardonis, A. Deakin, Harvey, Skabardonis, Incorporated P.O. Box 9156 Berkeley California 94709; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Oct 1988 141p 22 Fig. 29 Tab. 31 Ref. 1 App.. REPORT NO: FHWA-RD-89-132. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

Many traffic control systems on urban arterials and grid networks include signals with actuated controllers. However, commonly used computer programs for signal timing cannot directly optimize the timing of coordinated signals. Users have to apply techniques designed for pretimed signals, and then "translate" the optimized pretimed settings into settings for the actuated controllers. In addition, other signal control choices, such as whether to operate a particular signal as pretimed, semi-actuated, or fully actuated, are left entirely to the user. This report describes the development of procedures for applying the MAXBAND, PASSER and TRANSYT-7F timing programs to systems with actuated controllers. The results from the testing of the procedures on 14 representative grid systems and arterials with the NETSIM simulation model are presented. The report also describes the development and testing of criteria for selecting the type of signal control at specific intersections for commonly occurring field conditions. The report is the first volume produced in this study. Volume 2 is the User's Guide for implementation of the research findings.

PROGRESSION THROUGH A SERIES OF INTERSECTIONS WITH TRAFFIC ACTUATED CONTROLLERS. VOLUME 2: USER'S GUIDE. FINAL REPORT. Skabardonis, A. Deakin, Harvey, Skabardonis, Incorporated P.O. Box 9156 Berkeley California 94709; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Oct 1988 30p 7 Fig. 2 Tab. 8 Ref.. REPORT NO: FHWA-RD-89-133. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

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PROPOSALS FOR A SINGLE-LANE TRAFFIC SIMULATION MODEL. Gynnerstedt, G; Palaniswamy, SP. National Swedish Road & Traffic Research Institute Fack S-581 01 Linkoeping Sweden 0347-6049. N398A 1984 Monograph 8p 1 Ref.

The report presents the preliminary outlines for the necessary modifications and extensions to a simulation model of motor traffic on two-lane rural roads for adaptation to narrow roads -single-lane and intermediate-lane roads and for the heterogeneous traffic conditions prevailing in India. The report also focuses upon the types of field studies proposed for the model development and for the validation of the model. The two-lane simulation model has been developed in Sweden at VTI (Swedish Road and Traffic Research Institute) and the required modifications and extensions will be performed at the IIT (Indian Institute of Technology) in cooperation with VTI. (Author/TRRL)

QUALITY OF TRAFFIC SERVICE. Ardekani, S; Herman, R. Texas University, Austin Center for Transportation Research Austin Texas 78712 Res Rpt. 304-1; Texas State Department of Highways & Public Transp Transportation Planning Division, P.O. Box 5051 Austin Texas 78763; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Jun 1982 Intrm Rpt. 110p. REPORT NO: FHWA/TX-82/17+304-1. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

The Two-Fluid Model has been used to model the quality of service in Austin and Dallas traffic networks. In addition, the physical interpretation of the model parameters is closely examined. Furthermore, the Two-Fluid Model is slightly modified to better predict the average minimum trip time and stop time per unit distance. Finally, the results of two ergodic experiments as well as data in very light traffic conditions have been used to investigate the consistency of the underlying assumptions of the Two-Fluid Model. The interrelation between the Two-Fluid Mdel and other macroscopic traffic models such as a simple fuel consumption model is also discussed. The report is concluded with a discussion of the use of time-lapse aerial photography in the investigation of the Two-Fluid Model assumptions and in the derivation of relations that may exist among the means of the speed, density, and flow in a traffic network. (FHWA)

QUEUEING MODEL FOR TRANSYT 7. Bell-M.C.. Newcastle upon Tyne Univ. (England). Transport Operations Research Group. Science Research Council, Swindon (England). TORGRR34. Oct 80. 30p. UNITED-KINGDOM.

A simple spatial queueing model for the program TRANSYT 7 is described. In the model, vehicles queue one behind the other; at the commencement of the green phase the start wave travels along the queue discharging vehicles from the front at the saturation flow rate; vehicles arriving before the start wave reaches the back of the queue extend the queue. The results of on-street surveys of traffic queueing were used to calibrate the model. The model gave a more realistic estimate of the actual length of the queue at each step in the cycle than does TRANSYT. In order to assess the degree of queueing in a network, measures of spare road storage capacity, developed previously, were incorporated into the modified version of TRANSYT 7 as part of the performance indicator used for signal plan optimization.

REDUCING TRAFFIC CONGESTION IN HERALD SQUARE. Rathi, AK; Lieberman, EB. Institute of Transportation Engineers. ITE Journal VOL. 56 NO. 9 Sep 1986 pp 27-31 Figs. Tabs. 1 Ref.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

The traffic congestion in Herald Square (intersection of Broadway, Avenue of the Americas, and 33rd and 34th Streets in New York City) is described, and efforts of the New York City Department of Transportation to alleviate congestion are noted. The various approaches that were explored for improving traffic operations are briefly described. Computer simulation and field evaluation of an approach to a solution which involved signal timing changes is also presented. The three possible solutions that were considered are as follows: grade separation of traffic; diversion to alternative routes; a control policy involving signal timing changes. Computer simulation and field studies of the signal timing changes indicated substantial improvements. This solution is noted as an example of a low-cost, transportation system management (TSM) technique.

REPRESENTING TRAFFIC FLOW PROFILES FROM SAMPLE DATA. Mathews, DH; Phillips, JG (Transport and Road Research Laboratory; Advisa Research & Consultancy Services). PTRC Education and Research Services Limited. Planning & Transport Res & Comp, Sum Ann Mtg, Proc 1984 pp 121-133 6 Fig. 3 Tab. 9 Ref.

The practical application of traffic models requires the use of such basic information as the total annual flow and the degree of seasonal and daily variation in that flow. The information needs to be based on sample data which may be limited to a single classified count of twelve hour duration. On behalf of the Department of Transport, TRRL has carried out research into how such limited data may be used in estimating annual flows and in modelling the distribution of hourly flows within the day and throughout the year. One effective approach uses discrete distributions based on statistical stratification of hourly flows. Each hour of the year is allocated to a particular flow group according to the season, day of week and type of road considered. An example application is in quadro where default hourly flow profiles are available. If sample data are extensive, site-specific hourly flow profiles can be generated. The paper describes how discrete distributions are used to represent traffic flow profiles. Current research has focussed on the modelling of traffic flows using continuous distributions; an up-to-date summary of this approach is presented. For the covering abstract of the proceedings see TRIS 450538. (Author/TRRL) Proceedings of Seminar M, Highway Appraisal and Design, Held at the 12th PTRC Summer Annual Meeting, University of Sussex, England, from 10-13 July 1984, Volume P255.

RESEARCH INITIATIVES FOR TRAFFIC SIGNAL CONTROL SYSTEMS. Transportation Research Board. Transportation Research Circular N380 Oct 1991 15p. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

To take advantage of improved traffic control systems and communication technology, there is a need now to research algorithms and approaches for improved traffic signal system operation, to make these systems more responsive to traffic demands, and to provide improved equipment diagnostics and fail-safe operation. Also, the output from new computer models for analyzing traffic movement need to be correlated, and the models need to be made more user friendly. In addition, there is a need to look to the future--to determine through research how to make the best use of existing street and freeway networks. This can be accomplished through development of advanced traffic control systems and improved motorist information systems, and through research on driver behavior as it relates to motorist acceptance and use of new traffic control and motorist information and guidance systems. The Traffic Signal Systems Committee of the Transportation Research Board has developed this Circular of research problem statements which list and discuss specific research needs for the present and the future. Chapter I discusses the areas that need research in advanced technology, while Chapter II describes the research needed now.

REVIEW OF FREEWAY CORRIDOR TRAFFIC MODELS. FINAL REPORT. Van Aerde, M; Yagar, S. Ontario Ministry of Transportation & Communic, Can 1201 Wilson Avenue Downsview Ontario M3M 1J8 Canada. Jun 1985 62p Tabs. Refs.. AVAILABLE FROM: Ontario Ministry of Transportation & Communic, Can 1201 Wilson Avenue Downsview Ontario M3M 1J8 Canada

The following types of models were reviewed for potential application to freeway-dominated corridors in Ontario: MACK, FREFLO, FREGON, INTRAS, TRAFFICQ, FREQ, CORQ, CORCON, SCOT, TRAFLO, DYNEV, CONTRAM, SATURN, and MICRO-assignment. Based on a literature review and a preliminary evaluation in view of some basic requirements, a short list of models was developed for detailed evaluation, consisting of: FREQ, CORQ-CORCON, TRAFLO, DYNEV, CONTRAM AND SATURN. This detailed examination indicated that while none of the current models fully satisfy all major criteria, some models can be upgraded while others cannot. Consequently, CONTRAM and CORQ were recommenced for further consideration, as they were found most suitable for incorporating the required enhancements. Finally, specific improvements were outlined for purposes of both immediate application and longer term development. (Author/TRRL)

REVIEW OF TRAFFIC MODELLING TECHNIQUES. Pretty, RL (Queensland University, Australia). Society of Automotive Engineers (Australasia) 191 Royal Parade Parkville Victoria 3052 Australia. May 1982 pp 1-9 21 Ref.. REPORT NO: Paper 22

A traffic model is virtually essential for any study of the interaction between road users and roadways. A model can be devised to represent the existing situation and then predict behavior in a future situation without any actual construction taking place. Traffic modelling techniques may be physical or mathematical and, if the latter, they may be analytical or stochastic and studies by means of simulation. In this review, mathematical traffic models concerned with fuel consumption and emissions are considered in order of increasing complexity. For general traffic situations, the elemental model seems to have advantages of calibration, reliability and convenience over other models. The elemental model must be used with a second model which will predict the average stopped time and stop rate for traffic streams subject to delay. For networks of traffic signals, the TRANSYT method of co-ordination is an example of a single simulation model which will predict fuel consumption and optimize signal settings at the same time. In the future, a dynamic co-ordination program such as scat may be able to optimize settings, adapt to changing traffic demands and calculate fuel consumption (a). The paper was presented as Paper 22--Session 7--Traffic Modelling (SAE 82152). The number of the covering abstract of the conference is TRIS no. 367871. (TRRL) Second Conference on Traffic, Energy and Emissions, Melbourne, May 1982 Program and Papers.

REVIEW OF TRAFFIC SIMULATIONS FOR INTELLIGENT VEHICLE-HIGHWAY SYSTEM EVALUATION. UNDERWOOD, SE. UNIVERSITY OF MICHIGAN TRANSPORTATION RESEARCH. IVHS TECHNICAL REPORT ; N90-1 Jan 1990 ENGLISH. REPORT NO: 0

STEVEN E. UNDERWOOD OTHER PHYS. DESCRIPTION: 5 JANUARY 31, 1990 INCLUDES BIBLIOGRAPHICAL REFERENCES LEAVES ADDL CORP. AUTHOR INFO: UNIVERSITY OF MICHIGAN. TRANSPORTATION RESEARCH INSTITUTE UNIVERSITY OF MICHIGAN TRANSPORTATION RESEARCH INSTITUTE

ROUNDABOUT CONTROL IS SIGNAL SUCCESS. Belcher, M (West Midland County Council). Specialist and Professional Press. Surveyor VOL. 163 NO. 4780 Feb 1984 pp 13-14 1 Fig. 1 Phot.

The first signal controlled roundabout in the West Midlands is now operational on a four-armed layout on the Wolverhampton ring road carrying between 4000 and 5000 vehicles per hour at peak periods. A computer simulation of the network, treating the roundabout as four t junctions linked together showed that a modified TRANSYT system could reduce delays at peak periods. Because delays could increase outside the peaks, the signals were operated on a part-time basis. An additional lane was provided on one of the approaches and the radii on the roundabout inside was increased slightly to provide greater width at the stop lines. A microprocessor controller uses parallel-stage streaming allowing the junction to operate as a four independent two-stage installation. Green times and offsets calculated using TRANSYT have proved very effective but improvements could be gained by having different control plans for different days of the week. Eventually the junction will be linked with others within the utc area as part of the country SCOOT system. (TRRL)

SATURN - A BRIGHT STAR. Carlisle, JS; Tudge, RT. Institution of Engineers, Australia 11 National Circuit Barton A.C.T. 2600 Australia. 1985 pp 42-46 2 Fig. 11 Ref.. REPORT NO: No. 85/11. AVAILABLE FROM: Institution of Engineers, Australia 11 National Circuit Barton A.C.T. 2600 Australia

SATURN (simulation and assignment of traffic to urban road networks) is a computer model suite developed for the analysis and evaluation of traffic management schemes. It is most suitable for the analysis of "movement-based" control systems such as one-way streets, changes to intersection controls, bus-only streets, pedestrian malls, etc. This paper explains the SATURN model and presents an overview of the basic theory, some recent enhancements, examples of application and conclusions on suitability. For the covering abstract of the conference see IRRD 277786. (Author/TRRL) Transport '85, Sydney, 17-19 July 1985. National Conference Publication Preprints of Papers.

none of the current models fully satisfy all major criteria, some models can be upgraded while others cannot. Consequently, CONTRAM and CORQ were recommenced for further consideration, as they were found most suitable for incorporating the required enhancements. Finally, specific improvements were outlined for purposes of both immediate application and longer term development. (Author/TRRL)

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SCENE 1: A MODEL OF PARKING-LOT ENTRANCE AND EXIT CONDITIONS. Poon, WF; Young, W. Printerhall Limited. Traffic Engineering and Control VOL. 30 NO. 6 Jun 1989 pp 304-310 Figs. Tabs. Refs.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London England

The interaction between car parks and the transport system is a function of the traffic flows and the design of the interfaces (entrances and exits). Existing analytical models can only be used to estimate the delay at unsignalised car park entrances and exits under certain restricted and sometimes unrealistic conditions. This paper outlines a model (SCENE) which can be used to investigate car park intersection layouts. Three types of unsignalised car park entrances and exits are considered in SCENE. The first type contains only one lane for both exit and entry vehicles. The second allows vehicles to enter and exit in separate lanes, while the third has one entrance lane and two exit lanes for the left-turn and right-turn vehicles. SCENE has two forms of output: the first, a detail report, lists the arrival time, movement, head-of-queue arrival time, departure time, queue length experienced and head-of-queue delay as well as the total delay of every vehicle simulated after the warm-up period. The second, a summary report, contains the statistical measures for the queue length, head-of-queue delay and total delay of vehicles using each approach. The average head-of-queue delay and total delay of all vehicles are also calculated.

SCOOT DATA AND ROUTE GUIDANCE. SECOND INTERNATIONAL CONFERENCE ON ROAD TRAFFIC MONITORING. Hounsell, NB; McDonald, M. Institution of Electrical Engineers Savoy Place London WC2R OBL England 0-85296373-4. 1989 pp 191-194 9 Ref.. AVAILABLE FROM: Institution of Electrical Engineers Savoy Place London WC2R OBL England

A key feature of SCOOT is its traffic model which predicts the main elements of traffic performance -such as flow, delay stops and congestion -from information received every second from detectors on each link in the network. In addition to its use for network control, this up-to-the-minute information is available for any other purpose and can be obtained via standard SCOOT messages at a variety of levels of detail. One of the many potential uses for the data is in traffic responsive route guidance systems such as autoguide, which is likely to be in operation in London in the early 1990s. The following sections describe the characteristics and accuracy of the data available from SCOOT which could be useful for route guidance and discusses possible ways in which the data may be used for this purpose. (Author/TRRL)

SECOND CONFERENCE ON TRAFFIC, ENERGY AND EMISSIONS, MELBOURNE, MAY 1982. PROGRAM AND PAPERS. Society of Automotive Engineers (Australasia) 191 Royal Parade Parkville Victoria 3052 Australia. May 1982 Monograph n.p. Figs. Tabs. Refs.

The conference was jointly organized by the Society of Automotive Engineers, Australasia and the Australian Road Research Board. Papers were presented in the following sessions: Session 1--A. Vehicle design for fuel consumption, B. Measurement of vehicle fuel consumption; Session 2--Fuel consumption modelling (1); Session 3--Fuel consumption modelling (2); Session 4--Research in progress; Session 5--Emissions modelling; Session 6--Driving patterns; Session 7--Traffic modelling; Session 8--Research into practice. For abstracts of individual papers presented at the conference see TRIS nos 367872-901. (TRRL)

SEGMENTWIDE TRAFFIC RESPONSIVE FREEWAY ENTRY CONTROL: FREEWAY CORRIDOR MODELING, CONTROL STRATEGY, AND IMPLEMENTATION PLAN. Kahng, SJ; Jeng, C-Y; Campbell, JF; May, AD. California University, Berkeley Institute of Transportation Studies, 109 McLaughlin Hall Berkeley California 94720; California Department of Transportation 1120 N Street Sacramento California 95814; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Aug 1984 Final Rpt. 171p Figs. Tabs. 24 Ref. 6 App.. REPORT NO: FHWA-CA-TO-84-5. AVAILABLE FROM: California University, Berkeley Institute of Transportation Studies, 109 McLaughlin Hall Berkeley California 94720

Major outcomes of this research are threefold: development of a macroscopic freeway corridor simulation model (FRECON2); development and evaluation, by simulation, of a segmentwide traffic responsive freeway entry control strategy (ELT control); and development of field implementation guidelines. The macroscopic freeway corridor model, FRECON2, was developed by extending an existing macroscopic dynamic freeway model, FRECON, in the following three areas: priority entry treatment, drivers' spatial diversion, and alternative surface streets with flow-dependent travel costs. Then, FRECON2 was calibrated using two days' data from the Santa Monica Freeway Corridor in Los Angeles, California. As a new segmentwide control strategy, extended local traffic responsive (ELT) control was developed. ELT control has been applied, by simulation, to freeway corridors with different operating environments. When its performance was evaluated, ELT control achieved a three to eleven percent net savings in total corridor travel time. Based on the above results, guidelines for field implementation have been prepared, including development of software for the central computer and 170 type controllers, and a before and after study plan. (Author)

SEGMENTWIDE TRAFFIC RESPONSIVE FREEWAY ENTRY CONTROL: FREEWAY CORRIDOR MODELING, CONTROL STRATEGY, AND IMPLEMENTATION PLAN. Kahng, SJ; Jeng, CY; Campbell, JF; May, AD. California University, Berkeley Institute of Transportation Studies, 109 McLaughlin Hall Berkeley California 94720. Aug 1984 186p. REPORT NO: UCB-ITS-RR-84-5; FHWA/CA/TO-84/5. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

Major outcomes of this research are threefold: development of a macroscopic freeway corridor simulation model (FRECON2); development and evaluation, by simulation, of a segmentwide traffic responsive freeway entry control strategy (ELT control); and development of field implementation guidelines.

SETTING CHANGE INTERVALS AT SIGNALIZED INTERSECTIONS. Chan, Y; Liao, T. Institute of Transportation Engineers. ITE Journal VOL. 57 NO. 2 Feb 1987 pp 45-50 Figs. 22 Ref.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

This article discusses simulation and analysis of driver response to a yellow light, and describes a procedure that can be used to scientifically set change intervals at signalized intersections. The associated computer program is also described. The procedure was employed to analyze 18 yellow lights in a city in Washington State. The results show that most change intervals in the field are shorter than desired as indicated by the existence of dilemma zones. Case studies show that there are a number of ways to eliminate the dilemma zone in the field. Apart from the obvious option of altering the change interval, it was found that adjustment of speed, repaving roads, and cutting down cross-street width through improved markings are equally viable. An interesting adjustment is the revision of the speed limit upward to minimize the dilemma zone.

SIDRA-2 DOES IT LANE BY LANE. Akcelik, R. Australian Road Research Board 500 Burwood Road Vermont South Victoria 3133 Australia 0572-1431. VOL. 12 NO. 4 1984 pp 137-149 3 Fig. 1 Tab. 19 Ref.

SIDRA-2 has been developed as a computer program to aid traffic engineers and researchers in the design and analysis of signalized intersections. SIDRA-2 implements the techniques described in the ARRB Research Report ARR No. 123 (Traffic Signals: Capacity and Timing Analysis). Although the fundamental principles and methods are the same, there are some important differences between ARR No. 123 and SIDRA-2. The most important is the lane-by-lane calculation of capacities and operating characteristics such as delay, number of stops and queue length. This paper outlines the main features of SIDRA-2 and discusses various aspects of the new method of lane-by-lane calculations. The "lane interaction" and "opposed turn" models are described briefly. Lane-by-lane calculations allow for predictions. The use of the "opposed turn equivalents" operating characteristics. This also improves the capacity predictions. The use of the 'opposed turn equivalents' e(sub o) and other movement saturation flow adjustments, eg, for lane under-utilization, are no longer necessary. The paper discusses a problem in the theory of signal design which is related to the application of the formulae for delays, etc, on a lane-by-lane against movement-by- movement basis. A full intersection example is given to illustrate the use of SIDRA-2. The number of the covering abstract for the conference is TRIS No. 393385. (Author/TRRL) This paper was presented during the 12th Australian Road Research Board Conference, Hobart, Tasmania, 27-31 August 1984.

SIDRA-2 FOR TRAFFIC SIGNAL DESIGN. Akcelik, R (Australian Road Research Board). Printerhall Limited. Traffic Engineering and Control VOL. 26 NO. 5 May 1985 pp 256-261 6 Fig. 8 Ref.

SIDRA (Signalized Intersection Design and Research Aid) has been developed as a computer program to aid traffic engineers and researchers in their design and analysis of signalized intersections. This paper describes the facilities and use of SIDRA-2 which basically implements the techniques given int he Australian Road Research Board Report ARR no 123 together with additional advanced features. SIDRA-2 output is very extensive and includes: (1) listing of basic movement and intersection variables (flow ratios, lost times, degrees of saturation, etc); (2) estimates of movement saturation flows, capacities and spare capacities; (3) lane information (lane flows and saturation flows, effective green and red times, lane utilization and operating characteristics); (4) computed signal timings and a signal timing diagram; (5) performance measures for computed or specified signal timings (delay, number of stops, queue length, fuel consumption, etc); and (6) separate summations for user-specified movement groupings such as pedestrians, buses, cars, major-and minor-road vehicles, etc. An example of both input data listing and output is given to illustrate the SIDRA method of estimating lane flows, capacities and operating characteristics. SIDRA-2 is now in use in traffic engineering practice and teaching in Australia and New Zealand. (TRRL)

SIGNAL-CONTROLLED ROUNDABOUTS. Flanagan, TB; Salter, RJ (Bradford University, England). PTRC Education and Research Services Limited. Planning & Transport Res & Comp, Sum Ann Mtg, Proc 1983 pp 181-192 5 Fig. 4 Tab. 9 Ref.. AVAILABLE FROM: PTRC Education and Research Services Limited 110 Strand London WC2 England

The last decade has seen an increasing realization that in the future large-scale grade-separated highway construction in urban areas will be severely limited. Instead, the emphasis has changed to traffic management and the optimal use of existing facilities by the geometric re-design of roundabouts and the use of computer control to improve flow through signal-controlled networks. This trend has led to increasing interest being paid to the signal-controlled roundabout which combines the separation of traffic conflicts with accurate computer control. This paper reviews the theoretical concepts which have so far been expounded on the signal-controlled roundabout. A detailed explanation is given of 'conflict separation' and 'natural cycle time', and a comprehensive example is included to illustrate how these concepts can be applied to a specific scheme. Details are given of the performance of signal-controlled roundabouts in Bradford and in Huddersfield, West Yorkshire. The paper goes on to describe a computer model which has been developed to simulate traffic flow in and around a signal-controlled roundabout. A before and after study is conducted utilizing the simulation model and the Department of Transport's model for roundabouts, ARCADY. A comparison of queue lengths and delays before and after the installation of signal control is made and conclusions drawn. In addition, the improvement in the level of service after the installation of signals is discussed using the distribution of individual vehicle delays as a basis. (Author/TRRL) This paper was presented at Seminar K, Traffic Operation and Management, held at the PTRC 11th Annual Summer Meeting, University of Sussex, England, 4-7 July, 1983.

SIGNAL IMPROVEMENTS SAVE TIME AND FUEL. Brohard, T. Public Works Journal Corporation. Public Works VOL. 117 NO. 2 Feb 1986 pp 52-53. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

Improvements made under California's Fuel Efficient Traffic Signal Management (FETSIM) program at over 3,000 traffic signals throughout the state are saving California motorists some $20 million in fuel costs and 11.3 million hours in travel annually by minimizing stops and reducing delays. Cities receiving grants have ranged from those with sophisticated computer controlled systems to those with traffic actuated and older electromechanical dial units. Grant applications were accepted for intersection networks containing ten or more traffic signals with the capacity for at least three different daily timing plans. Funds were used for all aspects of traffic signal timing optimization including data collection and processing, computer access and time, and timing plan development, implementation, and evaluation.

SIGNAL SYSTEMS: METHODOLOGY FOR PROJECT SELECTION. VOLUME 2. FINAL REPORT. Carter-E.C. Maryland Univ., College Park. Dept. of Civil Engineering. Federal Highway Administration, Baltimore, MD. Maryland Div. Maryland State Highway Administration, Baltimore. AW085285046 VOL2, FHWAMD8820. Feb 88. 155p.

A study of three recently installed signal systems in Maryland included travel time, fuel consumption and traffic volumes for all movements at all signalized intersections. A field after study, a field before study (system modified to represent before - uncoordinated - conditions), and computer simulation runs were compared, using travel time, delay and fuel consumption MOE's. Both NETSIM and TRANSYT 7F models were used. It was shown that computer simulation models can be used to predict changes in these parameters which can then be used to make decisions on which of several candidate new signal systems will likely be the most cost effective to meet budget constraints.

SIGNAL SYSTEMS: METHODOLOGY FOR PROJECT SELECTION. VOLUME 1. SUMMARY REPORT. Carter-E.C. Maryland Univ., College Park. Dept. of Civil Engineering. Federal Highway Administration, Baltimore, MD. Maryland Div. Maryland State Highway Administration, Baltimore. AW085285046 VOL1, FHWAMD8819. Feb 88. 33p.

This is a Summary of a study to determine if computer simulation programs could be used to evaluate the operation of new signal systems. The study showed that both NETSIM and TRANSYT 7F models accurately estimate travel time, delay and fuel consumption, and can be used in establishing priorities among candidate signal systems. A more complete description of the project is contained in, 'Final Report: Signal Systems: Methodology for Project Selection, Volume II.

SIGNAL TIMING BASED ON TRANSYT-7F. Davis, SW (City of Fort Wayne, Indiana). Purdue University. Engineering Bulletin of Purdue University N153 1982 pp 131-133. AVAILABLE FROM: Purdue University West Lafayette Indiana 47907

This presentation summarizes Fort Wayne, Indiana's participation in the National Signal Timing Optimization Project using the computerized optimization model for TRANSYT-7F. Five separate timing plans involving 45 signals within our CBD computerized network were optimized. Approximately 20 separate optimization computer runs were required to come up with the final results. The total cost of the project was $13,272.76. The total estimated cost savings as a direct result of this project amounted to $554,798 annually. It can be seen from this that computer optimization programs are very cost effective. The TRANSYT program, in particular, provides a very powerful tool for the traffic engineer in analyzing his signal network and timing it to its maximum efficiency. This paper was presented at the 68th Annual Road School, Purdue University, March 9-11, 1982.

SIGOP-III. USER'S MANUAL. Lieberman; Lai, J; Ellington, RE. Federal Highway Administration Research, Development & Technology, 6300 Georgetown Pike McLean Virginia 22101. Jul 1983 Final Rpt. 135p 36 Fig. 2 App.. REPORT NO: FHWA-IP-82-19. AVAILABLE FROM: Federal Highway Administration Office of Implementation McLean Virginia 22101

This manual explains how to use the SIGOP-III signal optimization computer program. The program, which is written in FORTRAN, is designed to generate traffic signal timing plans for both grid networks and arterials. The program not only optimize splits and offsets, and selects the optimum cycle length, it also outputs time-space diagrams. In addition to the normal measures of effectiveness associated with traffic flow, estimates of fuel consumption and vehicle emissions are provided.

SIGSIGN: A PHASE-BASED OPTIMIZATION PROGRAM FOR INDIVIDUAL SIGNAL-CONTROLLED JUNCTIONS. Silcock, JP; Sang, A. Printerhall Limited. Traffic Engineering and Control VOL. 31 NO. 5 May 1990 pp 291-98 8 Fig. 2 Tab. 15 Ref.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London W1P 3PE England

SIGSIGN is a microcomputer program which, given a pattern of traffic, will provide three sets of signal timings which are optimal according to each of the following criteria: (a) critical cycle time; (b) maximum practical capacity; and (c) minimum total junction delay. This article discusses the computer program and the advantages of the phase-based method and looks at some example applications.

SIMAUT AND META, TWO MOTORWAY TRAFFIC SIMULATION MODELS : CONCEPTUALIZATION, CALIBRATION AND VALIDATION. COHEN, S. INSTITUT NATIONAL DE RECHERCHE SUR LES TRANSPORTS. RAPPORT INRETS, NN108 Mar 1989 70 PP FRENCH

ISBN: 2857822901 SIMON COHEN ... DECEMBRE 1989 INCLUDES ENGLISH SUMMARY INCLUDES BIBLIOGRAPHICAL REFERENCES ADDL CORP. AUTHOR INFO: INRETS INSTITUTE : FRANCE INSTITUT NATIONAL DE RECHERCHE SUR LES TRANSPORTS ET LEUR SECURITE

SIMLA2 - A MICROSCOPIC SIMULATION MODEL OF TRAFFIC FLOW ON TWO-LANE RURAL ROADS. Brannolte, U (Karlsruhe Universitaet, West Germany). Australian Road Research Board 500 Burwood Road Vermont South Victoria 3133 Australia 0572-1431. VOL. 12 NO. 5 1984 pp 88-92 4 Fig. 5 Ref.

The model simulates at a microscopic level the flow of traffic, including passing, on a two-lane road section with varying possibilities for the horizontal and vertical alignment. Different compositions of curvature elements, including asymmetrical configurations, are permissible. Simulated driving speeds in curves depend both on vehicle characteristics and on the direction of flow, as well as on potential restrictions in visibility. Climbing and descent sections can be simulated. From the results of micro simulation, macroscopic traffic flow characteristics for specified types of road may be worked out. A special feature of the model consists of the detailed recording of each path driven. Such data facilitate the representation of traffic flow on film in the form of an aerial view. The film yields further information about the speeds driven in relation to alignment. Such a film (16 mm projection) is a part of the presentation. Also from the data, values for fuel consumption, which are directly related to the actual engine performance may be determined. (Author/TRRL) This paper was presented during the 12th Australian Road Research Board Conference, Hobart, Tasmania, 27-31 August 1984.

MULATION AND OPTIMIZATION OF TRAFFIC FLOW ON INTERCITY NETWORKS. Hu, YC; Schonfeld, P. Maryland iversity, College Park Transportation Studies Center College Park Maryland 20742. Jul 1983 288p. REPORT NO: HWA/MD-83/05. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 2161

A macroscopic Traffic Simulation and Optimization (TSAO) model has been developed for regional highway networks. In its latest version, this model uses a macroscopic research approach to simulate vehicle platoons through the network, Lighthill's shockwave function to simulate queue propagation, event-scan time management, and a quasi-Newton optimization algorithm. It was applied to the Maryland Eastern Shore network, where heavy recreational traffic creates severe congestion and long queues at bottlenecks on summer weekends. Fourteen alternatives for improvement, including capacity expansion projects and route diversion, were analyzed. Results show the cost-effectiveness of route diversion as a substitute for new construction on intercity networks where high demand peaks are infrequent. The applicability of the TSAO model to large networks with complex demand patterns and insufficient capacity is also demonstrated. Portions of this document are not fully legible.

SIMULATION MODEL APPLIED TO JAPANESE EXPRESSWAY. Makigami, Y; Nakanishi, T; Seill, K (Ritsumeikan University). American Society of Civil Engineers. Journal of Transportation Engineering VOL. 110 NO. 1 Jan 1984 pp 94-111 8 Ref.. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

A traffic simulation model is developed which computes traffic flow characteristics and traces the behavior of congestions under given traffic demands. A 24 km study section was selected from Meishin expressway is Osaka where congestion occurs from two tunnels almost every morning during peak period. An extensive traffic survey was conducted making use of aerial photography, video camera recording, and floating tests. A simulation model for traffic flow through bottlenecks was developed on the basis of the results of the traffic survey. The expressway bottleneck simulation model was a macroscopic model based upon the theory of compressible fluid. The results of the simulation model are satisfactory.

SIMULATION MODEL FOR THE ANALYSIS OF COMPLEX TRAFFIC WEAVING PROBLEMS. O'Leary, TJ (Arizona State University). Transportation Planning and Technology VOL. 8 NO. 2 1983 pp 101-115 7 Fig. 4 Tab. 11 Ref.

A simulation modeling approach has been developed to analyze a complex traffic weaving problem. It is presented, discussed, and demonstrated on an actual dual purpose weaving area that is closely followed by an entrance-exit junction. Specifically, the model identifies problem areas in the system, assists the traffic engineer in the formulation of feasible solution strategies, and analyzes the effectiveness of alternative strategies. The simulation model is not presented as a panacea to weaving analysis rather as an interesting and unique approach that has the potential to analyze a wide variety of weaving patterns. The primary conclusion of the paper is that the model can be a valuable tool for analysis of certain types of traffic congestion problems. (Author/TRRL)

SIMULATION OF DELAYS AND QUEUE LENGTHS AT OVER-SATURATED PRIORITY HIGHWAY JUNCTIONS. Salter, RJ (Bradford University, England). Australian Road Research Board. Australian Road Research VOL. 12 NO. 4 Dec 1982 pp 239-246 8 Fig. 7 Ref.

Delays and queue lengths at over-saturated priority highway junctions are examined by means of computer simulation of the traffic flow. A simple over-saturated rectangular surge of non-priority route flow is initially considered; theoretical expressions for the capacity and average delay per vehicle in terms of priority route headway and driver gap acceptance are given. The less restrictive case when drivers have a range of gap acceptance is also considered. Secondly, a more realistic form of non-priority route flow surge of the trapezoidal form is considered. A theoretical expression is given for the average delay per vehicle in terms of demand and capacity and it is verified by computer simulation. Thirdly, a simulation model is discussed in which it is possible to input both priority and non-priority route flows which have a flow variation typical of peak hour traffic. One model is programmed for use on a main frame computer and the other model, written in basic, was programmed for use on a micro-computer. The output from the main frame model in terms of average delay per vehicle and queue length on the non-priority route is illustrated. Using the micro-computer model a comparison of simulated and observed traffic delays is made for an intersection in the City of Bradford, U.K. (Author/TRRL)

SIMULATION OF TRAFFIC FLOW AT SIGNAL-CONTROLLED ROUNDABOUTS. Salter, RJ; Okezue, OG. Printerhall Limited. Traffic Engineering and Control VOL. 29 NO. 3 Mar 1988 pp 142-147 Figs. Tabs. 1 Ref.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London England

A computer simulation model, SIGART, has been developed to study the operation of signal controlled traffic circles (roundabouts). The SIGART can be divided into 2 parts: the first part accepts input data and performs necessary calculation - its output consists mainly of signal-settings and processed traffic flow details; second part performs a simulation study using the traffic signal information supplied. The validation of the model is described. The relationships between queuing delay cycle time, demand flow and inscribed circle diameter were obtained for a three-arm traffic circle operating under idealized conditions of equal demand flows on each approach, balanced turning movements and equal vehicle speeds. For specific conditions for 3- or 4-arm signalized traffic circle with up to three lanes on an approach and desired turning movements the program SIGART could determine for the required inscribed diameter, expected queue lengths and associated delays at both internal and external stoplines.

SIMULATION OF TRAFFIC FLOW PARAMETERS ON A SERIES OF SIGNALIZED INTERSECTIONS. Savic, D. Savez Inzenjera I Tehn Saobracaja I Veza Jugo. Zbornik III Jugo Savetovanje Tehn Regul Saobracaja Apr 1983 pp 189-199 4 Fig. 5 Tab. Serbian

This paper investigates the control of a series of signalized intersections. The simulation model uses the GPSS programming language. The results obtained can be correlated with empirical data. The model is flexible and can be adjusted for any traffic network. (TRRL)

SIMULATION OF VEHICLE EMISSIONS AT INTERSECTIONS. Lee, F-P; Lee, CE; Machemehl, RB; Copeland, CR, Jr. Texas University, Austin Center for Transportation Research Austin Texas 78712; Texas State Department of Highways & Public Transp Transportation Planning Division, P.O. Box 5051 Austin Texas 78763; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Aug 1983 Intrm Rpt. n.p.. REPORT NO: FHWA/TX-84/17+250-1

High concentrations of vehicular emissions at road intersections are a health-related issue of concern, and the associated fuel consumption is a matter of continuing economic interest. For this study, a computer simulation model called TEXAS-II was developed at the Center for Transportation Research to estimate with respect to time and location the source of carbon monoxide, hydrocarbon, and oxides of nitrogen emissions and the amount of fuel consumed by vehicles as they pass through an intersection. The model was run approximately 300 times in a series of experiments designed to obtain quantitative estimates of the effects of various traffic and intersection factors on emissions, fuel consumption, traffic delays, and queue lengths. The resulting data were utilized to build predictive models for emissions and fuel consumption at intersections. The factors which were used for simulating the intersection environment were (1) intersection size, (2) presence or absence of a special left-turn lane, (3) pretimed signal control, (4) fully-actuated signal control, (5) all-way stop-sign control, (6) traffic volume, (7) number of left turns, and (8) number of heavy-duty vehicles. Traffic engineers and transportation planners can utilize the results of this study in three ways: the predictive models can be applied to calculate the expected source of emissions, fuel consumption, and traffic performance parameters for any intersection situation that was included in the range of simulated conditions; these values can be looked up in a series of tables; and the TEXAS-II computer simulation program can be run to obtain detailed data concerning any specific intersection environment of practical interest. (FHWA)

SIMULTANEOUS ANALYSIS OF A SIGNALIZED INTERSECTION. HIGHWAY CAPACITY AND LEVEL OF SERVICE. PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON HIGHWAY CAPACITY, KARLSRUHE, GERMANY, 24-27 JULY 1991. Ozaki, H. Balkema (AA) P.O. Box 1675 3000 BR Rotterdam Netherlands 90 5410 011 7. 1991 pp 271-282 9 Fig. 3 Tab. Refs.. AVAILABLE FROM: Balkema (AA) Publishers Old Post Road Brookfield Vermont 05036

This paper discusses a method of analysis for a signalized intersection which considers prevailing geometric, traffic, and signal operating conditions simultaneously. The present Highway Capacity Manual recommends the analysis procedure on a module-by-module basis. Traffic engineers should prepare intersection design alternatives with estimated or assumed parameters of geometric, traffic, and signalization conditions. Since these parameters of the prepared design alternatives influence the analyzed results, trial and error procedure is required in order to obtain appropriate plans. In this paper, a signalized intersection is viewed as a time and space sharing system and is formulated as one of the scheduling problems. The continuous and discrete nature of design parameters are examined and a set of constraints and objective functions is described. Performance of the proposed method is illustrated by a numerical example.

SIMULTANEOUS OPTIMIZATION OF SIGNAL SETTINGS AND LEFT-TURN TREATMENTS. Rouphail, NM; Radwan, AE. Transportation Research Board. Transportation Research Record N1287 1990 pp 1-10 6 Fig. 4 Tab. 28 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

Two apparent weaknesses in current signal setting methodology are addressed, namely the identification of the optimum number of phases and the optimization of left-turn phasing (e.g., protected, permissive, or both). The proposed method integrates these two elements into the signal timing process for isolated intersections, which also entails the optimization of cycle length and splits. The method directly considers the effect of minimum green times, practical cycle lengths, and permissive left-turn capacity models in an attempt to reach an optimal decision. Although primarily applicable to pretimed signal control the logic may also be adapted to single-ring actuated controllers. The scope of the method is limited to intersection geometries with exclusive left-turn lanes on all approaches and no overlap phasing. This paper appears in Transportation Research Record No. 1287, Traffic Flow, Capacity, Roadway Lighting, and Urban Traffic Systems 1990.

SINGLE-ARTERIAL VERSUS NETWORKWIDE OPTIMIZATION IN SIGNAL NETWORK OPTIMIZATION PROGRAMS (DISCUSSION AND CLOSURE). Johnson, V; Cohen, SL; Chang, ECP. Transportation Research Board. Transportation Research Record N1142 1987 pp 6-15 7 Fig. 11 Tab. 3 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

The optimization of signal timing in a traffic network involves finding the timing plan that optimize the overall performance in the network. In theory, the network closure constraints limit the performance on individual arteries of the network. Thus networkwide optimization has the potential of imposing some cost or penalty, or both, to individual arterials in the network. The objective of this study was to determine how or if the network closure constraint affects or limits arterial performance in the program for maximum-bandwidth, MAXBAND, and in the program for minimum stops, delay, and fuel consumption, TRANSYT-7F. The results of this study show that for small and medium-sized closed networks, optimization of an entire network using MAXBAND or TRANSYT-7F costs very little in terms of stops, delay, and green bandwidth on the arteries within the network. The added cost associated with the additional stops and delays resulting from networkwide optimization can be expected to impose approximately a 5 percent penalty on individual arteries within the network. This paper appeared in Transportation Research Record No. 1142, Urban Signal Systems and Transportation System Management.

SOME EXPERIENCE WITH THREE URBAN NETWORK MODELS: SATURN, TRANSYT/8 AND NETSIM. Luk, JYK; Stewart, RW (Waterloo University). Australian Road Research Board. Australian Road Research VOL. 14 NO. 2 Jun 1984 pp 82-87 2 Fig. 4 Tab. 18 Ref.

The experience of using three urban network models for predicting the performance of signal co-ordination in an arterial road is reported. The three models, or packages, selected are SATURN, TRANSYT/8 and NETSIM. They represent different levels of modelling details. Both SATURN and TRANSYT/8 belong to the category of macroscopic models, whereas NETSIM is a microscopic model. SATURN has traffic assignment capability but this aspect is not investigated in this paper. The three models were tested using a real- world network in Parramatta, New South Wales. The task of preparing three sets of consistent input data was found to be non-trivial. Several problems were encountered and could be attributed to incompatible structures in these models. For example, the simulation module of SATURN does not directly accept link traffic flows as input data. SATURN was found to underestimate total delay by 29 per cent and fuel consumption by seven per cent when compared with TRANSYT/8. There was, however, no difference between the two models in the prediction of the number of stops. Netsim was found to have a bias in the lane distribution of traffic flows. This problem frequently created spill-back and the model was difficult to use in near-saturated conditions. TRANSYT/8 was found to be the simplest of the three models in preparing the input data and the most consistent in performance prediction. (Author/TRRL)

SOME MEASUREMENTS OF ROBERTSON'S PLATOON DISPERSION FACTOR. Axhausen, KW; Korling, H-G. Transportation Research Board. Transportation Research Record N1112 1987 pp 71-77 5 Fig. 9 Tab. 17 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

At the core of TRANSYT, the platoon dispersion model of Robertson is probably the most widely used traffic model in the world. In spite of its wide use, only a relatively small number of studies have tried to calibrate the model for a range of traffic conditions. The default values of the TRANSYT handbooks provide the only information on the value of the dispersion factor available to most users. In the first section of the paper, the sensitivity of the TRANSYT results to the dispersion value is shown. Next, available information on the model is summarized and the results are classified. In the last section of the paper, the results of measurements taken in Karlsruhe and in Pforzheim, West Germany, are reported. The experimental design of the sites was selected to determine the influence of the gradient and the number of lanes on the platoon dispersion. This paper appeared in Transportation Research Record No. 1112, Highway Capacity and Flow Theory and Characteristics.

SOME MICROCOMPUTER APPLICATIONS IN TRAFFIC ENGINEERING IN CHILE. Ortuzar, J, de D. PTRC Education and Research Services Limited. Planning & Transport Res & Comp, Sum Ann Mtg, Proc VOL P249 1984 pp 73-75 4 Ref. AVAILABLE FROM: PTRC Education and Research Services Limited 110 Strand London WC2 England

The advent of the low cost microcomputer has offered Chile the opportunity of significantly improving several traffic engineering operations. This short paper briefly describes applications in the following areas: data collection and analysis; optimum signal settings; evaluation of low investment traffic management schemes in urban corridors. It was found that in all these tasks the microcomputer allowed jobs to be performed better, more quickly and less expensively. (TRRL) Microcomputer Applications in Developing Countries. Proceedings of Seminar F held at the 12th PTRC Summer Annual Meeting, University of Sussex, England, July 10-13, 1984. For the covering abstract of the seminar see IRRD 283731 (TRIS 458582).

SOME PROPERTIES OF MACROSCOPIC TRAFFIC MODELS. Ross, P. Transportation Research Board. Transportation Research Record N1194 1988 pp 129-134 2 Fig. 12 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

Three "equations of state" are required to describe the traffic fluid. The first is volume equals speed times density, and the second is the continuity of vehicles. There are at least four options for the third equation: (1) the deterministic speed-density model, (2) the equilibrium speed-density model, (3) the Payne model, and (4) the Ross model. Two restrictions on the space step DX and time step DT apply to numerical integrations of all four models. There is an additional restriction on DT that applies to the last three models and a special restriction on the "anticipation" term in the Payne model. The time required to perform numerical integrations of all four models is shown to be inversely proportional to the square of the length of the smallest feature represented. A general form for the "relaxation time" in the three non-deterministic models is derived. It is argued, on the basis of experience with the Ross model, that although a dependence upon speed is "correct," setting the relaxation time constant is adequate for most traffic purposes. The relationship between relaxation time and lost time at signals in the Ross model is shown to be linear. This paper appears in Transportation Research Record No. 1194, Traffic Flow Theory and Highway Capacity.

SSTOP - A SIGNAL SYSTEM OPTIMIZATION PROGRAM. McGill, J (Ontario Ministry of Transportation & Communic, Can) Institute of Transportation Engineers. ITE Journal VOL. 54 NO. 3 Mar 1984 pp 38-40. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

Optimum signal timings and offsets which properly match green time to vehicular demand provide for the smooth and progressive flow of traffic through a network and significantly reduce fuel consumption. Therefore, updating signal systems every year or two, or when traffic conditions change, can be very cost effective. In recent years several computerized algorithms have been developed to provide engineers with an easy to use tool to assist in the development of efficient timing plans. As one such program, the Signal System Optimization Program (SSTOP) is fast becoming the adopted standard tool for signal system analysis and optimization in Ontario.

STATE OF THE ART REPORT. TRAFFIC MANAGEMENT. TRAFFIC CONTROL Kinslea Press Limited. Municipal Engineer VOL. 1 NO. 3 Oct 1984 pp 255-274 11 Fig. 11 Phot. 120 Ref.. AVAILABLE FROM: Kinslea Press Limited Central Buildings, 24 Southwark Street, London Bridge London England

Any method or device limiting or segregating conflicts between either vehicles or pedestrians or both can be considered as a form of traffic control. The article considers in detail traffic signals at road junctions, pelican and zebra crossings, linked signals and urban traffic control and special signal applications ranging from peak hour control of roundabouts to those assisting emergency service vehicles. Appendices list the appropriate standards for the design and layout, equipment installation and maintenance. Current specifications relating to specialist signal control are also quoted. Methods of estimating capacities, green times and vehicle delays at signal-controlled junctions are discussed. Current designs make use of the greater flexibility provided by microprocessor phased-based controllers. The operation of the TRANSYT and SCOOT programs, available for urban traffic control, are outlined. Typical installation costs and recommended procedures for carrying out roadworks are discussed

Reference is made to documents containing details of the legal requirements and an extensive bibliography is included. For abstract of the first part of this paper (pp 253-255), on traffic signs and carriageway markings, see IRRD 288463. (TRRL)

STATE SIGNAL TIMING OPTIMIZATION PROGRAMS. Arnold, ED. Institute of Transportation Engineers. ITE Journal VOL. 59 NO. 2 Feb 1989 pp 33-35 1 Tab. 1 Ref.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

The findings are documented of a survey of signal timing optimization activities in 9 states: California; Florida; Illinois; Maryland; Michigan; Missouri; New York; North Carolina; and Wisconsin. The timing programs were of 4 types: lead agency promotes the benefits of optimal signal timing, providing training and technical assistance; the program is established to which local agencies submit a formal application to undertake a timing project; lead agency contracts with a consultant; state transportation agency undertakes the timing program. The source of funds and program costs are discussed. Targeted intersections in the programs are also discussed. The fuel savings, operational improvements, and costs of programs in the several states are discussed. The status of Virginia's program is described.

STATISTICAL ANALYSIS OF OUTPUT RATIOS IN TRAFFIC SIMULATION. Gafarian, AV; Halati, A. Transportation Research Board. Transportation Research Record N1091 1986 p 29-36 2 Fig. 4 Tab. 5 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

Simulation models are increasingly becoming the most convenient tool for traffic studies. Users of such models need valid statistical methods to draw correct inferences. Presented in this paper is one such method applicable to several important traffic parameters. The motivation for this research arose from a study sponsored by the FHWA, U.S. Department of Transportation, to develop statistical guidelines for simulation experiments with traffic models. NETSIM, widely used for simulating vehicular traffic flow on urban streets, was used in the study. The output of the NETSIM model includes estimates of average speed, average delay per vehicle, and average travel time per vehicle mile. Because NETSIM uses the ratio of sample means to estimate these parameters, a situation exists that involves the ratios of observations that are in fact autocorrelated and cross correlated. In this paper, the efficacy of the ratio of sample means (used in NETSIM) as an estimator of the ratio of steady state means is discussed. Monte Carlo experiments have demonstrated that the user of the NETSIM model, in estimating these parameters from the model output, must apply statistical techniques based on ratio estimators. A technique that provides a measure of the accuracy of the estimate with a confidence interval is developed and demonstrated. The efficacy of the method is assessed through Monte Carlo experiments. The method is easy to use and can be applied just as readily to field data. It can be extended to the comparison of model outputs to field observations for simulation validation studies. This paper appeared in Transportation Research Record N1091, Traffic Flow Theory, Characteristics, and Highway Capacity.

STOP PROBABILITY AND DELAY ESTIMATIONS AT LOW VOLUMES FOR SEMI-ACTUATED TRAFFIC SIGNALS. Luh, JZ; Lee, CY. Operations Research Society of America. Transportation Science VOL. 25 NO. 1 Feb 1991 pp 65-82 Figs. Tabs. Refs.. AVAILABLE FROM: Operations Research Society of America Mount Royal and Guilford Avenue Baltimore Maryland 21202

Semi-actuated signals have been widely used on arterials, since they provide flexible controls for minor street traffic to reduce delays and stops. It is very important to estimate average delays and stops under such signal control in designing timing plans or evaluating operational performance. A common approach is to estimate average green times, then to apply a model for pretimed signals to calculate delays and stops. This method produces reasonable approximations when traffic volumes are moderate to high. When traffic volumes are low, however, this method produces biased approximations since it does not consider phase skipping due to lack of traffic demand. This paper presents an analytical method to directly estimate stop probability and average delay for semi-actuated signals at low volumes, under both isolated and coordinated controls. This method uses probability theory and stochastic processes to consider the various cycle lengths and green times under such signal control with simplified assumptions. A comparison with the results of a simulation demonstrates the validity of the method.

STREET-WISE SCOOT MOVES TRAFFIC THAT OTHER SYSTEMS CAN'T REACH. Bowen, GT; Vincent, RA. Business Press International Limited. Surveyor Public Authority Technology VOL 165 NO. 4875 Dec 1985 pp 8-9 2 Fig. 1 Phot.. AVAILABLE FROM: Business Press International Limited Throwley Way Sutton Surrey United Kingdom

SCOOT is an on-line, fully adaptive system, developed by TRRL, for coordinating traffic lights in urban areas by adjusting the timing of traffic lights in response to varying traffic conditions. Eight SCOOT systems are in operation and eight more are planned. Details are given of improvements made to the system which include the selection of which arms of junction queues should be allowed to form, e.g., on side roads while main roads are kept clear and the possibilities of applying weighting factors to specific routes so that they are favored (e.g., routes with buses). Other research being undertaken includes the study of severely congested areas where SCOOT's second-by-second adjustments can make full use of the available capacity. Also being developed is the automatic measurement of SCOOT parameters for more rapid installation of the system. (TRRL)

STUDY AND NUMERICAL MODELLING OF NON-STATIONARY TRAFFIC FLOW DEMANDS AT SIGNALIZED INTERSECTIONS. Chodur, J; Tracz, M (Cracow Technical University). VNU Science Press Bv P.O. Box 2073 Utrecht Netherlands 90-6764-008-5. 1984 pp 134-154 13 Fig. 1 Tab. 12 Ref.

Empirical studies of traffic flow variations and theoretical analyses have been conducted in order to derive characteristics of traffic flow variability, particularly in relation to peak periods. The length of flow counting interval, t-r, as well as profiles of flow rate variations for peak periods have been determined. The flow profiles are based on a time scale divided into units t-r, within which demand flow is assumed as stationary. A computer simulation program has been developed for modelling of traffic flow with varying flow rates accordingly to an assumed curve. This program simulates the vehicle arrival process at an approach to fixed time traffic signals and calculates delays, stops, queue lengths, saturation ratios and their probabilistic statistics, which characterize level of service in the considered period of time. The primary application of this program lies in a simulation study of the effect of flow rate variability on the effectiveness of signal settings and estimation of traffic conditions during peak periods. (Author/TRRL) Papers presented during the Ninth International Symposium on Transportation and Traffic Theory held in Delft the Netherlands, 11-13 July 1984.

TESTING DELAY MODELS WITH FIELD DATA FOR FOUR-WAY, STOP SIGN-CONTROLLED INTERSECTIONS. Zion, M; List, GF; Manning, C. Transportation Research Board. Transportation Research Record N1225 1989 pp 83-90 10 Fig. 6 Tab. 8 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

Four-way, stop sign-controlled intersections are a relatively common phenomenon, especially in urban networks, yet little analysis has been devoted to determining their capacity and delay characteristics. This paper presents the results of new field studies and compares data collected from two recent delay models. Generally, findings are that delay increases as the intersecting volumes increase; intersections with balanced volumes have lower delays than those without; and the percentage of left turns has a noticeable effect on delay. Statistical analyses suggest that one of the two models considered in this research may provide satisfactory delay estimates. This paper appears in Transportation Research Record No. 1225, Highway Capacity, Flow Measurement, and Theory.

TESTING OF DYNAMIC MODELS FOR SIGNAL CONTROLLED INTERSECTIONS. Beskos, DE; Okutani, I; Michalopoulos, P (Minnesota University, Minneapolis; Shinshu University Japan). Pergamon Press Limited. Transportation Research. Part B: Methodological VOL. 18B NO. 4/5 1984 pp 397-408 3 Fig. 3 Tab. 10 Ref.

Three continuum traffic models and the simple input-output one are implemented at a signalized intersection and tested against limited data collected by time lapse photography. A comparative performance evaluation is made based on estimations of the queue length, the effective queue size and interrupted total travel time. These estimates are obtained from initial and boundary conditions measured in short time increments at each end of the link under consideration. The test results indicate that the continuum models are more effective in estimating the above state variables and measure of effectiveness. A simple statistical adjustment suggests that the least sophisticated continuum model performs consistently better than any other alternative. The findings of this study can only be tentative due to the limitations of the data base. (Author/TRRL)

THE ARTERIAL ANALYSIS PACKAGE. Gibson, DRP; Williams, L. Federal Highway Administration, Office of R&D. Public Roads VOL 50 NO. 3 Dec 1986 pp 91-96 Figs. 3 Ref.. AVAILABLE FROM: Government Printing Office Superintendent of Documents Washington D.C. 20402

Reference is made to documents containing details of the legal requirements and an extensive bibliography is included. For abstract of the first part of this paper (pp 253-255), on traffic signs and carriageway markings, see IRRD 288463. (TRRL)

STATE SIGNAL TIMING OPTIMIZATION PROGRAMS. Arnold, ED. Institute of Transportation Engineers. ITE Journal VOL 59 NO. 2 Feb 1989 pp 33-35 1 Tab. 1 Ref.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

The findings are documented of a survey of signal timing optimization activities in 9 states: California; Florida; Illinois; Maryland; Michigan; Missouri; New York; North Carolina; and Wisconsin. The timing programs were of 4 types: lead agency promotes the benefits of optimal signal timing, providing training and technical assistance; the program is established to which local agencies submit a formal application to undertake a timing project; lead agency contracts with a consultant; state transportation agency undertakes the timing program. The source of funds and program costs are discussed. Targeted intersections in the programs are also discussed. The fuel savings, operational improvements, and costs of programs in the several states are discussed. The status of Virginia's program is described.

STATISTICAL ANALYSIS OF OUTPUT RATIOS IN TRAFFIC SIMULATION. Gafarian, AV; Halati, A. Transportation Research Board. Transportation Research Record N1091 1986 p 29-36 2 Fig. 4 Tab. 5 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

Simulation models are increasingly becoming the most convenient tool for traffic studies. Users of such models need valid statistical methods to draw correct inferences. Presented in this paper is one such method applicable to several important traffic parameters. The motivation for this research arose from a study sponsored by the FHWA, U.S. Department of Transportation, to develop statistical guidelines for simulation experiments with traffic models. NETSIM, widely used for simulating vehicular traffic flow on urban streets, was used in the study. The output of the NETSIM model includes estimates of average speed, average delay per vehicle, and average travel time per vehicle mile. Because NETSIM uses the ratio of sample means to estimate these parameters, a situation exists that involves the ratios of observations that are in fact autocorrelated and cross correlated. In this paper, the efficacy of the ratio of sample means (used in NETSIM) as an estimator of the ratio of steady state means is discussed. Monte Carlo experiments have demonstrated that the user of the NETSIM model, in estimating these parameters from the model output, must apply statistical techniques based on ratio estimators. A technique that provides a measure of the accuracy of the estimate with a confidence interval is developed and demonstrated. The efficacy of the method is assessed through Monte Carlo experiments. The method is easy to use and can be applied just as readily to field data. It can be extended to the comparison of model outputs to field observations for simulation validation studies. This paper appeared in Transportation Research Record N1091, Traffic Flow Theory, Characteristics, and Highway Capacity.

STOP PROBABILITY AND DELAY ESTIMATIONS AT LOW VOLUMES FOR SEMI-ACTUATED TRAFFIC SIGNALS. Luh, JZ; Lee, CY. Operations Research Society of America. Transportation Science VOL 25 NO. 1 Feb 1991 pp 65-82 Figs. Tabs. Refs.. AVAILABLE FROM: Operations Research Society of America Mount Royal and Guilford Avenue Baltimore Maryland 21202

Semi-actuated signals have been widely used on arterials, since they provide flexible controls for minor street traffic to reduce delays and stops. It is very important to estimate average delays and stops under such signal control in designing timing plans or evaluating operational performance. A common approach is to estimate average green times, then to apply a model for pretimed signals to calculate delays and stops. This method produces reasonable approximations when traffic volumes are moderate to high. When traffic volumes are low, however, this method produces biased approximations since it does not consider phase skipping due to lack of traffic demand. This paper presents an analytical method to directly estimate stop probability and average delay for semi-actuated signals at low volumes, under both isolated and coordinated controls. This method uses probability theory and stochastic processes to consider the various cycle lengths and green times under such signal control with simplified assumptions. A comparison with the results of a simulation demonstrates the validity of the method.

STREET-WISE SCOOT MOVES TRAFFIC THAT OTHER SYSTEMS CAN'T REACH. Bowen, GT; Vincent, RA. Business Press International Limited. Surveyor Public Authority Technology VOL 165 NO. 4875 Dec 1985 pp 8-9 2 Fig. 1 Phot.. AVAILABLE FROM: Business Press International Limited Throwley Way Sutton Surrey United Kingdom

SCOOT is an on-line, fully adaptive system, developed by TRRL, for coordinating traffic lights in urban areas by adjusting the timing of traffic lights in response to varying traffic conditions. Eight SCOOT systems are in operation and eight more are planned. Details are given of improvements made to the system which include the selection of which arms of junction queues should be allowed to form, e.g., on side roads while main roads are kept clear and the possibilities of applying weighting factors to specific routes so that they are favored (e.g., routes with buses). Other research being undertaken includes the study of severely congested areas where SCOOT's second-by-second adjustments can make full use of the available capacity. Also being developed is the automatic measurement of SCOOT parameters for more rapid installation of the system. (TRRL)

STUDY AND NUMERICAL MODELLING OF NON-STATIONARY TRAFFIC FLOW DEMANDS AT SIGNALIZED INTERSECTIONS. Chodur, J; Tracz, M (Cracow Technical University). VNU Science Press Bv P.O. Box 2073 Utrecht Netherlands 90-6764-008-5. 1984 pp 134-154 13 Fig. 1 Tab. 12 Ref.

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TESTING OF DYNAMIC MODELS FOR SIGNAL CONTROLLED INTERSECTIONS. Beskos, DE; Okutani, I; Michalopoulos, P (Minnesota University, Minneapolis; Shinshu University Japan). Pergamon Press Limited. Transportation Research. Part B: Methodological VOL. 18B NO. 4/5 1984 pp 397-408 3 Fig. 3 Tab. 10 Ref.

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THE ARTERIAL ANALYSIS PACKAGE. Gibson, DRP; Williams, L. Federal Highway Administration, Office of R&D. Public Roads VOL 50 NO. 3 Dec 1986 pp 91-96 Figs. 3 Ref.. AVAILABLE FROM: Government Printing Office Superintendent of Documents Washington D.C. 20402

This article discusses the three component traffic signal timing programs of the Arterial Analysis Package (AAP). The AAP, which was conceived as a tool for timing traffic signals on arterial streets, gathers the most widely used design and analysis programs to provide a framework for solving signal timing problems using commonly available traffic engineering data. The component timing programs discussed here are as follows: the Signal Operations Analysis Package (SOAP), Progression Analysis and Signal System Evaluation Routine (PASSER), and the Traffic Network Study Tool (TRANSYT). The article also discusses how to define a problem for analysis, how to prepare the input deck using the support programs, how to interpret results, and how the AAP was tested.

THE BANDWIDTH-CONSTRAINED TRANSYT SIGNAL-OPTIMIZATION PROGRAM (DISCUSSION AND CLOSURE). Cohen, SL; Liu, CC; Chang, EC-P. Transportation Research Board. Transportation Research Record N1057 1986 pp 1-9 5 Fig. 5 Tab. 13 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

A discussion is presented of previous attempts to combine bandwidths and delay and stop considerations as criteria for computing signal-timing plans for arterial signal systems. In particular, deficiencies in these previous attempts are pointed out. A new approach that involves constraining the TRANSYT-7F model to preserve the two-way band computed by a bandwidth program is described. This new approach was tested on 10 widely varying arterial data sets by using the MAXBAND program to develop the green bands, and the NETSIM model to evaluate the effectiveness of the resultant signal-timing plans with a weighted combination of delay and stops as the measure of performance. It is shown that no statistically significant improvement in arterial performance is obtained by adjusting offsets only, even in the case of short block spacing. However, if both offsets and green times are adjusted, statistically significant improvements in arterial performance are obtained. This paper appeared in Transportation Research Record N1057, Traffic Signal Systems.

THE CALCULATION OF THE ORIGIN DESTINATION MATRIX FROM THE MEASUREMENT OF TRAFFIC FLOWS BASED ON THE HYPOTHESIS OF PROPORTIONAL ASSIGNMENT. Cascetta, E (Naples University, Italy). Casa Editrice la Fiaccola. Vie e Trasporti VOL. 51 NO. 486 Jan 1982 pp 25-35 3 Fig. 3 Tab. 5 Ref. Italian

This article deals with the problem of determining the transport demand in an urban road network when the traffic flow distribution is known but not that of the origin-destination. Two approaches are analyzed: the geometric approach based on minimum distance modelling; and the maximum probability approach deriving from the theory of entropy. It is concluded that the maximum probability method is to be preferred because, in addition to requiring very little memory space, it can make sure of whatever information there is available on the network under examination. An algorithm obtained by the use of Legrange multipliers, is proposed for the solution of the origin destination. (TRRL)

THE DEVELOPMENT OF TRANSIM - A DISPLAY ORIENTED TRAFFIC SIMULATION MODEL. Foster, D; Smare, AD (West Yorkshire Metropolitan County Council). Echo Press Limited. Municipal Engineer VOL. 110 NO. 6 Jun 1983 pp 201-205 5 Fig.

A traffic simulation system is being developed to model the progress of individual vehicles through junctions and highway systems. This enables an examination of proposals for dealing with particular conditions at specific sites. The system also incorporates a visual display facility in color providing a rapid, easily assimilated assessment of traffic movement and conditions for the design engineer and management. Three main phases are involved: specification of data, model construction and operating procedure. Vehicles may be classified as private cars, public service vehicles or goods vehicles and are modelled according to specified origins and destinations. Speed characteristics are also accommodated and modified by highway parameters. Appropriate signal cycle times are specified at each junction with co-ordination data relating to any traffic control system. Vehicles can weave to overtake other slower or stationary vehicles. Outputs are conditioned by hardware availability: hard-copy plotting facilities can be used and graphic images on a color display tube can be photographed sequentially with a cine or video camera. (TRRL)

THE DEVELOPMENT OF UTCS/NETSIM/ICG: AN INTEGRATED URBAN TRAFFIC CONTROL SYSTEM - NETWORK SIMULATION - INTERACTIVE COMPUTER GRAPHICS PROGRAM. Eiger, A; Chin, S-M. Rensselaer Polytechnic Institute Department of Civil Engineering Troy New York 12181; Department of Transportation Office of University Research, 400 7th Street, SW Troy New York 12181. 1982 Final Rpt 50p. REPORT NO: DOT-RSPA-DMA-50/83/5. AVAILABLE FROM: Rensselaer Polytechnic Institute Department of Civil Engineering Troy New York 12181

This report discusses the development of an Urban Traffic Control System simulation program which: 1. provides pseudo real-time graphic displays of signal settings surveillance data and system performance measures, and 2. simulates user intervention by providing interactive capabilities. The development of the simulator supports current and future research in urban traffic control systems, provides the necessary evaluation tool prior to the implementation of these systems, and is potentially useful as a training aid for UTCS operators.

THE EFFECTS OF PELICAN CROSSING FACILITIES IN A LINKED SIGNAL SYSTEM: A SIMULATION STUDY. Taylor, IG. Newcastle upon Tyne University, England Transport Operations Research Group, Claremont Road Newcastle NE1 7RU Tyne and Wear England. May 1984 42p 15 Fig. 2 Tab. 14 Ref.. REPORT NO: 55

Research conducted into the prediction and means of minimizing the delays incurred by both vehicles and pedestrians at light-controlled pedestrian crossings have led to the setting up of recommendations which increase pedestrian safety but also increase vehicle delay. Within a coordinated area traffic control system the signal settings are almost always calculated to minimize vehicle delay. In broad terms, this reduces costs both to drivers and to the environment. Pedestrian crossings, on the other hand, which increase vehicular delay may be seen to be in direct conflict with this strategy. Simulation models have been used to study the effects of pelican pedestrian crossings operating within coordinated signal systems to consider how the delays to both types of user may be minimized by selection of appropriate crossing locations and signal timings. (TRRL)

THE EFFECTS OF TRAFFIC CONTROL OPERATION SYSTEMS WITH SPECIAL REGARD TO THE NOISE SITUATION IN THE VICINITY OF INTERSECTIONS. Teichgraeber, W; Elsner, A; Gudehus, V. Bundesminister fuer Verkehr, Abteilung Strassenbau Lennestrasse 30 D-5300 Bonn West Germany. 1985 40p German. REPORT NO: 443. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

The effects of different kinds of traffic controls (operating systems) on the noise situation was examined at 3 selected junctions at times of little traffic. These operating systems were: priority for traffic from the right; road signs regulating priority; traffic signals with fixed time control; traffic signals with timing of controls depending either partly or wholly on traffic. Apart from the noise measurements near the junction, the methods of driving were also taken into account, which contributed to a noticeable raising of the noise level. At junctions without visible traffic signals, there were noticeably fewer stops at night, and a much better quality of traffic with regard to waiting times. There was an increase in speed, if the traffic signals were switched off. A model for "stopping" and for "braking and driving on" was developed for the noise emission near the junction.

THE FUEL-EFFICIENT TRAFFIC SIGNAL MANAGEMENT PROGRAM: EVALUATION OF THE FOURTH AND FIFTH FUNDING CYCLES. Skabardonis, A; Singh, R; Deakin, EA. California University, Berkeley Institute of Transportation Studies Berkeley California 94720 0192-4095; California Department of Transportation 1120 N Street Sacramento California 95814. Apr 1988 30p 6 Tab. 9 Ref.. REPORT NO: UCB-ITS-RR-88-8. AVAILABLE FROM: California University, Berkeley Institute of Transportation Studies Berkeley California 94720

The Fuel-Efficient Traffic Signal Management (FETSIM) Program was initiated in 1982 to help local agencies retime their traffic signals to reduce stops, delays, and fuel consumption. This report presents the results of the fourth and fifth grant cycles of the FETSIM Program. During the two grant cycles, local agency staff and their consultants were provided training, technical assistance and funding necessary to optimize the timing of their signal systems and to put the new timing plans into operation. In the 1986 grant cycle, thirty-one local agencies retimed 1169 signals at a total cost of $1.5 million. In the 1987 grant cycle, sixteen cities retimed 797 signals at a cost of $1.2 million. The 1986 program produced 12 percent reduction in delays, an 11 percent reduction in stops, and a 7 percent reduction in fuel use in the affected signal systems. The 1987 program produced average reductions of 13 percent in delays, 12 percent in stops, and 8 percent in fuel use. The dollar value of the benefits from the 1986 and 1987 programs total $47.4 million annually. Together, the two program cycles will produce a benefit-cost ratio of 53:1, assuming the benefits are sustained for three years on average. In addition, the program will produce benefits which have not been quantified, including reduced pollutant emissions, improved traffic safety due to smoother traffic flows, and enhanced staff capabilities in state of the art signal timing methods. Based on surveys done in

1984 and 1985, it appears that as many as 6,500 additional signals could be retimed under the program in the future. Additional program options could be developed to permit retiming of even more signals.

THE NETSIM GRAPHICS SYSTEM. Andrews, B; Lieberman, EB; Santiago, AJ. Transportation Research Board. Transportation Research Record N1112 1987 pp 124-131 14 Fig. 6 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

Described in this paper is the development of an interactive computer graphics (ICG) system, named GTRAF, that provides users with a new and highly efficient methodology for analyzing results generated by the NETSIM microscopic traffic simulation program. This tool may be executed on microcomputers (PCs) with graphics capabilities or on any larger computer that supports Fortran and graphics. Portability of the software is assured through the adherence to ANSI Fortran and the Graphics Kernel System (GKS) standard. Following a discussion outlining the need for and use of ICG systems for the traffic engineering profession, an outline is provided of the concepts and objectives guiding the design of GTRAF, as well as a description of its logical structure. The reader is then walked-through an ICG session with GTRAF. Photographs of the displays are provided to illustrate the process. This paper appeared in Transportation Research Record No. 1112, Highway Capacity and Flow Theory and Characteristics.

THE NEW NETSIM SIMULATION PROGRAM. Rathi, AK; Santiago, AJ. Printerhall Limited. Traffic Engineering and Control VOL. 31 NO. 5 May 1990 pp 317-320 14 Ref.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London W1P 3PE England

The NETSIM simulation program is now a component model of the TRAF simulation system. The current version of the model is therefore referred to as the TRAF-NETSIM program. As part of an effort aimed at developing, maintaining and supporting the TRAF simulation system, TRAF-NETSIM has been extensively modified over the past five years. Four new features have been added to the TRAF-NETSIM simulation program: actuated controller logic, identical traffic streams, conditional turning movements and signal transition. Several major modifications have also been made to the simulation logic to resolve the problems encountered during the testing of the simulation program; to enhance the logic to represent complex decision processes; and to enhance and extend the input-output capabilities, user interaction and the computational efficiency of the program. These new features and the modifications incorporated in the TRAF-NETSIM simulation model are described in this paper.

THE PASSER II-84 SYSTEM: A PRACTICAL SIGNAL TIMING TOOL. Marsden, BG; Chang, CP; Derr, BR. Institute of Transportation Engineers. ITE Journal VOL 57 NO. 3 Mar 1987 pp 31-36 Figs. 1 Tab. 13 Ref.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

The PASSER II-84 system is described which combines the theories of maximum bandwidth and minimum delay while allowing the maximization process to dominate. It allows traffic engineers to quickly and easily develop signal timing patterns that save motorists delay, stops, and fuel. Although the minimization of delay and maximization of bandwidth methods appear to be in direct conflict, PASSER II-84 incorporates a new series of programming applications to create substantial improvements by combining the apparent advantages of these two methods. Several additional features would enhance PASSER II even further. They include the ability to change embedded values such as lost time per phase and the addition of a rigorous left-turn analysis procedure for protected/permitted phasing. The article gives details of PASSER II-84 input data requirements (movement designation, signal phasing), and measures of effectiveness (volume-to-signal capacity ratio, delay, probability of clearing queue, stops, fuel consumption estimation, efficiency and attainability, maximum, and the time-space diagram).

THE PASSER II-87 MICROCOMPUTER PROGRAM. Chang, EC-P. Printerhall Limited. Traffic Engineering and Control VOL. 29 NO. 11 Nov 1988 pp 574-578 Figs. Tabs.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London England

PASSER II-87 microcomputer program version 1.0 has been developed and is available for public distribution. PASSER II can be used to assist transportation professionals to analyze isolated intersection timing evaluations, progression signal timing optimization and 'existing' timing evaluations. The system contains the updated microcomputer version of the PASSER II program, advanced analysis similar to and beyond those used in the 1985 Highway Capacity Manual, and the latest Artificial Intelligence technology and Expert Systems design. PASSER II-67 can analyze 'permitted', 'protected' and complicated permitted/protected or protected/permitted 'combined phase' left-turn signal treatments. The microcomputer system will be distributed with the intelligent, user-friendly, menu-driven, full-function, input/output processor, main executable program, optional user help information, and microcomputer user's guide. The new program provides the enhanced program output and improved signal timing reports, allows the user to modify all the embedded data and accepts all the existing coded PASSER II or PASSER II-84 data without requiring any user revisions. The PASSER II-87 microcomputer system can provide alternative left-turn analysis and advanced capacity evaluation well beyond the Left-Turn Analysis Package (LEFTTURN) and the 1985 Highway Capacity Software (HCS) packages.

THE POTENTIAL FOR ROUTE GUIDANCE IN ON-LINE COMPUTER CONTROLLED UTC (URBAN TRAFFIC CONTROL) NETWORKS. TRAFFIC OPERATION AND MANAGEMENT. PROCEEDINGS OF SEMINAR M HELD AT THE PTRC SUMMER ANNUAL MEETING, UNIVERSITY OF SUSSEX, ENGLAND, 15-18 JULY 1985, VOLUME P269. McDonald, M; Hounsell, NB. PTRC Education and Research Services Limited 110 Strand London WC2 England 0266-4593 086050-154-X. 1985 pp 33-43 3 Fig. 1 Tab. 21 Ref.. AVAILABLE FROM: PTRC Education and Research Services Limited 110 Strand London WC2 England

The TRANSYT method which operates on fixed times plans based on historical data, has been widely used, but more recently the traffic responsive system SCOOT has been demonstrated to offer further delay savings over TRANSYT. This system, in which signal timings are adjusted in frequent small increments to match the latest traffic situation, is already operational in 14 cities in the UK including Southampton. The installation rate is likely to increase in the next few years as on-line computer control of smaller networks becomes increasingly cost-effective. The SCOOT model receives information from traffic detectors on each link "continuously" and determines signal settings that minimize the performance index (pi) in the network. This information can also be used for a variety of traffic management purposes, one potential application being the feedback of information to drivers for route guidance purposes. This could be achieved in a number of ways, ranging from local radio broadcasts based on up-to-the-minute congestion information, through variable message signing for specific routes to fully automatic route guidance incorporating a one or two-way communication link between electronic devices at the roadside and in vehicles. This paper discusses the full range of alternative route guidance systems with particular reference to the SCOOT type of network. The potential benefits are identified in the context of the results of a survey in Southampton which indicated savings of up to 7% from route guidance on a small part of the network. For the covering abstract of the seminar see IRRD 286745. (TRRL)

THE PROBLEM OF PERFORMANCE EVALUATION AT SIGNALIZED INTERSECTIONS WITH VARIOUS TRAFFIC CONTROL STRATEGIES. HIGHWAY CAPACITY AND LEVEL OF SERVICE. PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON HIGHWAY CAPACITY, KARLSRUHE, GERMANY, 24-27 JULY 1991. Hsu, T-P. Balkema (AA) P.O. Box 1675 3000 BR Rotterdam Netherlands 90 5410 011 7. 1991 pp 173-180 9 Fig. 3 Tab. Refs.. AVAILABLE FROM: Balkema (AA) Publishers Old Post Road Brookfield Vermont 05036

Different traffic control strategies affect the performance of a signalized intersection through variable signal timing in response to traffic demand. The capacity of signalized intersections can be determined with the combination of signal timing and saturation flow. The performance on signalized intersections also depends on signal timing, e.g., stopped delay can be estimated with the combination of green time, cycle length and the other parameters. A method or a parameter for performance evaluation on signalized intersections should be able to evaluate the contribution of various traffic control strategies on intersection performance. Therefore, the problem of evaluation by traffic dependent control strategy was addressed in this paper. As example, this paper presents the result by traffic actuated control. Further research is to be expected in the future with respect to the conclusion of this paper.

THE SCOOT ON-LINE TRAFFIC SIGNAL OPTIMIZATION TECHNIQUE. Hunt, PB; Robertson, DI; Bretherton, RD; Royle, MC. Printerhall Limited. Traffic Engineering and Control VOL. 23 NO. 4 Apr 1982 pp 190-192 2 Fig. 2 Tab. 3 Ref.

Many large cities have, or plan to have, urban traffic control (utc) systems that centrally monitor and control the traffic signals in their jurisdiction. The present generation of utc systems usually co-ordinates the signals on fixed-time plans, which consist of sets of timings that determine when each signal turns red and green. The plans are precalculated to suit average conditions during each part off the day (e.g. A.M. peak) and do not respond to variations in flows in the network. Since 1973 the UK Transport and Road Research Laboratory has been researching a vehicle responsive method of signal control called SCOOT (split, cycle and offset optimization technique). Research was carried out in Glasgow by a small team from TRRL and the Ferranti, GEC and Plessey traffic companies, with assistance from Strathclyde Regional Council. In 1976 the success of the research phase led to a development project between the departments of transport and of industry and the three traffic companies. TRRL continued research into SCOOT and in 1979 carried out a full-scale trial of SCOOT in Glasgow. As part of the development project, and with the co-operation of West Midlands County Council, SCOOT was installed in Coventry. A further full-scale trial of the developed system was carried out in 1980. This paper describes the SCOOT system and the results of the trials which compared SCOOT with up-to-date fixed-time systems. It is concluded that SCOOT reduced vehicle delay by an average of about 12 percent during the working day. The surveys demonstrate that scoot rapidly adapts to unusual traffic conditions as well as to the usual variations in demand that occur throughout the day and night. It is an important benefit of SCOOT that there is no need to periodically prepare new fixed-time plans and that the signal timings are automatically kept up-to-date. The traffic model in SCOOT provides real-time information on flows and queues and is likely to be a key element in the development of new traffic management strategies that make the best overall use of roads in urban areas. This paper is a shortened version of TRRL Report LR 1014 (see TRIS 348845). This paper was presented at the IEE's Conference on Road Traffic signalling, London, March 1982. See also TRIS abstracts 368871 and 368872. (TRRL)

THE TEXAS MODEL FOR INTERSECTION TRAFFIC--A USER-FRIENDLY MICROCOMPUTER VERSION WITH ANIMATED GRAPHICS SCREEN DISPLAY. Lee, CE; Machemehl, RB. Transportation Research Board. Transportation Research Record N1142 1987 pp 1-5 2 Fig. 1 Tab. 4 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

Two interactive data-entry programs have been incorporated into the TEXAS Model for Intersection Traffic to produce the user-friendly TEXAS model. With these programs, a user, by working through an alphanumeric terminal connected in an interactive time-sharing mode to a mainframe computer or through the keyboard of a microcomputer, can respond to screen-displayed prompts and instructions and enter all the data needed for a simulation run in about one-tenth the time previously required. The actual simulation can then be executed either on a mainframe computer or on an IBM personal computer. During simulation, the progress of each individually characterized vehicle moving through a simulated intersection is recorded and subsequently displayed in real time or in stop action on a microcomputer-driven graphics screen. This animated graphics display allows the user to study the overall traffic performance at an intersection or to examine the behavior of any selected vehicle or vehicles in great detail. It also offers an effective way of describing alternative intersection traffic flow conditions at public meetings and technical work sessions. Tabular summary statistics may be produced for each simulation run if requested by the user. With the user-friendly version of the TEXAS model, alternative intersection designs and traffic-control schemes can be evaluated quickly and accurately in a timely and cost-effective manner. This paper appeared in Transportation Research Record No. 1142, Urban Signal Systems and Transportation System Management.

THE TWO AND A HALF LANE RURAL ROAD. Hoban, CJ. Australian Road Research Board 500 Burwood Road Vermont South Victoria 3133 Australia 0572-1431. 1982 pp 59-70 4 Fig. 5 Tab. 29 Ref.

Two major methods of improvement for two-lane rural highways are realignment to a higher design speed, and upgrading to a four-lane divided road. An intermediate alternative which is now receiving some attention is the systematic provision of short overtaking lanes along the two-lane road, in effect creating a "two and a half lane road". Recent studies have indicated that overtaking lanes may offer substantial benefits in travel time, level of service and safety at comparatively very low costs. This paper uses traffic simulation to compare different options for rural road improvement and to investigate the effects of each option on traffic speeds, bunching and travel times. Construction costs and expected accident reductions are also considered, in order to derive overall measures of the relative cost-effectiveness of each option. The results suggest that the "two and a half lane road" may be a practical and effective alternative to both realignment and duplication of two-lane roads, offering many of the benefits of these improvements at much lower costs. The selective stage construction of long duplication projects is also shown to have many of the advantages of overtaking lanes (a). The number of the covering abstract of the conference is TRIS No. 368448. (TRRL) Proceedings of the Eleventh Australian Road Research Board Conference, held at the University of Melbourne, August 23-27, 1982.

THE USE OF BINARY CHOICE DECISION PROCESS FOR ADAPTIVE SIGNAL CONTROL. Lin, F-B. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 115 NO. 3 May 1989 pp 270-282 Figs. Tabs. Refs. 2 App.. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017

This paper identifies and discusses several issues concerning the use of binary-choice decision process for signal-timing adjustment. The problem of making binary choice decisions for timing adjustment is described, and several issues related to the acquisition and synthesis of traffic information for decision making are then identified and analyzed through computer simulation. It is noted that adaptive control based on the binary decision process can use a very limited amount of advance information to produce efficient signal operations. In applying this decision process, the use of incorrect average travel timing in modeling vehicle arrival patterns has only a slight impact on control efficiency, if the discrepancies between the assumed and the actual average travel times are less than 4 sec. To facilitate a binary choice, it is not necessary to evaluate a large number of alternative green extensions.

THE USE OF MICRO SIMULATION FOR THE DESIGN OF WEAVING SECTIONS. HIGHWAY CAPACITY AND LEVEL OF SERVICE. PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON HIGHWAY CAPACITY, KARLSRUHE, GERMANY, 24-27 JULY 1991. Vermijs, RGMM. Balkema (AA) P.O. Box 1675 3000 BR Rotterdam Netherlands 90 5410 011 7. 1991 pp 419-427 6 Fig. 4 Tab. Refs.. AVAILABLE FROM: Balkema (AA) Publishers Old Post Road Brookfield Vermont 05036

In the Netherlands the American Highway Capacity Manual (HCM) is commonly used for traffic engineering purposes. Because of the differences in traffic legislation and driver behavior between the Netherlands and the USA, the HCM cannot be used for the design of weaving sections on Dutch freeways. To create a new set of standards for weaving sections, the micro simulation model FOSIM is used. FOSIM is developed in the USA for simulation of traffic flow on multi-lane freeways and is fully revised for use in the Netherlands. The paper presents the results of calibration and validation of FOSIM for weaving sections on Dutch freeways. Moreover, it describes a method of using FOSIM as a tool to create up to date standards for all sorts of freeway sections.

THE USE OF SIMULATION AS AN AID TO TRAFFIC ACCIDENT RESEARCH. Corner, JPA (Queensland Institute of Technology). Australian Road Research Board 500 Burwood Road Vermont South Victoria 3133 Australia 0 86910 127 7. 1983 pp 171-178

Simulation work currently being developed using modified versions of TRARR and elements of the CRASH 3 program is reviewed. The model being developed is for run off the road accidents on lightly trafficked rural roads. Various modifications to TRARR completed and proposed are also outlined. (TRRL) Program and papers from Workshop on Rural Traffic Simulation, Vermont South, Victoria, June 2-3, 1983. This paper was presented in Session 5: Further Applications.

THE USE OF SIMULATION IN THE ROAD DESIGN PROCESS. Golding, S (Queensland Main Roads Department, Australia). Australian Road Research Board 500 Burwood Road Vermont South Victoria 3133 Australia 0 86910 127 7. 1983 pp 105-118 5 Fig. 7 Ref.

The use of computer simulation in the road design process is explored and recommendations about the use of these techniques are given. The areas of roadway geometry and traffic operations are considered, with the greater emphasis on traffic operations. Possible uses of simulation in the area of traffic operations in road design are discussed in relation to some typical examples. (TRRL) Program and papers from Workshop on Rural Traffic Simulation, Vermont South, Victoria, June 2-3, 1983. This paper was presented in Session 4: Practical Application of Rural Traffic Simulation.

THE USE OF THE QDELAY SURVEY METHOD IN THE ESTIMATION OF FUEL CONSUMPTION AT SIGNALIZED INTERSECTIONS. Richardson, AJ (Monash University, Australia). Society of Automotive Engineers (Australasia) 191 Royal Parade Parkville Victoria 3052 Australia. May 1982 pp 1-11 1 Fig. 20 Ref.. REPORT NO: Paper 24

This paper describes the use of a field traffic survey method, Gdelay, in the estimation of excess fuel consumption at signalized intersections. The survey method inputs and outputs are described, together with the field procedure for conduct of the survey. Special features of the survey method are then discussed with reference to the estimation of traffic system fuel consumption. In describing the technique currently used within Gdelay for fuel consumption estimation, it is evident that several deficiencies exist. The paper therefore describes ways in which these deficiencies might be overcome, based on recent work using incremental power relationships. Finally, some comments on application of the Gdelay survey method are presented (A). The paper was presented as Paper 24-Session 7-Traffic Modelling (SAE 82154). The number of the covering abstract of the conference is TRIS no. 367893. (TRRL) Second Conference on Traffic Energy and Emissions, Melbourne, May 1982. Program and Papers.

THE USE OF TRANSYT AT SIGNALIZED ROUNDABOUTS. Lines, CJ; Crabtree, MR. Printerhall Limited. Traffic Engineering and Control VOL. 29 NO. 6 Jun 1988 pp 332-337 Figs. 9 Ref.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London England

> Increasing traffic flows at major roundabouts (traffic circles) has necessitated the signalling of some or all entry arms. Studies have shown this can successfully increase capacity and reduce delays at the intersection, and allow the traffic engineer to control where and when queues form. This article describes a Transport and Road Research Laboratory study of the use of the TRANSYT computer program at an experimental site in High Wycombe, England. The details are described of the modelling including links, shared links, flared links, saturation flows, cycle time, limit queues, blocking-back, safety, and coordination. The study found that TRANSYT, when used appropriately, is suitable for modelling traffic behavior on large fully-signalized roundabouts, and is capable of producing signal timings which provide good coordination and prevent locking-up.

THE VALUE OF FIXED-TIME SIGNAL CO-ORDINATION IN DEVELOPING COUNTRIES. II. IMPROVED BUS MODELING AND RESULTS. Willumsen, LG; Coeymans, JE. Printerhall Limited. Traffic Engineering and Control VOL. 30 NO. 3 Mar 1989 pp 126-134 Figs. Tabs. Refs.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London England

> This paper addresses the issue of explicitly adapting the model in TRANSYT to the traffic conditions in a network in Santiago, Chile. It is believed that the main source of differences between European traffic conditions and those in Chile is the presence of a large number of unregulated buses. The research reported here confirmed this assumption and developed an improved approach. This resulted in an enhanced link structure, a redefinition of some basic measures like saturation flow and cruise times, and a recalibration of the platoon dispersion parameters in TRANSYT. This additional effort produced considerable improvements in performance, more than doubling the benefits of plans prepared with more conventional TRANSYT values. A complete statistical analysis of these results completes this paper.

THE VTI TRAFFIC SIMULATION MODEL. A DESCRIPTION OF THE MODEL AND PROGRAM SYSTEM. Brodin, A; Carlsson, A; Bolling, A. National Swedish Road & Traffic Research Institute. VTI Meddelanden N321 1982 Monograph 193p Figs. Tabs. 11 Ref. Swedish

> The National Swedish Road and Traffic Research Institute has developed a traffic model which uses simulation techniques to describe the traffic sequence on a two lane rural road. A comprehensive program system has been built up in conjunction with the simulation model in order to achieve complete computerized handling of the model. The aim of this report is to provide a general description of the traffic simulation model and its associated program system. (TRRL)

THE VTI TRAFFIC SIMULATION MODEL: DESCRIPTION AND SOME APPLICATIONS. CARLSSON, A. NEW ZEALAND ROADING SYMPOSIUM NEW ZEALAND ROADING VOL. 3 1987 PP 451-463 ENGLISH

> BY A. CARLSSON ILL., MAPS, CHART INCLUDES BIBLIOGRAPHICAL REFERENCES NEW ZEALAND ROADING SYMPOSIUM NEW ZEALAND ROADING SYMPOSIUM

THREE-DIMENSIONAL RELATIONSHIPS AMONG TRAFFIC FLOW THEORY VARIABLES. Gilchrist, RS; Hall, FL. Transportation Research Board. Transportation Research Record N1225 1989 pp 99-108 9 Fig. 13 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

> This paper is an investigation of the relationships among speed, flow, and occupancy, representing the three variables of traditional theory for uninterrupted traffic flow. The variables were examined in three-dimensional space, rather than two at a time as has previously been the case. Scatter plots showing connected data points were positioned in space using a three-dimensional rectangular coordinate system. Oblique views of the data were projected as two-dimensional plots for presentation purposes. The resulting pictures were evaluated for points of agreement with traditional traffic flow theory and with a possible new approach based on the Cusp catastrophe theory. The results suggest that conventional theory is insufficient to explain the data and that the plotted data are visually consistent with the catastrophe theory model of uninterrupted traffic flow. This paper appears in Transportation Research Record No. 1225, Highway Capacity, Flow Measurement, and Theory.

TIMING DESIGN OF TRAFFIC SIGNALS. Sakita, M. Transportation Research Board. Transportation Research Record N1069 1986 pp 83-87 4 Fig. 1 Tab. 5 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

A method of optimizing signal timing by the use of a linear programming technique is described. The linear program is based on the premise that the green time given to each traffic movement in the signal cycle must be long enough to handle the traffic coming into the intersection in one cycle. The linear programming method gives minimum signal phase times, minimum cycle time, and critical movements. The optimum signal phase times and cycle time can also be obtained in a nondirect manner. The linear programming method may be used as an off-line tool to analyze signal timing or it may be adopted as the basis for developing a new local controller for critical intersections of centrally controlled systems. When used as an off-line tool, the linear programming method is very effective for "what if" analysis of traffic signal timing problems. This paper appeared in Transportation Research Record N1069, Traffic Control Devices and Rail-Highway Crossings.

TIMING OF INTERGREEN PERIODS AT SIGNALIZED INTERSECTIONS: THE GERMAN METHOD. Retzko, HG; Boltze, M. Institute of Transportation Engineers. ITE Journal VOL. 57 NO. 9 Sep 1987 pp 23-26 Figs. Refs.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

This article introduces an algorithm that is part of the official signal timing standards (RiLSA) in the Federal Republic of Germany and is in wide use there. The article also reports a new approach of timing intergreen periods. The new approach to intergreen timing depends on a probabilistic treatment. All cases of conflicts are classified to typical cases. For every type of conflict a specific intergreen time is determined wherein the traffic streams that form a conflict can be alternatively treated as "clearing" or "entering". The intergreen time values have to be increased if there are triangular islands and/or divisional islands. Only car traffic is considered, in so far as the new approach has disadvantages. The new approach of intergreen timing can be applied to intersections with "normal" character. If cyclists are considered together with car traffic at large intersections, a value must be added.

TIMING PLAN SENSITIVITY TO CHANGES IN PLATOON DISPERSION SETTINGS. Guebert, AA; Sparks, G. ENGINEERING FOUNDATION. TRAFFIC CONTROL METHODS. PROCEEDINGS OF THE FIFTH 1990 131-45

The TRANSYT simulation, and optimization program incorporates platoon dispersion by applying a form of geometric smoothing to the incoming traffic on each link, in order to predict the arrival pattern of vehicles at the next intersection. The calculation of stops and delay by the TRANSYT program, and the effectiveness of the signal timings resulting from the optimization procedure, depend on the platoon dispersion model to predict traffic flow patterns from one signal to another. In much of the research to date, it has been suggested that timing plans are sensitive to platoon dispersion, and that platoon dispersion is a function of roadway, and traffic conditions. This suggests that the platoon dispersion algorithm used in the TRANSYT model should be calibrated for specific conditions. On the other hand, if the optimal timing plans generated by the TRANSYT program are not particularly sensitive to platoon dispersion, then calibration of the algorithm to local site conditions may not be required. The importance of accurate modelling of platoon dispersion in developing signal timing plans depends upon this sensitivity. The purpose of this paper is to determine the sensitivity of optimized signal timing plans to changes in the variables within the TRANSYT model that describes platoon dispersion, and to quantitatively show what effect inappropriate dispersion values have on the resulting timing plans. The results of this sensitivity analysis show that accurate modelling of platoon dispersion in developing traffic signal timing plans is indeed important to the effective and efficient implementation of those plans. In a field where improvements of two or three percent have a major impact on fuel consumption, the amount and type of emissions, as well as traffic accidents, the differences shown in the above analysis indicate that the platoon dispersion algorithm should be calibrated for local site conditions.(A) For the covering abstract of the conference see IRRD 832076.

TOWARD INTELLIGENT TRAFFIC SIGNAL DESIGN SYSTEM. Pattnaik, SB; Rajeev, S; Mukundan, A. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 117 NO. 5 Sep 1991 pp 524-539 Figs. Refs. 1 App.. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017-2398

The development of an expert system to act as the postprocessor of the simulation model is discussed. This paper presents a framework for an intelligent traffic signal design system that employs both expert systems and conventional algorithmic programs. For the first stages in the development of the traffic signal design system, an expert system called PHASES is developed. Its development, implementation and validation are described. The major accomplishments of this work is in selecting a strategy for generating phase plans that can be expressed as a set of rules, and highlighting the advantages of a frame-based representation of the intersection details.

TOWARDS A REVIEW OF THE CONCEPT OF LEVEL OF SERVICE FOR TWO- LANE RURAL ROADS. Hoban, CJ. Australian Road Research Board. Australian Road Research VOL. 13 NO. 3 Sep 1983 pp 216-218 2 Fig. 2 Tab. 9 Ref.

The concept of level of service has been widely used in assessing traffic performance for various road and traffic conditions. For rural roads, however, the existing definitions have a number of deficiencies. This note considers some of these deficiencies and suggests a new set of criteria based on traffic bunching (or platooning). Bunching appears to closely reflect the quality of rural traffic operations as perceived by the driver, and it has the advantage of being easy to measure in the field. The rural traffic simulation model trarr was used to derive bunching criteria which correspond to the existing level of service definitions. Suggested maximum bunching criteria for levels of service A, B, C and D respectively are 30, 60, 75 and 80 per cent of journey time spent following in bunches. The new criteria were applied to 24 simulated road conditions to derive approximate service volumes for each case. It was found that these were easily defined in terms of bunching and automatically took account of changes in driver expectations on different road types. (Author/TRRL)

TRAF II NETSIM USER GUIDE. FINAL REPORT. Hagerty, BR. Michigan Department of Transportation State Highways Building, 425 West Ottawa, P.O. Box 30050 Lansing Michigan 48909; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Mar 1987 v.p. 1 App.. REPORT NO: FHWA-MI-RD-87-01. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

This guide is for users of the TRAF II Netsim Surface Street Traffic Simulation model. TRAF II Netsim is a stand-alone version of Netsim, version 99 developed as a submodel of the TRAF II family of models. This documentation is intended for use by Michigan Department of Transportation personnel as an addendum to the TRAF II User Guide (FHWA-RD-85). Interactive data input procedures are covered in the TRAFLO-M Forms Display User Manual (FHWA-MI-RD-85-01).

TRAF SYSTEM - TECHNICAL SUMMARY. Final rept. Lieberman-E.; Yedlin-M.; Andrews-B.; Sheridan-K. KLD Associates, Inc., Huntington, NY. Federal Highway Administration, Washington, DC. KLDTR135, FHWARD83084. Apr 85. 34p.

This report presents an overview of the TRAF traffic simulation system. Its purpose is to provide the minimum amount of information needed for making intelligent decisions concerning the use of this system. The models currently included in the system are: Netsim, which simulates urban traffic in a detailed or microscopic fashion; Netflo, which performs a similar simulation at lower levels of detail; Freflo, for a coarse or macroscopic representation of freeway traffic; and Roadsim, a detailed two-lane, rural road traffic simulator. Each component model is briefly described. The descriptions cover the input requirements and the output capabilities which include measures of effectiveness of traffic performance, fuel consumption, and air polluting emissions.

TRAFFIC MANAGEMENT. RTS ENGLISH ISSUE NUMBER 6. A COMPARISON OF TWO MOTORWAY TRAFFIC SIMULATION MODELS. Cohen, S; Aron, M; Pierrelee, J-C. Institut National Recherche sur Transp et Securite. Recherche Transports Securite N6 Feb 1991 pp 113-118 Figs. Tabs.. AVAILABLE FROM: Institut National Recherche sur Transp et Securite 2, Avenue du General Malleret-Joinville, BP 34 94114 Arcueil Cedex France

The need for simulation tools able to test, evaluate and compare various road traffic management systems has arisen for reasons of safety and because of the difficulties and costs associated with field test experiments. This paper describes and compares two macroscopic traffic simulation models: SIMAUT and META. It presents the steps involved in the calibration and validation of each model through a concrete example: the A13 motorway at the west of Paris. The comparison is based upon the theme of traffic reconstitution. The conclusion presents the results of tests carried out on the chosen site, and underlines current developments aimed at improving and extending the field of application of the models tested.

TRAFFIC MODELING TO EVALUATE POTENTIAL BENEFITS OF ADVANCED TRAFFIC MANAGEMENT AND IN-VEHICLE INFORMATION SYSTEMS IN A FREEWAY ARTERIAL CORRIDOR. GARDES, Y; MAY, AD. INSTITUTE OF TRANSPORTATION STUDIES UNIVERSITY OF BERKELEY CALIF. Jun 1990 15 PP ENGLISH

YONNEL GARDES, ADOLF D. MAY OTHER PHYS. DESCRIPTION: IX ILLUSTRATED PROGRAM ON ADVANCED TECHNOLOGY FOR THE HIGHWAY JUNE 1990 INCLUDES BIBLIOGRAPHICAL REFERENCES

UCB-ITS-PRR-90-3 ADDL CORP. AUTHOR INFO: UNIVERSITY OF CALIFORNIA, BERKELEY. INSTITUTE OF TRANSPORTATION STUDIES ADDL CORP. AUTHOR INFO: PROGRAM ON ADVANCED TECHNOLOGY FOR THE HIGHWAY CALIF INSTITUTE OF TRANSPORTATION STUDIES UNIVERSITY OF CALIFORNIA AT BERKELEY

TRAFFIC MODELLING AND SIMULATION. Heydecker, BG. ENGINEERING FOUNDATION. TRAFFIC CONTROL METHODS. PROCEEDINGS OF THE FIFTH 1990 345-51

The participants in this workshop included practitioners and researchers from local and national government agencies, consultants, manufacturers and universities in the USA, Canada, West Germany and United Kingdom. Wide ranging discussions on a variety of topics were held. These included the potential offered by new hardware and software technology, and the uses that might be made of this potential; advanced traffic modelling requirements; communication between practitioners and researchers; and research needs. For the covering abstract of the conference see IRRD 832076.

TRAFFIC MODELLING IN KUWAIT.: 1., DEVELOPMENT OF A SATURN NETWORK DATABASE. MCSHEEN, JR; HALE, RC. TRAFFIC ENGINEERING & CONTROL VOL. 30 NO. 10 1989 PP 466-473 ENGLISH

BY J.R. MCSHEEN AND R.C. HALE ILLUSTRATED BIBLIOGRAPHY: P. 473 BY J.R. MCSHEEN AND R.C. HALE ILLUSTRATED BIBLIOGRAPHY: P. 473

TRAFFIC MODELLING IN KUWAIT.: 2, DEVELOPMENT OF A MULTI-MODAL TRAFFIC MODEL FOR THE KUWAIT METROPOLITAN AREA. HALE, RC; MCSHEEN, JR. TRAFFIC ENGINEERING & CONTROL VOL. 30 NO. 10 Nov 1989 PP 534-544 ENGLISH

BY R.C. HALE AND J.R. MCSHEEN ILLUSTRATED BIBLIOGRAPHY: P. 544 BY R.C. HALE AND J.R. MCSHEEN ILLUSTRATED BIBLIOGRAPHY: P. 544

TRAFFIC MODELLING TECHNIQUES FOR THE DEVELOPING WORLD. TIMBERLAKE, RS. NATIONAL RESEARCH COUNCIL TRANSPORTATION RESEARCH WASHINGTON DC. 1988 ENGLISH

R.S. TIMBERLAKE OTHER PHYS. DESCRIPTION: 33 LEAVES ILLUSTRATED COVER TITLE PAPER PRESENTED AT THE 1988 ANNUAL MEETING OF THE TRANSPORTATION RESEARCH BOARD, WASHINGTON, D.C INCLUDES BIBLIOGRAPHICAL REFERENCES PAPER NO. 870514 ADDL CORP. AUTHOR INFO: NATIONAL RESEARCH COUNCIL U.S.. TRANSPORTATION RESEARCH BOARD NATIONAL RESEARCH COUNCIL TRANSPORTATION RESEARCH BOARD

TRAFFIC MODELLING: 1969-1989. Gipps, PG. Australian Road Research Board. Australian Road Research VOL. 20 NO. 1 Mar 1990 pp 22-29. AVAILABLE FROM: Australian Road Research Board Executive Director, P.O. Box 156 Nunawading Victoria 3131 Australia

This paper reviews some of the developments in traffic flow theory in Australia or relevant to Australia over a twenty year span. The discussion is not exhaustive in the range of topics examined nor in the work done in those topics, rather it tries to provide a general picture of the field and how it was changing. Traffic modelling is one means of obtaining a better understanding of how the road and traffic system operates in order to improve it. Traffic is an example of a large scale system with many sub-systems involving complex interactions, but which is itself a sub-system within higher level systems such as the transport system in general. The interactions between vehicles, the traffic stream, components of other transport sub-systems, and abutting land use mean that the overall performance of the system is not a simple function of the performance of individual components. The perfect tool for modelling the traffic system would be a unified general theory covering all aspects of the movement of people and vehicles in a coherent fashion. Such a theory is recognized as an unobtainable idealization among even the most optimistic traffic modellers, and models must be designed to operate within practical limits on data, and analytical or computational resources (A).

TRAFFIC MODELLING: A REVIEW OF NEEDS AND CAPABILITIES. TAYLOR, MAP; OGDEN, KW; SZWED, N. AUSTRALIAN ROAD RESEARCH BOARD PROCEEDINGS 1986 PP 84-95 ENGLISH

M.A.P. TAYLOR, K.W. OGDEN, N. SZWED BIBLIOGRAPHY: P. 93-95 M.A.P. TAYLOR, K.W. OGDEN, N. SZWED BIBLIOGRAPHY: P. 93-95

TRAFFIC MODELS AND ROAD TRANSPORT INFORMATICS (RTI) SYSTEMS. STERGIOU, B; STATHOPOULOS, A. TRAFFIC ENGINEERING & CONTROL VOL 30 NO. 12 1989 PP 580-586 ENGLISH

BY BASIL STERGIOU AND ANTONY STATHOPOULOS ILLUSTRATED INCLUDES BIBLIOGRAPHICAL REFERENCES

TRAFFIC OPERATION ON BUSY TWO-LANE RURAL ROADS IN THE NETHERLANDS. Botma, H. Transportation Research Board. Transportation Research Record N1091 1986 p 127-131 2 Fig. 3 Tab. 7 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

In the framework of updating standards for describing the quality of traffic flow on two-lane rural roads, research into the behavior of the traffic flow on relatively high-volume roads was carried out. Presented in this paper are findings about the relation between the volume and traffic composition as explanatory factors for speeds, headways, and platooning. It was found that mean speed was only marginally influenced by volume and truck percentage, whereas the standard deviation of speeds decreased substantially with increasing volume. An exponential tail model for headways, large enough to be relevant for passing opportunities, was used and its parameters were successfully related to volume. This model fits reality much better than the assumption that headways have a negative exponential distribution, which leads to severe underestimation of passing opportunities. Simple models were developed that relate the proportion of vehicles following in a platoon and the maximum platoon length in 5 min to volume and truck percentage. A comparison is made with results in the proposed Chapter 8 on Two-Lane Highways of the 1985 Highway Capacity Manual. This paper appeared in Transportation Research Record N1091, Traffic Flow Theory, Characteristics, and Highway Capacity.

TRAFFIC OPERATIONS OF BASIC ACTUATED TRAFFIC CONTROL SYSTEMS AT DIAMOND INTERCHANGES. Messer, CJ; Chang-M-S. Texas Transportation Institute Texas A&M University College Station Texas 77843; Texas State Department of Highways & Public Transp Transportation Planning Division, P.O. Box 5051 Austin Texas 78763; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Aug 1985 Final Rpt. 76p 30 Fig. 8 Tab. 8 Ref.. REPORT NO: FHWATX-85/75+344-2F; Res Rpt. 344-2F. AVAILABLE FROM: Texas Transportation Institute Texas A&M University College Station Texas 77843

This report contains the results of field studies conducted to evaluate four types of basic, full traffic actuated signal control systems. Two signal phasing strategies were tested. These were three-phase and four-phase with two overlaps. Two small loop (point) detection patterns, single- and multi- point detection, were evaluated for each type of phasing. An assessment of these systems was conducted based on the results of statistical and observational evidence regarding their operational effects on queues and cycle models that relate queuing delay to traffic characteristics. This report summarizes and research conducted within a HP&R study entitled "Guidelines for Diamond Interchange Control" sponsored by the Texas Department of Highways and Public Transportation in cooperation with the U.S. Department of Transportation, Federal Highway Administration.

TRAFFIC PATTERNS IN UNSTABLE TRAFFIC FLOW ON FREEWAYS. HIGHWAY CAPACITY AND LEVEL OF SERVICE. PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON HIGHWAY CAPACITY, KARLSRUHE, GERMANY, 24-27 JULY 1991. Kuhne, R. Balkema (AA) P.O. Box 1675 3000 BR Rotterdam Netherlands 90 5410 011 7. 1991 pp 211-223 14 Fig. Refs.. AVAILABLE FROM: Balkema (AA) Publishers Old Post Road Brookfield Vermont 05036

To explain the different traffic patterns for very dense traffic on freeways like spreading shock fronts, irregular stop-start waves, instability and hysteresis phenomena, a dynamic traffic model is presented. This model shows, depending on essentially two control parameters, the quoted variety of different traffic patterns. The patterns are derived as stationary profiles for regular stop-start waves and stable running shock waves and as transients approaching the stationary profiles as bifurcation with supercritical or subcritical dependence on the two control parameters, namely bottleneck capacity and mean density. Finally irregular motion examples are given. These irregularities are explained by means of chaos theory similar to the turbulence description of fluid motion. Freeway traffic control for dense traffic needs besides a traffic flow model advanced technologies for detection of section related traffic variables. As nonlocal measurement technique which uses a correlation method between neighbored measurement sites a mm-wave radar set up is described.

TRAFFIC PLATOON DISPERSION MODELING. Denney, RW, Jr. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 115 NO. 2 Mar 1989 pp 193-207 Figs. Refs. 1 App.. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017

A review is made of research in platoon dispersion modeling. The models are analyzed to suggest a new mechanism for predicting platoon dispersion. This mechanism consists of an analytical and an empirical component. the acquisition of field data to provide empirical support to test various aspects of this mechanism is described. The use of simulation to provide empirical support is investigated. The effectiveness of the mechanism in predicting field measured platoon flow profiles is analyzed. It is noted that platoon dispersion models can be presented in a form which suggests a simple-to-understand and simple-to-implement mechanism. Areas for future study are indicated.

TRAFFIC-RESPONSIVE SIGNAL CONTROL AT ISOLATED JUNCTIONS. Bell, MGH; Cowell, MPH; Heydecker, BG. ENGINEERING FOUNDATION. TRAFFIC CONTROL METHODS. PROCEEDINGS OF THE FIFTH 1990 273-94

Most isolated signal controlled road junctions in Britain now operate under vehicle-actuated control. With the advent of microprocessor controllers, interest is turning to increasingly sophisticated forms of vehicle-actuated control. In this paper, a novel approach to the optimization of traffic signal control in real time is described, in which the current state of traffic at the junction, including queue lengths, is estimated using a model of traffic behavior. Conventional inductive loop detector information is used in an optimal filtering framework to update and correct the estimates of system state yielded by the traffic model, as well as the model parameters themselves. The traffic model is then used by the optimizer within a dynamic programming framework to evaluate the likely consequences of alternative courses of action. In this framework, the observations are used to counteract the tendency for the predictions of the traffic model to drift away from the true state of the system. This is possible although the observations themselves may relate only indirectly to the state of the system, provided that the condition of observability is fulfilled. Development of the filtering and optimization modules is taking place on a Sun workstation. These modules are interfaced with a simulation of traffic at the junction which is sufficiently detailed to provide realistic detector output and measures of performance. To achieve this, a vehicle-following sub-model has been adopted which is solved in discrete time. An event-based framework is used to simulate the control and operation of the junction. The computational demands of such a detailed simulation prohibit its use for optimization: here its purpose is to facilitate development of the filtering and optimization techniques before recourse to real traffic is possible. Once development is sufficiently far advanced, the simulation will be removed and an equivalent interface will be made to a real junction for field tests.(A) For the covering abstract of the conference see IRRD 832076.

TRAFFIC SIGNAL TIMING AS A TRANSPORTATION SYSTEM MANAGEMENT MEASURE: THE CALIFORNIA EXPERIENCE. Deakin, EA; Skabardonis, A; May, AD. Transportation Research Board. Transportation Research Record N1081 1986 pp 59-65 1 Fig. 4 Tab. 12 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

Traffic signal retiming has long been suggested as a means of improving traffic operations and reducing fuel consumption and emissions. However, few local agencies have been able to muster the resources to systematically retime their signals. In California, a statewide program--the Fuel Efficient Traffic Signal Management (FETSIM) Program--was established to address this need. The FETSIM Program provides funds, training, and technical assistance to local agencies to retime their signal systems for greater operating efficiency. To date, 62 local jurisdictions have participated in the program, receiving grants totaling $4 million (1983-1985). In 1986 and 1987 an additional $2 million will be available for grants. The objectives, design, and results of the FETSIM Program's first three funding cycles are described. The program was intended both to produce immediate transportation benefits and to develop within local agencies the skills needed to use state-of-the-art methods for longer-term signal systems management. The transportation benefits have been substantial, with average first-year reductions of 16 percent in stops, 15 percent in delays, 7.2 percent in travel times, and 8.6 percent in fuel use in the retimed systems. Training benefits to local agency personnel also have been positive. However, the program has not had a major influence on local priorities; basic problems in funding and staffing for local transportation activities, including signal work, remain. These problems appear likely to work against long-term maintenance of efficient signal-timing plans unless state funding continues to be made available. This paper appeared in Transportation Research Record N1081, Urban Traffic Management.

TRAFFIC SIGNAL TIMING MODELS FOR OVERSATURATED SIGNALIZED INTERCHANGES. (Interim Report March 1989-January 1992). Kim-Y.; Messer-C.J. Texas Transportation Inst., College Station. Federal Highway Administration, Austin, TX. Texas Div. Texas Dept. of Transportation, Austin. Transportation Planning Div. TTI218881148, RR11482, FHWATX9211482. Jan 92. 123p.

The research report documents the development models for control of signalized diamond interchanges during oversaturated traffic conditions. Oversaturated traffic conditions occur when the average traffic demand exceeds the capacity of the signal system. The dynamic optimization model proposed is the principal product of the research. The control objective of the dynamic model is to provide maximum system productivity as well as minimum delay for a selected roadway system. A special feature predetermined upper limits. The dynamic model was developed for conventional diamond interchanges and three-level diamond interchanges. The model takes the form of mixed integer linear programming. The effectiveness of the control strategies generated by the dynamic model was compared to those derived from conventional signal timing models, using the TRAF-NETSIM microscopic simulation model. It was found that the dynamic models produced optimal signal timing plans for the oversaturated signalized interchanges. The dynamic model consistently outperformed conventional models with respect to system productivity. The conclusion was drawn from the TRAF-NETSIM simulation. The dynamic model solutions significantly reduced total system delay for most test cases, while slightly increasing the delay for a few test cases.

TRAFFIC SIGNAL TIMING OPTIMIZATION IN LARGE NETWORKS. VLAHOS, NJ; JOVANIS, PP. Aug 1987 ENGLISH

NICHOLAS J. VLAHOS, PAUL P. JOVANIS OTHER PHYS. DESCRIPTION: 34 LEAVES COVER TITLE SUBMITTED FOR PRESENTATION AT THE JANUARY, 1988 ANNUAL MEETING OF THE TRANSPORTATION RESEARCH BOARD AUGUST, 1987 INCLUDES BIBLIOGRAPHICAL REFERENCES ADDL CORP. AUTHOR INFO: NORTHWESTERN UNIVERSITY EVANSTON, ILL.. TRANSPORTATION CENTER

TRAFFIC SIGNAL TIMING OPTIMIZATION STUDY FOR THE CITY OF EL CAJON. PRC VOORHEES SAN DIEGO CALIF. Feb 1984 ENGLISH

BY PRC VORHEES OTHER PHYS. DESCRIPTION: 1 VOL CHARTS, MAPS FINANCED BY THE CALIFORNIA ENERGY COMMISSION FEBRUARY 1984 ADDL CORP. AUTHOR INFO: PRC VOORHEES FIRM ADDL CORP. AUTHOR INFO: CALIFORNIA ENERGY COMMISSION

TRAFFIC SIGNAL TIMING OPTIMIZATION STUDY FOR THE CITY OF SAN DIEGO. PRC VOORHEES SAN DIEGO CALIF. Feb 1984 ENGLISH

BY PRC VORHEES OTHER PHYS. DESCRIPTION: 1 VOL FINANCED BY THE CALIFORNIA ENERGY COMMISSION FEBRUARY 1984 ADDL CORP. AUTHOR INFO: PRC VOORHEES FIRM ADDL CORP. AUTHOR INFO: CALIFORNIA ENERGY COMMISSION

TRAFFIC SIGNAL TIMING PROGRAM PASSER II - 84. Chang, E C-P; Messer, CJ. Texas Transportation Institute. Texas Transportation Researcher VOL. 20 NO. 2 Apr 1984 pp 7-9. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

Traffic signal optimization is a very complicated process that determines the proper settings of cycle length, green time interval, phase sequence, and off-sets between the signals. The optimization resulting from this calculation depends heavily on the relative relationships among the distances between signalized intersections, speed of traffic, cycle length, roadway capacity, and side friction along the arterial. To better improve the popularly used PASSER II computer program, the State Department of Highways and Public Transportation and the Federal Highway Administration sponsored a research project entitled 'Reduced-Delay Optimization and Other Enhancements to PASSER II-80'. The purpose of the study was to find an efficient and usable delay-based search algorithm for practicing traffic engineers in selecting a minimum-delay, arterial signal timing plan that optimize the phasing sequence, cycle length, and offsets based on maximum bandwidth solution as the starting point.

TRAFFIC SIMULATION STUDIES: A REVIEW. KATTI, BK; CHARI, SR. INDIAN HIGHWAYS VOL 13 NO. 4 Apr 1985 PP 5-13 ENGLISH

BY B.K. KATTI AND S. RAGHAVA CHARI INCLUDES BIBLIOGRAPHICAL REFERENCES BY B.K. KATTI AND S. RAGHAVA CHARI INCLUDES BIBLIOGRAPHICAL REFERENCES

TRAFFIC SIMULATION STUDY FOR TWO-LANE RURAL HIGHWAY OVERTAKING IMPROVEMENTS. OKURA, I; MATSUMOTO, K. AUSTRALIAN ROAD RESEARCH BOARD PROCEEDINGS 1990 PP 43-56 ENGLISH

IZUMI OKURA AND KENJIRO MATSUMOTO ILLUSTRATED INCLUDES BIBLIOGRAPHICAL REFERENCES

TRAFFIC SIMULATION: COURSE NOTES. Young, W; Allsop, R; Cornwell, RR; Gipps, PG; Hoban, CJ; Vandebona, U; Johnston, DK; Luk, JYK; Taylor, MAP; Richardson, AJ (University College, London; Road Traffic Authority). Monash University, Australia Department of Civil Engineering, Wellington Road Clayton Victoria 3168 Australia 0-86746-337-6. 1984 Monograph n.p. Figs. Tabs. Phots. Refs.

The publication was prepared for a series of courses in traffic science run at Monash University in September 1984. Most of the publication consists of course notes compiled by Young, W. However it also includes a forward: Introduction to Simulation of Road Traffic (Allsop, E) and the following papers on simulation applications: Simset 2--Simulation of Isolated Traffic Signals (Cornwell, PR); Multism: A Simulation Model for Multi-lane Traffic Flows (Gipps, PG); The Use of Computer Graphics in Developing a Simulation Model (Gipps, PG); The "TARR" Rural Traffic Simulation Model (Hoban, CJ); The Trams Package (Vandebona, U); Introduction to Traffic: A Simulation Model for Vehicle and Pedestrian Flows in Complex Road Networks (Johnston, DK); Some Experience with Three Urban Network Models: Saturn, Transyt/8 and NETSIM (Luk, JYK); The LATM Local Area Traffic Management Model (Taylor, MAP); The Simulation of Data Sets for Model Testing (Richardson, AJ). (TRRL)

TRAFFIC SOFTWARE INTEGRATED SYSTEM (TSIS). Santiago, AJ; Rathi, AK. ENGINEERING FOUNDATION. TRAFFIC CONTROL METHODS. PROCEEDINGS OF THE FIFTH 1990 307-13

This paper presents the development of the Traffic Software Integrated System (TSIS) sponsored by the Federal Highway Administration, US, Department of Transportation. TSIS is a comprehensive set of microcomputer programs and models used for the design, test, and analysis of traffic control strategies. The system is composed of an executive software which enables the proper installation of all the component programs, traffic simulation and signal timing optimization programs (referred to as traffic models), pre-processors and post-processors for traffic models, and several utilities which ease the task of using the system by automating the process of loading and retrieving from a microcomputer. The paper is mainly oriented for traffic engineers with little or no computer background. However, some computer related technical information is also provided to assist readers in determining whether or not TSIS will operate on their systems and/or whether or not TSIS will satisfy their needs. The Phase I development of the system was completed and has been released to the US microcomputer software distribution centers at the University of Florida (McTRANS Center) and the University of Kansas (PCtrans Center) for public distribution. Phase I includes analysis tools for surface streets traffic operations. Phase II, currently under development, will incorporate analysis tools for freeways and corridors.(A) For the covering abstract of the conference see IRRD 832076.

TRAFLO-M MACROSCOPIC TRAFFIC SIMULATION MODEL USER'S MANUAL. Goldblatt, R; Hagerty, B; Laban, T. KLD Associates Incorporated 300 Broadway Huntington Station New York 11746; Michigan Department of Transportation State Highways Building, 425 West Ottawa, P.O. Box 30050 Lansing Michigan 48909; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Oct 1984 Final Rpt. v.p. Figs. Tabs. Refs. 7 App.. REPORT NO: FHWA-MI-RD-85-01. AVAILABLE FROM: KLD Associates Incorporated 300 Broadway Huntington Station New York 11746

This manual is a guide for users of the TRAFLO-M Integrated Traffic Simulation Model. TRAFLO-M is a hybrid version of TRAFLO. The major improvements include: 1) TRAFLO-M contains the DYNEV Freeway Model rather than FREFLO, 2) DYNEV includes special logic to simulate ramp metering strategies, and 3) A special version of TRAFLO-M simulates networks that include Light Rail Transit Vehicles operating in the median of divided highways. (Author)

TRAFLO-M MACROSCOPIC TRAFFIC SIMULATION MODEL. USER'S MANUAL. Hagerty, BR. KLD Associates Incorporated 300 Broadway Huntington Station New York 11746. Oct 1984 450p. REPORT NO: FHWA/MI/RD-85/01. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

The manual is a guide for users of the TRAFLO-M Integrated Traffic Simulation Model. TRAFLO-M is a hybrid version of TRAFLO. The major improvements include: (1) TRAFLO-M contains the DYNEV Freeway Model rather than FREFLO; (2) DYNEV includes special logic to simulate ramp metering strategies; and (3) a special version of TRAFLO-M simulates networks that include Light Rail Transit Vehicles operating in the median of divided highways. See also PB87-166575/WTS.

TRAF-NETSIM: HOW IT WORKS, WHAT IT DOES. Wong, S. (Federal Highway Administration, Washington, D.C.). Institute of Transportation Engineers, ITE Journal, Vol. 60. No. 4, Apr 1990, pp 22-27.

TRAFSIG: A COMPUTER PROGRAM FOR SIGNAL SETTINGS AT AN ISOLATED UNDER- OR OVERSATURATED, FIXED-TIME CONTROLLED INTERSECTION. Reljc, S. Printerhall Limited. Traffic Engineering and Control VOL. 29 NO. 11 Nov 1988 pp 562-566 Figs. Tabs. Refs.. AVAILABLE FROM: Printerhall Limited 29 Newman Street London England

> TRAFSIG is a computer program, written in ANSII FORTRAN 77 language, which calculates the signal plan at an isolated, undersaturated or oversaturated fixed-time controlled intersection. The signal plan can be calculated for an intersection with maximum n=20 approaches and m=10 stages in a cycle. The flow at each approach is allowed to have right-of-way in only one period within a cycle, even though this period can be made up of several consecutive stages. Several examples of applying the TRAFSIG program indicate that it gives a plan whose cycle duration is shorter than the one obtained by Webster's method or by Akcelik's method, and highly similar to the signal plan obtained by SIGSET (when only the delay is minimized). When one wishes to give importance to the number of stops, TRAFSIG gives a signal plan whose cycle duration is shorter than the cycle time obtained by Akcelik. In comparison with SOAP84 and Akcelik the TRAFSIG program explicitly calculates the optimal signal plan satisfying the imposed constraints.

TRANSPORTATION AND TRAFFIC THEORY. PROCEEDINGS OF THE TENTH INTERNATIONAL SYMPOSIUM ON TRANSPORTATION AND TRAFFIC THEORY, HELD JULY 8-10, 1987, AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY, CAMBRIDGE, MASSACHUSETTS. CONTINUED FROM TRIS ACCESSION NO 24XXXX. Gartner, NH; Wilson, NHM. Massachusetts Institute of Technology Center for Transportation Studies Cambridge Massachusetts 02139 0-444-01227-3. 1987 506p Figs. Tabs. Refs.. AVAILABLE FROM: Elsevier North-Holland Incorporated 52 Vanderbilt Avenue New York New York 10017

> Theoretical Considerations for Signal Timing Plan Selection in UTCS First Generation Control Systems; Delay-Minimizing Control and Bandwidth-Maximizing Control of Coordinated Traffic Signals by Dynamic Programming; The Interaction Between Signal Control Policies and Route Choice; Updating of Volume-Density Relationships for an Urban Expressway Control System; Traffic Responsive Control of Freeway Networks by a State Feedback Approach; Fuzzy On-Ramp Control Model on Urban Expressway and Its Extension; The Kalman Filtering Approaches in Some Transportation and Traffic Problems; Equilibrium in Competitive Urban Mass Transportation Markets; Stochastic Properties of Flows in Freight Consolidation Networks; Methods to Combine Different Data Sources and Estimate Origin-Destination Matrices; and Airport Terminal Geometries for Minimal Walking Distances.

TRANSYT-7F AND NETSIM, COMPARISON OF ESTIMATED AND SIMULATED PERFORMANCE DATA. Dudek, G; Goode, L; Poole, M. Institute of Transportation Engineers, ITE Journal, Vol 53., No. 8, Aug 1983, pp 32-34.

TRANSYT-7F OR PASSER II, WHICH IS BETTER - A COMPARISON THROUGH FIELD STUDIES. Shui-Ying Wong, Federal Highway Administration Office of Traffic Operations Washington D.C. 20590. Jan 1991. Transportation Research Board. Transportation Research Record N1324, 1991, pp 83-97. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418.

> Several studies had compared the arterial signal timings optimized by TRANSYT-7F and PASSER II before. The comparisons, however, were based on simulated results. In this paper, we compared the TRANSYT-7f timing plans to the PASSER II timing plans based on operational characteristics, field results and simulated results. We were able to make these comparisons because 1) the signals on two arterials in San Francisco were optimized by TRANSYT and implemented in 1987, 2) the same signals were retimed by PASSER II and implemented in 1988, and 3) before and after studies were conducted. From our field results, the overall effectiveness of TRANSYT-7F and PASSER II was about the same in terms of travel time and stops along the arterial (excluding cross streets). On one of the arterials, the offset pattern and operational characteristics of the TRANSYT timing were very different from those of PASSER's while on the other arterial, they were very similar. The TRANSYT-7F simulated travel times were reasonably close to the field travel times. However, the simulated measures of effectiveness (MOE's) in general were inclined in favor of the timing plans optimized by TRANSYT-7F. As part of the comparison, we described how and what field data were collected and the required sample size to ensure 95% level of confidence. We found that travel time data were reliable and easy to collect. Statistically it required 1 to 5 samples to attain 95% level of confidence for our example arterials each with thirty or more signalized intersections.

TRANSYT-7F USER'S MANUAL. Wallace, CE; Courage, KG; Reaves, DP; Schoene, GW; Euler, GW. Florida University, Gainesville Transportation Research Center Gainesville Florida 32611; Federal Highway Administration Office of Traffic Operations Washington D.C. 20590. Jun 1984 510p. REPORT NO: UF-TRC-U32 FP-06/07. AVAILABLE FROM: Florida University, Gainesville Transportation Research Center Gainesville Florida 32611

This document is the User's Manual for the computer program TRANSYT-7F (Traffic Network Study Tool, version 7F). TRANSYT is a traffic signal optimization model originally written in Great Britain by the Transport and Road Research Laboratory. Version 7 of the model was modified by the TRC to improve its utility in this country. Modifications included reorganized inputs, U.S. signal timing conventions, improved output formats, estimates of fuel consumption and the provision of time-space diagrams. TRANSYT-7F has proven far easier to use than earlier versions. Field implementation in a number of cities has demonstrated the model's usefulness in retiming traffic signal networks. TRANSYT-7F was developed under FHWA's National Signal Timing Optimization Project. Distribution of Release 4 of the TRANSYT-7F program began in June 1984. The revised version of the User's Manual is being distributed along with the Release 4 version of the program. (FHWA)

TWO-LANE TRAFFIC SIMULATION: A FIELD EVALUATION OF ROADSIM. Morales, JM; Paniati, JF. Transportation Research Board. Transportation Research Record N1100 1986 pp 29-39 11 Fig. 4 Tab. 6 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

Roadsim is a traffic simulation model for two-lane rural roads developed in 1980 by FHWA. In the subject study the accuracy of the model was evaluated by comparing its results with observed traffic behavior. The field data were collected on a two-lane rural road in Loudoun County, Virginia. Statistical analyses were performed to compare the measures of effectiveness (MOEs) observed in the field with those obtained from the simulation. The selected MOEs included mean vehicle speed, traffic volume, percent of vehicles following, platoon distribution, and average platoon size. Analysis showed that Roadsim's simulation results compared favorably with those observed in the field. Although this study validates Roadsim under a single geometric and traffic condition, results support its potential usefulness to the transportation engineering community. Further validation under a wide range of traffic and geometric conditions, however, is needed. Researchers are encouraged to use Roadsim to further validate its potential and recommend enhancements. This paper appeared in Transportation Research Record N1100, Design and Operational Effects of Geometrics.

TWO-PHASE TRAFFIC SIGNAL TIMING WITH 'CONFLICT POINT METHOD. YANG, P. AUSTRALIAN ROAD RESEARCH VOL. 19 NO. 2 Jun 1989 PP 155-163 ENGLISH

YANG PEI-KUN ILLUSTRATED BIBLIOGRAPHY: P. 161 YANG PEI-KUN ILLUSTRATED BIBLIOGRAPHY: P. 161

TWO TRAFFIC-RESPONSIVE AREA TRAFFIC CONTROL METHODS: SCAT AND SCOOT. Luk, JYK (Australian Road Research Board). Printerhall Limited. Traffic Engineering and Control VOL 25 NO. 1 Jan 1984 p 14 3 Tab. 17 Ref.

Area or urban traffic control systems can now be found in many cities. Traditionally, these systems employ the fixed-time control method by which signal timing plans are switched into operation by time-of-day. Recent research has led to the development of several traffic-responsive methods which allow the basic control elements - cycle time, phase splits and offset - to vary according to prevailing traffic conditions. This paper is concerned with the development and evaluation of this new generation of methodologies. Two such methods are reviewed and compared in this paper. They are the Sydney Coordinated Adaptive Traffic (SCAT) method developed in Australia and the Split, Cycle and Offset Optimization Technique (SCOOT) developed in the UK. The field evaluations of scoot and scat show that both methods are capable of performing better than the simpler fixed-time control method in reducing journey time and stops. By comparing these two methods, future research needs are identified. These include introducing the concept of modelling in the scat offset algorithms and the modification of the scoot models to incorporate vehicle-actuated control tactics available from a microprocessor traffic controller. (Author/TRRL)

UNDERSTANDING THE CUMULATIVE STATISTICS FROM TRAF-NETSIM. Chen, H. and Thor, C. PC-TRANSmission Vol 4., No. 2, October 1989.

This paper discusses the cumulative statistics as generated by TRAF-NETSIM, the Federal Highway Administrations microscopic urban network simulation model.

UNSIGNALISED ISOLATED INTERSECTION SIMULATION MODEL. Stanojevic, M. Savez Inzenjera I Tehn Saobracaja I Veza Jugo. Zbornik III Jugo Savetovanje Tehn Regul Saobracaja Apr 1983 pp 201-209 7 Fig. 7 Ref. Serbian

The paper describes the derivation of a stochastic simulation model of traffic flow for an unsignalised isolated intersection, based on digital simulation of events. The importance of simulation in investigating traffic flow at unsignalised intersections is stressed. Some experimental results referring to traffic flow characteristics at junctions depending on the level of traffic flow on the major road are given. (TRRL)

URBAN NETWORK TRAFFIC SIMULATION: TRAF-NETSIM PROGRAM. Rathi, AK; Santiago, AJ. American Society of Civil Engineers. Journal of Transportation Engineering VOL 116 NO. 6 Nov 1990 pp 734-743 Refs. 1 App.. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017-2398

This paper presents information about the latest version of the NETSIM simulation model. Many new features have been added to the program. These include the following: actuated controller logic; identical traffic streams; conditional turning movements; and signal transition. Major modifications have been made to the simulation logic to resolve the problems encountered during the testing of the simulation program: to enhance the logic to represent complex decision processes, and to enhance and extend the input-output capabilities, user-interaction, and the computational efficiency of the program.

URBAN ROAD TRAFFIC MODELS FOR ECONOMIC APPRAISAL: STAGES I AND II. FISK, CS; DUNN, RCM. DEPT OF CIVIL ENGINEERING UNIVERSITY OF AUCKLAND. SCHOOL OF ENGINEERING REPORT, NO 428 , N428 Nov 1986 175 PP ENGLISH

BY C.S. FISK AND R.C.M. DUNN OTHER PHYS. DESCRIPTION: XVII FORM SCHOOL OF ENGINEERING REPORT, NO. 428 , ISSN:0111-0136 -UNTRACED SERIES PREPARED FOR AND FUNDED BY THE ROAD RESEARCH UNIT ADMINISTRATIVE COMMITTEE OF THE NATIONAL ROADS BOARD, NEW ZEALAND NOVEMBER, 1986--COVER BIBLIOGRAPHY: P. 149-161 ADDL CORP. AUTHOR INFO: UNIVERSITY OF AUCKLAND. DEPT. OF CIVIL ENGINEERING ADDL CORP. AUTHOR INFO: NEW ZEALAND. ROAD RESEARCH UNIT

URBAN TRAFFIC MODELS FOR OPERATIONAL ANALYSES AND ECONOMIC APPRAISALS. NEW ZEALAND ROADING SYMPOSIUM 1987. VOLUME 3. Fisk, CS; Dunn, RCM. National Roads Board, New Zealand P.O. Box 12-041 Wellington New Zealand 0-477-07156-2. 1987 pp 475-481 2 Ref.. AVAILABLE FROM: National Roads Board, New Zealand P.O. Box 12-041 Wellington New Zealand

This paper is based on a review of urban traffic models available in New Zealand and overseas for predicting impacts of urban road improvement schemes. The review was undertaken for the administration committee of the Road Research Unit (National Roads Board) with the final objective of standardizing modelling procedures for the economic appraisal of proposed improvement projects. The main outcome of this work is a set of recommendations leading to the acquisition of specific models and modifications to some models to cater for New Zealand road traffic rules and control environment. For the covering abstract of the symposium see IRRD 810782. (Author/TRRL)

URBAN TRAFFIC NETWORK FLOW MODELS. Williams, JC; Mahmassani, HS; Herman, R. Transportation Research Board. Transportation Research Record N1112 1987 pp 78-88 14 Fig. 1 Tab. 11 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

Addressed in this paper are the development and comparative assessment of macroscopic network-level traffic flow models, which describe the behavior and interrelation between traffic variables defined at the network level. These variables include average speed, concentration, flow, the fraction of vehicles stopped in the network, and the two-fluid running time variables. Three alternative sets of interrelated models, each with a different starting postulate, are presented and tested in terms of their performance against a series of microscopic simulation runs corresponding to different concentration levels. In each model system, a different functional form is postulated for either the speed-concentration relation or the fraction of vehicles stopped versus concentration relation. The functional form for the other relation is then derived from the postulated model by invoking the two-fluid theory of town traffic. The models are calibrated and tested using the simulation results. The analysis indicates that the network-level traffic variables are interrelated in a manner similar to that captured by the traffic models established for individual road sections. In particular, a well-known linear speed-concentration model as well as a nonlinear alternative are found to be generally applicable at the network level. This paper appeared in Transportation Research Record No. 1112, Highway Capacity and Flow Theory and Characteristics.

USE AND EFFECTIVENESS OF SYNTHETIC ORIGIN-DESTINATION DATA IN A MACROSCOPIC FREEWAY SIMULATION MODEL. Stokes, RW; Morris, DE. Institute of Transportation Engineers. ITE Journal VOL. 56 NO. 4 Apr 1986 pp 43-47 14 Ref.. AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

In recent years, the Texas State Department of Highways and Public Transportation and the Texas Transportation Institute have made extensive use of the FREQ simulation programs in evaluating proposed design configurations for freeways in Houston, Dallas, and San Antonio. Relative to other freeway simulation program packages, the FREQ programs offer the following advantages: (1) The programs are relatively simple to use, requiring little knowledge of computers and only a few basic hand calculations; (2) The programs are macroscopic in nature, thus requiring a minimum amount of input data and computer time; (3) The programs are flexible in the sense that they allow the user to input a wide variety of geometric designs and traffic demand patterns.

USE OF PREDICTED VEHICLE ARRIVAL INFORMATION FOR ADAPTIVE SIGNAL CONTROL--AN ASSESSMENT. Lin, F-B; Cooke, D; Vijayakumar, S. Transportation Research Board. Transportation Research Record N1112 1987 pp 89-98 12 Fig. 1 Tab. 14 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

Adaptive signal control at individual intersections relies on detectors to provide advance vehicle arrival information for real-time optimization of the signal operations. As much as 25 sec of advance information may be needed to achieve near optimal operations if flow rates reach about 700 vehicles per hour per lane (vphpl). However, it is often impossible or impractical to place detectors far enough from the intersection to provide the desired amount of information. The use of predicted data becomes a tempting alternative under the circumstance. In this paper, computer simulation is used to assess the desirability of using predicted data in combination with the data provided by the detectors for signal optimization. Three predictors are compared and one is chosen to assess the impact of using the predicted data. It is found that reliance on limited advance arrival information provided solely by the detectors is more desirable than using predicted data to increase the amount of advance information. This paper appeared in Transportation Research Record No. 1112, Highway Capacity and Flow Theory and Characteristics.

USE OF THREE-DIMENSIONAL CONJUGATE DIRECTIONS SEARCH METHOD TO IMPROVE TRANSYT-7F COMPUTATIONAL EFFICIENCY. Tsay, H-S; Wang, K-T. Transportation Research Board. Transportation Research Record N1225 1989 pp 116-129 7 Fig. 3 Tab. 11 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

A modification of the computer program TRANSYT-7F has been developed to reduce computational time and improve the performance index by using the conjugate directions search method in three dimensions. The original TRANSYT-7F uses the hill-climbing method to perform a two-step optimization. This type of optimizing procedure has been used in the TRANSYT program for many years, and even TRANSYT-7F's new version, 6.0, still applies the same algorithm. In this paper, a new search method is developed to obtain simultaneously the final cycle length, split, and offset. It is a one-step optimization algorithm. From tests of 21 cases on a PC/AT, this modified TRANSYT-7F reduces computational time significantly and improves the performance index slightly compared with the new TRANSYT-7F. It also allows the user to consider the spillover effect, perform arterial priority or link maximum-allowed delay, and fix the offsets for designated intersections. Currently, this program can be used not only as a detailed off-line signal-timing analysis tool but also as a part of computing software for four newly developed traffic control systems in Taiwan to generate on-line signal-timing plans. This paper appears in Transportation Research Record No. 1225, Highway Capacity, Flow Measurement, and Theory.

USE OF TRAFFIC SIMULATION TO EVALUATE RURAL ROAD IMPROVEMENT ALTERNATIVES. Hoban, CJ. Roads and Transportation Association of Canada 1765 St Laurent Boulevard Ottawa Ontario K1G 3V4 Canada. 1985 pp 3-20 6 Fig. 3 Tab. 10 Ref.. AVAILABLE FROM: Roads and Transportation Association of Canada 1765 St Laurent Boulevard Ottawa Ontario K1G 3V4 Canada

This paper describes a rural traffic simulation model called trarr version 3.0 developed at the Australian road research board. The model can be used to simulate the traffic operations on a real road in some detail, and to investigate the effects of changes in road and traffic characteristics. By changing the road geometry characteristics, alternative road improvement strategies may be compared. By changing the traffic characteristics, the user can investigate the effects of increased volumes, more heavy trucks, or long-term changes in vehicle size and power. Observed traffic characteristics include speed, travel time, bunching, time spent following, overtaking rate and fuel consumption. (TRRL) This paper appeared in RTAC 1985 Annual Conference Proceedings, Volume 2.

USER-FRIENDLY TEXAS MODEL--GUIDE TO DATA ENTRY. FINAL REPORT. Lee, CE; Machemehl, RB; Inman, RF; Copeland, CR, Jr; Sanders, WM. Texas University, Austin Center for Transportation Research Austin Texas 78712; Texas State Department of Highways & Public Transp Transportation Planning Division, P.O. Box 5051 Austin Texas 78763; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590. Nov 1985 210p 11 Fig. 6 Tab. 3 Ref. 3 App.. REPORT NO: FHWA/TX-86/54+361-1F; Res Rept 361-1F. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

> Two interactive data-entry programs have been incorporated into the TEXAS Model for Intersection Traffic to produce the User-Friendly TEXAS Model. Now, a user, working through an alphanumeric terminal connected in an interactive time-sharing mode to a mainframe computer or through the keyboard of a microcomputer, can enter all the data needed for a simulation run in about 1/10 the time previously required. During simulation, the progress of each individually-characterized vehicle moving through a simulated intersection is recorded and subsequently displayed in real-time or in stop-action on a microcomputer-driven graphics screen. This animated graphics display allows the user to study the overall traffic performance at an intersection or to examine the behavior of any selected vehicle(s) in great detail. Tabular summary statistics are also produced for each simulation run if requested by the user. With the user-friendly version of the TEXAS Model that is described in this guide, alternative intersection designs and traffic-control schemes can be evaluated quickly and accurately in a timely and cost-effective manner. Research study title: User-Friendly TEXAS Model for Intersection Traffic.

USER GUIDE TO CONTRAM VERSION 4. Leonard, DR; Gower, P. Transport and Road Research Laboratory Old Wokingham Road Crowthorne RG11 6AU Berkshire England 0305-1315 GRATIS. 1982 Monograph 68p 4 Fig. 6 Ref.. REPORT NO: SR 735

> Contram is a traffic assignment model for use in the design of traffic management schemes. The model predicts vehicle routes, flows and queues in a network of streets and junctions; junctions may be controlled by traffic signals or "give-way" rules. It is assumed that the numbers of trips between each origin and destination are known and that they may vary with time so that the growth and decay of congestion in peak periods can be studied. Allowance is made for the physical size of queues which may block back and restrict the throughput capacity at upstream junctions. Up to three classes of vehicles (eg cars, buses and lorries) can be represented, and selected vehicles (usually buses) can be sent along fixed routes. Contram provides comprehensive information on traffic conditions, including link delay times, turning movements and fuel consumption, to help the traffic engineer to understand and assess the merits of alternative traffic management schemes. This user guide gives a brief description of the model, details of data input and output, a test example to illustrate the use of the model and an outline of the structure and operation of the computer program. (Author/TRRL)

USER'S GUIDE FOR TRAF II NETSIM (OBJ)P Q 444 14 ON OBJECTS: SURFACE STREET TRAFFIC SIMULATION MODEL. HAGERTY, BR. MICHIGAN DEPT OF TRANSPORTATION LANSING MICH. 1987 ENGLISH

> PREPARED BY BRADLEY R. HAGERTY OTHER PHYS. DESCRIPTION: III ILLUSTRATED ADDL CORP. AUTHOR INFO: MICHIGAN. DEPT. OF TRANSPORTATION. CN

USER'S MANUAL FOR OBJP Q 444 11 ON OBJECTS AND OBJP Q 444 13 ON OBJECTS : TRAFLO-M MACROSCOPIC TRAFFIC SIMULATION MODEL. HAGERTY, BR. MICHIGAN DEPT OF TRANSPORTATION LANSING MICH. 1985 FINAL REPO ENGLISH. REPORT NO: FHWA/MI/RD-85/01

> COMPILED BY BRADLEY R. HAGERTY OTHER PHYS. DESCRIPTION: 1 V ILLUSTRATED COVER TITLE: TRAFLO-M MACROSCOPIC TRAFFIC SIMULATION MODEL USER'S MANUAL PREPARED BY KLD ASSOCIATES IN COOPERATION WITH THE FEDERAL HIGHWAY ADMINISTRATION ADDL CORP. AUTHOR INFO: MICHIGAN. DEPT. OF TRANSPORTATION ADDL CORP. AUTHOR INFO: KLD ASSOCIATES

USING TRAF-NETSIM TO EVALUATE THE EFFECTS OF DRAWBRIDGE OPENINGS ON ADJACENT SIGNALIZED INTERSECTIONS. Yauch, P; Gray, J; Lewis, W. Institute of Transportation Engineers, ITE Journal, Vol. 58, No. 5, May 1988, pp 35-39.

USING SIMULATION TO INVESTIGATE MATHEMATICAL TRAFFIC FLOW RELATIONSHIPS. McLean, JR. Australian Road Research Board 500 Burwood Road Vermont South Victoria 3133 Australia 0 86910 127 7. 1983 pp 179-193 5 Fig. 1 Tab. 13 Ref.

Preliminary work aimed at the development of a macroscopic model of two-lane traffic flow suitable for the evaluation of design and improvement options on a route specific basis is described. Early theoretical treatments of platooning in two-lane flow are shown to provide a possible framework for such a model. An equilibrium model is proposed, with level of platooning as the dependent variable, and overtaking opportunity and desired overtaking rate as the independent variables. An exploratory simulation study was conducted to examine equilibrium platooning characteristics and the feasibility of the modelling approach. The simulation generated data exhibited greater consistency when interpreted in a platooned flow context than in the conventional average speed versus total flow format. (TRRL) Program and papers from Workshop on Rural Traffic Simulation, Vermont South, Victoria, June 2-3, 1983. This paper was presented in Session 5: Further Applications.

USING TRANSYT FOR TRAFFIC SIGNAL OPTIMIZATION IN PARRAMATTA. Luk, JYK; Lowrie, PR; Sims, AG (New South Wales Department of Main Roads,Australia). Australian Road Research Board 500 Burwood Road Vermont South Victoria 3133 Australia 0572-1431. 1982 pp 12-22 7 Fig. 5 Tab. 21 Ref.

This paper summarizes the experience of using the computer program TRANSYT for the optimization of traffic signal timing plans for Parramatta, a regional center about 20 km west of Sydney. It describes the use of Version 7 of TRANSYT in a study for comparing the performance of various area traffic control methods. The selection of input parameters is discussed; in particular, the choice of the stop penalty and the period of flow are described in detail. The limitation of TRANSYT in modelling local signalized intersection designs is explained. These problems are illustrated with an intersection in the survey area and include assigning proper saturation flows which vary with time during green. On-site performance indicated that, with a stop penalty of 20, fixed-time control using TRANSYT plans is similar to the Sydney Adaptive Coordinated Traffic (SCAT) method in reducing journey times, but is poorer in reducing stops. The principle of adopting starting offsets for the reduction of stops is also discussed in detail (A). The number of the covering abstract of the conference is TRIS No. 368448. (TRRL) Proceedings of the Eleventh Australian Road Research Board Conference, held at the University of Melbourne, August 23-27, 1982.

USING VOLUME-TO-CAPACITY RATIOS TO SUPPLEMENT DELAY AS CRITERIA FOR LEVELS OF SERVICE AT TRAFFIC SIGNALS. Berry, DS. Transportation Research Board. Transportation Research Record N1112 1987 pp 23-28 2 Fig. 7 Tab. 8 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

The feasibility of using volume-to-capacity (v/c) ratios to supplement stopped delay for determining levels of service (LOS) at traffic signals when operating at near-capacity conditions is examined. Results indicate that the supplemental v/c criteria would be applicable in identifying LOS B, C, D, and E for many combinations of signal timing. Timing plans using the shorter cycle lengths and the longer green-to-cycle length (g/C) ratios benefitted the most because use of stopped delay criteria alone for those cases frequently requires that v/c exceed 1.00 in order to attain a delay value associated with LOS B, C, D, and E. Use of delay Equation 9-18 of the 1985 Highway Capacity Manual should be avoided when there is an overflow queue at the beginning of the 15-min analysis period, or when duration of overflow queuing lasts for more than 15 min. This paper appeared in Transportation Research Record No. 1112, Highway Capacity and Flow Theory and Characteristics.

VALIDATION OF A TRAFFIC MODEL. Cronje, WB. Transportation Research Board. Transportation Research Record N1069 1986 pp 73-79 6 Fig. 11 Tab. 6 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

Simulation is very useful for generating traffic data. However, for validating a traffic model, field data are essential. Because of the random variation of the traffic arriving at signalized intersections, a large number of observations are necessary at a particular intersection. To obviate the collection of a large amount of data, the Bootstrap technique was applied to a limited amount of field data that were collected at three fixed-time signalized intersections. In addition, the data were supplemented by simulation to cover a wide range of cycle lengths, types of flow, degrees of saturation, and ratios of the variation in the mean of the number of arrivals per cycle. A recently developed traffic model based on a Markov process and a geometric probability distribution, the Modified Geometric Model (M Geom Model), was used to estimate the measures of effectiveness commonly used for optimization purposes, namely, delay and stops. Satisfactory results were obtained, indicating that a limited amount of field data is required for validating a traffic model. This paper appeared in Transportation Research Record N1069, Traffic Control Devices and Rail-Highway Crossings.

VARIABILITY ASSESSMENT FOR TRAF-NETSIM. Chang, G-L; Kanaan, A. American Society of Civil Engineers. Journal of Transportation Engineering VOL. 116 NO. 5 Sep 1990 pp 636-657 Figs. Tabs. Refs. 3 App.. AVAILABLE FROM: American Society of Civil Engineers 345 East 47th Street New York New York 10017-2398

Statistical issues involved in the use of stochastic traffic simulation are briefly discussed, and simulation experiments using TRAF-NETSIM are described, with emphasis on effective procedures for output analyses. The exploratory results obtained from simulation experiments are further investigated, along with the development of guidelines for output variability assessment. It is noted that the variability of variables generated by a traffic simulation model can be assessed by variables' confidence intervals computed via the two most convenient approaches, the batch means, and replication methods.

VARIANCE REDUCTION APPLIED TO URBAN NETWORK TRAFFIC SIMULATION. Rathi-A.K.; Venigalla-M.M. Oak Ridge National Lab., TN. Department of Energy, Washington, DC. Sep 91. 31p.

This paper describes and illustrates the effectiveness of variance reduction techniques that users can apply to improve the efficiency and reliability of simulation experiments with the TRAF-NETSIM simulation model. The two variance reduction techniques, antithetic variates and common random numbers, reduce the variance of simulation output by replacing the original sampling procedure by a new procedure that yields the same parameter estimate but with a smaller variance. Thus, the user can obtain greater amount of statistical accuracy for the same number of simulation runs. A recent modification in the stochastic sampling process has made the TRAF-NETSIM model amenable to these variance reduction techniques, and allows the user to apply these techniques with minimal additional effort. The effectiveness of these techniques is evaluated through an analysis of simulation output from two TRAF-NETSIM data sets. The estimated values and variances are computed for some representative measures of effectiveness after 10, 20, and 30 replications. The results of this study indicate that both techniques are quite effective in reducing variance of the model output. By using the antithetic variates sampling procedure, the variance of simulation parameter estimates can be reduced by as much as 88 percent. In all cases studied, better statistical precision is obtained by making two-thirds fewer simulations than under conventional multiple replications-based experimentation. The common random number strategy also reduces the variance but is not as effective as the antithetic variates technique in this case study.

VEHICLES, PCUS AND TCUS IN TRAFFIC SIGNAL CALCULATIONS. Heydecker, BG (University College, London). Printerhall Limited. Traffic Engineering and Control VOL. 24 NO. 3 Mar 1983 pp 111-114 13 Ref.

There are many references in the literature to the fact that the time taken for a vehicle to cross the stop-line at a signal-controlled road junction varies according to the type of vehicle and the manoeuvre it performs. Allowance for these effects has long been a common feature of standard procedures in various countries for making estimates of capacity and delay at single-controlled road junctions. However, there has been relatively little discussion of exactly how these allowances should be applied. In this paper, one of the methods available is identified as being suitable for making these allowances. Another method which might seem to be suitable, is described and the errors which would result were it to be adopted are quantified. Full details are given of methods in which various combinations of estimates and raw data can be processed to give the quantities required for the estimation of capacity and delay. Some difficulties of data acquisition and processing are discussed and an approximate method is described which has much reduced requirements for raw data. (Author/TRRL)

VEHICULAR FUEL-CONSUMPTION MAPS AND PASSENGER VEHICLE FLEET PROJECTIONS. Santiago, AJ (Federal Highway Administration). Transportation Research Board. Transportation Research Record N901 1983 pp 5-11 7 Fig. 1 Tab. 8 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

The procedures and preliminary results of a study aimed at assessing the fuel-consumption characteristics of passenger vehicles that are representative of the current and near-future fleet in order to update the fuel-consumption models of computerized traffic simulation and optimization programs are presented. The paper identifies 21 engine-drivetrain combinations that are representative of 74 percent of the 1979-1985 passenger vehicle fleet and describes an instrumentation system that permits the collection of the microscopic on-the-road and laboratory test data necessary to fully assess the real-world fuel-consumption characteristics of vehicles.

(Author) This paper appeared in Transportation Research Record No. 901, Energy Impacts of Geometrics--A Symposium.

VOLUME-DELAY RELATIONSHIP AT FOUR-WAY-STOP CONTROLLED INTERSECTIONS: A RESPONSE-SURFACE MODEL. Chan, Y; Flynn, LJ; Stocker, KJ. Institute of Transportation Engineers. ITE Journal VOL. 59 NO. 3 Mar 1989 pp 27-34 Figs. Tabs. 16 Ref.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024

This study arrived at a single analytical equation that summarizes the varied volume-delay characteristics at 4-way-stop controlled intersections. A middle path is taken between a purely empirical approach and an analytical one through the construction of a response surface out of a collection of simulation and field data. A 4-way-stop intersection simulation program, STOP-4, is described. Computer runs from the model generated a majority of the statistics on volumes and delays at a one-lane approach intersection. These were field tested. It was found that the delay at an intersection is related statistically to split, left turns, and volume. Also, left-turn movements appear to have a larger effect on capacity reduction than previously reported.

VTI TRAFFIC SIMULATION MODEL - A USER GUIDE. Bolling, A; Junghard, O. National Swedish Road & Traffic Research Institute Fack S-581 01 Linkoeping Sweden. 1987 48p Swedish. REPORT NO: VTI/MEDDELANDE-542. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

The bulletin is a user guide to the most important programs included in VTI's traffic simulation model. The programs concern road and traffic description, which produce input files for the simulation programs, start of the simulation programs and statistical treatment of the results from the simulation. See also PB87-121851.

VTI TRAFFIC SIMULATION MODEL-REVISED USER GUIDE. Bolling, A; Junghard, O; Soerensen, G. National Swedish Road & Traffic Research Institute Fack S-581 01 Linkoeping Sweden. 1988 56p Swedish. REPORT NO: VTI/MEDDELANDE-580. AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

The bulletin is a revised edition of VTI Meddelande 542. It is a user guide to the most important programs included in VTI's traffic simulation model. The programs concern road and traffic description, which produce input files for the simulation programs. See also PB88-143755.

VTI TRAFFIC SIMULATION MODEL. A PROGRAM FOR THE MONTE CARLO SIMULATION OF VEHICLE TRAFFIC ALONG TWO-LANE RURAL ROADS. AN APPLICATION OF JSP AND SIMULA -67 LANGUAGE. REVISED EDITION. Brodin, A. National Swedish Road & Traffic Research Institute. VTI Topics N322A 1983 Monograph 81p 1 Fig. 6 Ref.

This report deals with a simulation program which describes the dynamic sequence of vehicle traffic over defined stretches of road for given traffic volumes and traffic compositions. In the program the stretch of road considered consists of a sequence of consecutive road block objects and a sight distance function in each direction of travel. Each road block object is homogeneous with regard to the following: (1) road width and road surface type, (2) auxiliary lane/lateral space (i.e. wide shoulder), (3) slope, (4) horizontal curvature, (5) speed limit, and (6) overtaking restrictions. Jackson Structured Programming technique (JSP) has been used in system and programming work and the programming language is SIMULA 67. (Author/TRRL)

WAITING TO CROSS A MAJOR STREAM AT AN UNCONTROLLED ROAD JUNCTION. Hurdle, VF; Hauser, E; Steuart, GN; Golias, JC. Toronto University Press Toronto Ontario Canada 0 8020 2461 0. 1983 pp 292-230 3 Fig. 16 Ref.

An analytical model is suggested which estimates the statistics of delay to drivers who arrive randomly at an uncontrolled junction and wait to cross a major stream. The complexity of the problem does not allow all the details of the real crossing process to be taken into account in the model. Some simplifying assumptions are therefore made in the analysis concerning the probability distribution of the first "gap" encountered by the waiting driver and the independence between certain distributions. Using thorough simulation, the effects of these assumptions on the estimated average delay have been investigated in the case of a cumulative Erlang distribution for the gap acceptance function, an Erlang distribution for the move-up time, and a gamma distribution for the major stream headways. The mean delay estimated by the analytical model was always well within 5 per cent of the value obtained by simulation, and the two values were usually almost equal. These results support the simplifying assumptions of the analytical model and suggest that it gives a satisfactory estimate of delay. For the covering abstract of the symposium see TRIS 452544. (Author/TRRL) Proceedings of the Eighth International Symposium on Transportation and Traffic Theory, Toronto, Canada, June 24-26, 1981.

WARRANTS FOR INTERCONNECTION OF ISOLATED TRAFFIC SIGNALS. Research rept. Sep 79-Aug 86 (Final). Chang-E.C.; Messer-C.J. Texas Transportation Inst., College Station. Texas State Dept. of Highways and Public Transportation, Austin. Transportation Planning Div. Federal Highway Administration, Austin, TX. Texas Div. TTI21880293, FHWATX86672931F. Aug 86. 77p.

The project suggests guidelines and procedures to identify when adjacent signalized intersections should be interconnected. Field data from several Texas cities were used to calibrate the TRANSYT-7F and PASSER II computer programs. These programs were used to address the effects of progression changes in travel time and travel volume. Detailed field studies were performed at six (6) intersections.

WHAT'S NEW IN SIGNAL TIMING OPTIMIZATION MODELS?. Wilbur, AD. Institute of Transportation Engineers. ITE Journal VOL 61 NO. 4 Apr 1991 pp 41-45 Figs. 1 Tab. Refs.. AVAILABLE FROM: Institute of Transportation Engineers 525 School Street, SW, Suite 410 Washington D.C. 20024-2729

Over the years, optimization models have evolved to take advantage of advances in microcomputer technology. Data are now entered through user-friendly input programs, and many outputs are presented graphically. Programs summarized in this article include the latest versions of TRANSYT-7F and PASSER-II signal timing optimization models, as well as a number of auxiliary programs designed to run in conjunction with them. Enhancements to TRANSYT-7F are described, as well as support programs that make entering data and analyzing the results of a TRANSYT-7F less tedious and error prone. PASSER II and improvements to it are described. The use of TRANSYT-7/F and PASSER II together is also described. Comments are made on software availability.

WORK ZONE ANALYSIS MODEL FOR THE SIGNALIZED ARTERIAL. Joseph, CT; Radwan, E; Rouphail, NM. Transportation Research Board. Transportation Research Record N1194 1988 pp 112-119 4 Fig. 2 Tab. 4 Ref.. AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

The purpose of this paper is to illustrate new theoretical concepts used to represent traffic flow in work zones. The paper presents the development and applications of a microcomputer program--Work Zone Analysis Tool for the Arterial (WZATA)--for the analysis and evaluation of a system consisting of a lane closure between two signalized intersections. The program consists of two parts: a semi-simulation model to represent and analyze flow between the intersections, and a macroscopic model to represent traffic characteristics at the downstream intersection. New techniques were developed to represent percentage merges and vehicle merge characteristics before the lane closure. The user was provided direct control over the merging of every vehicle. A modified version of the continuum-flow theory was utilized to represent and analyze traffic flow at the downstream intersection. Flow was considered to be composed of two parts: the platoon flow and the non-platoon flow. The techniques of analysis used also considered acceleration, deceleration, and start/stop losses. The program is written in Microsoft BASIC for the IBM-PC/XT/AT and is structured to facilitate easy modification of data as well as analysis of various hypothetical situations. Attempts are being made to include graphical display facilities in the model. This paper appears in Transportation Research Record No. 1194, Traffic Flow Theory and Highway Capacity.

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