Transportation Planning and Impact Forecasting Tools

A REPORT
OF THE
TRANSPORTATION TASK FORCE
OF THE

URBAN CONSORTIUM
FOR TECHNOLOGY INITIATIVES

SUPPORTED BY

U.S. DEPARTMENT OF TRANSPORTATION

WASHINGTON, D.C.
Updated Version
October, 1978

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The Urban Consortium for Technology Initiatives was formed to actively pursue technological solutions to pressing urban problems. The Urban Consortium is a coalition of 34 major urban governments, 28 cities and 6 counties, with populations over 500,000. These 34 governments represent over 20% of the nation's population and have a combined purchasing power of over $25 billion.

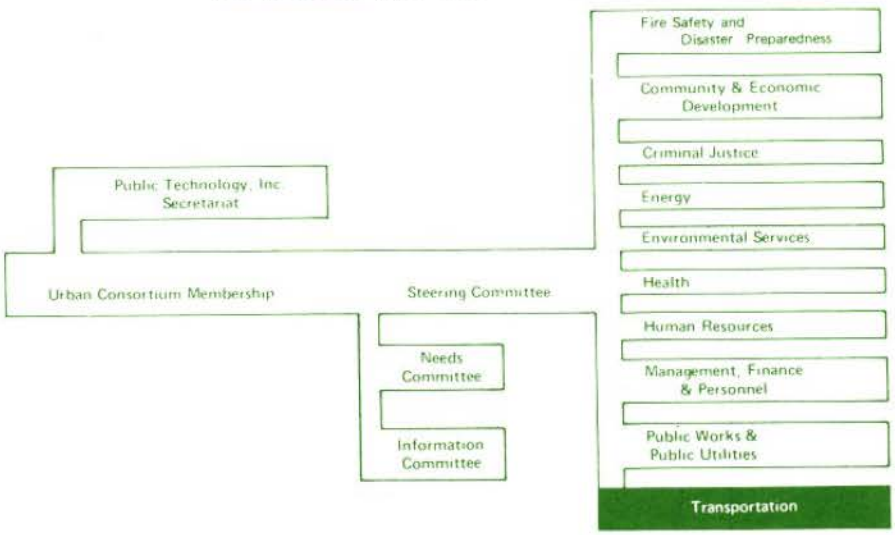
Formed in 1974, the Urban Consortium represents a unified local government market for new technologies. The Consortium is organized to encourage public and private investment to develop new products or systems which will improve delivery of local public services and provide cost-effective solutions to urban problems. The Consortium also serves as a clearing-house in the coordination and application of existing technology and information.

To achieve its goal, the Urban Consortium identifies the common needs of its members, establishes priorities, stimulates investment from federal, private and other sources and then provides on-site technical assistance to assure that solutions will be applied.

Public Technology, Inc. (PTI), a non-profit, tax-exempt, public interest organization serves as Secretariat to the Urban Consortium. PTI was established in December 1971, by The Council of State Governments, The International City Management Association, The National Association of Counties, The National Governors' Conference, The National League of Cities and The U. S. Conference of Mayors. The staff of PTI provides both technical and organizational services to the Urban Consortium and its Task Forces.

The work of the Urban Consortium for Technology Initiatives is focused through the ten Task Forces shown below. These Task Forces were formed as a result of the needs identification process used by the Consortium. An eleven member Steering Committee, whose members are chosen from among the participating jurisdictions, guides the activities of the Urban Consortium for Technology Initiatives.

ORGANIZATION OF THE URBAN CONSORTIUM FOR TECHNOLOGY INITIATIVES



Initial funding for the Urban Consortium for Technology Initiatives was obtained from the National Science Foundation / Research Applied to National Needs and from the Office of the Secretary, Department of Transportation. Additional funding has been provided by the Department of Housing and Urban Development, the Environmental Protection Agency, the Urban Mass Transportation Administration and the Federal Highway Administration of the U.S. Department of Transportation, and the National Fire Prevention and Control Administration of the U.S. Department of Commerce.

This report is a product of the activities of the Transportation Task Force. The work has been supported by the U. S. Department of Transportation; Office of the Secretary, Urban Mass Transportation Administration and Federal Highway Administration.

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Prepared by

PUBLIC TECHNOLOGY, INC.
1140 Connecticut Avenue, N.W.
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Secretariat
to the

URBAN CONSORTIUM FOR TECHNOLOGY INITIATIVES

Supported by

U.S. DEPARTMENT OF TRANSPORTATION
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URBAN CONSORTIUM FOR TECHNOLOGY INITIATIVES

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PREFACE

This is one of ten in the second series of Information Bulletins produced by the Transportation Task Force of the Urban Consortium for Technology Initiatives. Each Bulletin in this series addresses a priority transportation need area identified in the second annual needs selection by member jurisdictions of the Urban Consortium. The Bulletins are prepared by the staff of Public Technology, Inc. (PTI) for the Transportation Task Force.

The eight transportation needs which this second series of Information Bulletins covers are:

- Accelerated Implementation Procedures
- Center City Circulation
- Neighborhood Traffic Controls
- Parking Management
- Transit Marketing
- Alternative Work Schedules
- Traffic Performance Measurement
- Urban Goods Movement

There will also be two Revised Versions of Information Bulletins printed in 1977:

- Improving Transit Systems Productivity
- Institutional Framework for Integrated Transportation Planning

Updates will also be developed for two bulletins which have attracted substantial interest:

- Integration of Para-Transit with Conventional Transit Systems
- Transportation Planning and Impact Forecasting Tools

The needs highlighted by the Information Bulletins are selected in an annual process of needs identification used by the Urban Consortium. By identifying and then focusing on the priority needs of member jurisdictions, the Consortium assures that resultant research and development efforts are directly responsive to existing or anticipated local government problems.

Each Bulletin provides a nontechnical overview, from the local government perspective, of issues and problems associated with each need. Current research efforts and approaches to the problem used by local governments are also briefly identified. The Bulletins are not meant to be an in-depth review of the state-of-the-art or the state-of-the-practice. Rather, they serve as an information base from which the Transportation Task Force selects several needs for more attention.

The Information Bulletins have also proven useful to persons such as elected officials for whom transportation represents but one of many areas of concern.

The results of the needs selection process used by the Urban Consortium have been promising. Of the ten priority needs identified in the first annual needs selection, four were addressed by subsequent Transportation Task Force projects.

- To pursue the need for Preferential and Exclusive Lanes, a Manual for Planning and Implementing Priority Techniques for High Occupancy Vehicles (composed of a Chief Executive Report, Program Manager's Report, and Technical Guide) was developed. The methodology outlined in the manual is now being tested in Buffalo, St. Louis, San Francisco, and San Jose. A revised manual based on these demonstrations will be available in July, 1978.

- A National Conference on Transit Performance was organized to address the need for Transit System Productivity. The Conference, held in Norfolk, Virginia, in September, 1977, was attended by 200 government, industry, labor, and academic participants.

- To facilitate the provision of Transportation for Elderly and Handicapped Persons, an outline for a manual on techniques of providing such transportation services is being developed.

- Finally, two documents relating to the need for Transportation Planning and Impact Forecasting Tools are being prepared: (1) a paper describing local transportation planning issues and concerns directed to the Urban Mass Transportation Administration (UMTA); and (2) a management-level document for local officials describing UMTA's currently available tools and how they can be applied to local government.

Of the remaining six needs identified in the first annual selection, two remained as priority needs in the second annual needs selection. The Information Bulletin for "Institutional Framework for Integrated Transportation Planning" was included in the first series of Bulletins and will be revised as necessary. The Information Bulletin for "Accelerated Implementation Procedures" is part of this second series of Bulletins.

For the remaining four needs, the Transportation Task Force felt that current research directed toward them was adequate and that the Information Bulletins themselves fulfilled the Task Force's information dissemination goals. Thus, these needs have been dropped from the priority list.

Two major projects related to the second needs selection have already been completed. To help improve Center City Circulation (with the objectives of downtown revitalization and economic development) two projects have been completed. A recently published report--Center City Environment and Transportation: Local Government Solutions--shows how seven cities use transportation and pedestrian improvements as tools in downtown revitalization. Another project, addressing the coordination of public transportation investments with real estate development, culminated in a major national conference--The Joint Development Marketplace. The Marketplace, held in Washington, D.C. in June, 1978, was attended by over 500 people, including delegations from 37 cities and counties and representatives of over 100 private development and financial organizations. It is hoped that further research projects will be directed to the remaining new priority transportation needs of the Urban Consortium for Technology Initiatives.

The support of the Technology Sharing Division, Office of the Secretary; Federal Highway Administration; and the Urban Mass Transportation Administration of the U.S. Department of Transportation has been invaluable in the work of the Transportation Task Force of the Urban Consortium for Technology Initiatives and its staff from Public Technology, Inc. The guidance offered by the Task Force members will continue to insure that the work of the staff will meet the urgent needs which have been identified by members of the Urban Consortium for Technology Initiatives.

The members of the Transportation Task Force are listed below:

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Chapter I

ISSUES & PROBLEMS

The context of transportation planning has changed dramatically in recent years. The system scale, long-term metropolitan wide transportation studies of the 1950's and 1960's, such as the Chicago Area Transportation Study (CATS)[1], have given way to the need for short-term, small area studies. Environmental impact assessment requirements have been introduced. Greater concern has been placed on defining the interrelationships between transportation and land use.

The complexity of planning for urban transportation, and the cost of major new investments in highways and transit, make it imperative that accurate, policy sensitive tools be available to transportation planners and local decision-makers. Future travel demand, travel times, environmental and land use impacts and many more variables must be considered, not only to judge the costs and benefits of alternative investments, but also to allow all elements of the urban transportation system to function most efficiently.

The interrelationships between transportation and major development projects are another major area of concern. Large-scale developments such as regional shopping centers, industrial parks, major recreational facilities and extensive urban redevelopment areas create special transportation and other impact problems. Tools are needed to project the transportation needs and impacts likely to be associated with such projects. Methods by which potential problems can be ameliorated or eliminated are also needed.

New tools, both computerized and manual, are required to fill these needs. The metropolitan transportation studies introduced and institutionalized the computer as a transportation planning tool. Computer models have since been developed for transportation simulating and forecasting systems, urban development and environmental impacts. Many manual planning and forecasting tools are also available. However, many don't meet the needs of today's decision-makers. The following issues and problems concerning transportation planning and impact forecasting tools will be addressed in this paper:

- Present Planning Tools: Problems
- The Urban Transportation Planning System
- UTPS Funding

The discussion will focus on a widely used planning package, the Urban Transportation Planning System (UTPS).

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[1] Boyce, D.E., N.D. Day and C. McDonald. Metropolitan Plan Making, Monograph Series No. 4. Philadelphia, PA.: Regional Science Research Institute, 1970.

Chapter II provides sources of further information on programs and on-going research on transportation planning and impact forecasting tools. Chapter III gives an annotated bibliography.

Present Planning Tools: Problems

Historically, most planning tools have been oriented to long-range, system planning. They required large amounts of data with long turnaround times, and thus considerable computer and labor resources. Because of the high cost, and the inherent restrictions in some models, there were a limited number and type of alternatives that could be dealt with. Many planning techniques were unable to evaluate multi-modal alternatives accurately and responsively. The models often dealt only with aggregate travel data, and as such, were not sensitive to local conditions.

While transportation and land use planners were collecting data, developing models, calibrating models and making forecasts and evaluations to develop transportation plans, a process that sometimes consumed years, local decision-makers were being called upon to make project investment decisions and initiate project construction, sometimes under time limits of several months. Decision-makers needed policy-sensitive, short-range, planning tools which were inexpensive and did not require large amounts of data to evaluate alternative options and their impacts. Information on the land use and environmental impacts of various alternative transportation plans and projects were also needed in a timely manner.

In addition, new policies emanating from the Urban Mass Transportation Administration (UMTA) and the Federal Highway Administration (FHWA) have placed much greater emphasis on short-range, low-capital-intensive improvements, Transportation System Management (TSM) strategies[1]. The concept behind these policy directives is to insure that present transportation facilities are used to their full capacity before new capacity is added.

Analysis of alternatives and environmental impact has also been mandated. For those areas planning large-scale capital investments in mass transportation projects, UMTA has published a federal policy on assistance for "Major Urban Mass Transportation Investments"[2]. The policy statement mandates an alternatives analysis and final environmental impact statement by communities seeking capital assistance for major

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[1] UMTA and FHWA. "Transportation Improvement Program." Federal Register, Vol. 40, No. 181, September 17, 1975, pp 42976-42984.

[2] Urban Mass Transportation Administration, US DOT. "Major Urban Mass Transportation Investments." Federal Register, Vol. 41, No. 185, September 22, 1976, pp 41512-41514.

transit investments. Major mass transportation investments are defined as:

> any project which involves new construction or extension of a fixed guideway system (rapid rail, light rail, commuter rail, automated guideway transit) or a busway, except where such project is determined by the Administrator to be of importance as a demonstration of advanced technology.[1]

The alternatives analysis, which must occur in the context of a comprehensive transportation planning process, should consider a range of alternatives including TSM-type improvements. Federal support will be given only for those alternatives which:

> the analysis has demonstrated to be cost-effective, where effectiveness is measured by the degree to which an alternative meets the locality's transportation needs, promotes its social, economic, environmental and urban development goals, and supports national aims and objectives.[1]

Pursuant to the National Environmental Policy Act of 1969, the FHWA also requires alternatives analysis and projection of environmental impact for proposed projects:

> It is the policy of the Federal Highway Administration that in the development of a project a systematic interdisciplinary approach be used to assess engineering considerations and beneficial and adverse social, economic, environmental, and other effects; that project development involve consultation with local, State and Federal agencies, and the public; that decisions be made in the best overall public interest based upon a balanced consideration of the need for fast, safe and efficient transportation, public services, and social, economic and environmental effects, and national environmental goals.[2]

To meet the changing needs of transportation planners at the local level, the UMTA Office of Research and Development began a research and development program, in 1972, to:

- Research and develop improved planning techniques;
- Implement these techniques in generalized computer software;

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[1] Ibid., pp 41512-41514.

[2] FHWA. Federal-Aid Highway Program Manual, Vol. 7, Ch. 7, Sec. 2, January 2, 1976.

- Pilot test software in urban areas to ensure its appropriateness and demonstrate its utility;
- Distribute the software to local planners;
- Provide technical backup by training users and responding to queries from the field.

The result of these efforts is the Urban Transportation Planning System (UTPS). While the present UTPS package does not solve all of the problems mentioned above, it is constantly being improved and updated. A number of short-range, policy-sensitive techniques will soon be offered.

Historically, PLANPAC, the computer program package developed by FHWA, has been used by many jurisdictions. UTPS represents an improved transportation planning tool package and is now being supported by both UMTA and FHWA. Local governments are encouraged to become familiar with and use UTPS to assist their transportation planning efforts.

The next section overviews UTPS and the process by which it is developed and disseminated.

The Urban Transportation Planning System

The Urban Transportation Planning System (UTPS) is "comprised of computer programs, attendant documentation, users guides and manuals covering both computerized and manual planning methods"[1] for the planning and analysis of multimodal transportation systems. There are 20 computer software modules and other non-computer based techniques which manipulate and display data in forms usable by the transportation planner. Up to now, UTPS has most often been associated with long-range system planning. However, there is no structural limitation of the system to long-range planning, and better methods and programs for short-range and sketch planning levels of analyses are currently under development by UMTA and FHWA.

UTPS provides numerous opportunities for moderately sophisticated users to tailor the product to their specifications. The only demand model contained within UTPS is a "default" one, which can be used "as is" for a first-cut analysis. UTPS is not a monolith, and can be used for a variety of jobs. It is not limited to the straight trip generation, distribution, modal split and traffic assignment functions of conventional forecasting models. Nor is the model limited to forecasting only. It may be used to estimate costs, analyse accessibility to different kinds of opportunities, or process survey data, none of which relate directly to forecasting.

Because FHWA and UMTA realize the need for flexibility within their software system, the aim is to develop a UTPS system with three overlapping, sequential and iterative planning activities: long-range planning, which includes tactical and sketch planning; short-range planning; and system surveillance.

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[1] UMTA and FHWA. Urban Transportation Planning System Introduction. Washington, D. C.: US DOT, January 1976.

A number of improvements are planned for UTPS. Many of the near-term efforts are described in Chapter II of this report. Longer-term goals include: freeing UTPS users from their dependence upon IBM 360/370 computers or their equivalents (e.g. AMDAHL 470) by making the UTPS modules capable of running on other hardware systems and minicomputers; allowing for more real time interface between the user and the machine and less batch; graphic techniques instead of laborious coding; and using more disaggregate planning data and modules.

As new capabilities are developed, they are carefully tested and revised to meet uniform software design standards and fit into the UTPS format. This process allows easier dissemination to new users and deployment of new modules as they become available.

UTPS has an extensive dissemination program. Courses are held on three basic levels of familiarity with modeling techniques. The one-day management forum is held four times per year in the field. It is basically designed for non-technical management level staff in agencies potentially interested in using the UTPS system. Many of these sessions are followed by a one or two-day workshop with the technical people in the area who are using UTPS or some other computerized planning system. Attendees discuss problems with present programs, suggest improvements, outline ideas for innovative applications, and suggest new program capabilities.

The major training for users comes from the week-long UTPS training sessions held in Washington, D.C. and the field approximately four times a year. This course is designed for experienced transportation planners. Instructors take the prospective users through all the UTPS modules, explaining the wide variety of options available.

Users are also provided with the "Dial UTPS" number, a toll free line that can be used by anyone who has a terminal and long-distance phone hookup. Users can call into the number anytime with a question. The question and its answer are then stored temporarily so that callers have the benefit of the replies to previous questions. Any new developments in UTPS are also announced over the Dial UTPS line. New developments are covered in the UTPS newsletter, which also features announcements of training sessions, results of research and development projects and other information of interest to UTPS users.

UTPS is regarded by FHWA and UMTA as evolutionary, and all of the dissemination mechanisms described above are also used to gather feedback on how well UTPS is meeting the needs of its users. For example, previous comments indicated a weakness in the area of policy-sensitive tools suitable for short-range planning and analysis of Transportation System Management (TSM) improvements. This has become the prime area of present research and development. An extensive mailing list of former UTPS course enrollees is maintained to facilitate communication.

Even with the rigorous training schedule and extensive communication mechanisms, UTPS sponsors feel that present dissemination efforts may be

improved. Local governmental officials agree. Limited staff time and travel budgets make it unlikely that the number of courses given will expand greatly in the near future; however, classes fill up as soon as they are announced.

A problem acknowledged by many who develop and disseminate UTPS is that use of the system seems to currently reside almost exclusively at the Metropolitan Planning Organization (MPO) level, and few general purpose local governments have been able to take advantage of it. This void will become more critical as UTPS adds short-range, tactical planning capabilities.

Some MPO's, notably the North Central Texas Council of Governments (Dallas-Ft. Worth) and the Tri-State Planning Commission (New York City area) have taken steps to fill the void between the local governments and the MPO. Both Tri-State and NCTCOG are working out arrangements with their respective local governments to share some of the MPO's technical expertise in this area. Both MPO's are developing sub-area focusing and windowing techniques in conjunction with FHWA and UMTA. These are techniques for network aggregation which can focus on a smaller area, reducing the size of the coded description of the highway-transit network outside that area. Such techniques speed the computations and reduce costs.

Other MPO's could also make a valuable contribution to improving the quality of local government transportation planning by 1) informing the general purpose local governments, particularly planning and operating agencies within their jurisdiction, of the analytical capabilities provided by UTPS and offering to perform analyses for these agencies; 2) training agency personnel to do their own analyses, and 3) developing and refining the MPO's capability to focus accurately on sub-area planning issues with UTPS.

In addition to the UTPS training program, UMTA and FHWA jointly sponsor two general courses for planners. "An Introduction to Urban Transportation" and "An Introduction to Urban Transportation Analysis" are each offered three times a year in Washington, D. C. More information on these courses, as well as application procedures, can be obtained from your UMTA or FHWA Regional Office.

UTPS Funding

Funding for use of UTPS follows normal FHWA/UMTA procedures. (See report on Integrated Highway-Transit Planning.[1]) The MPO estimates the

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[1]Urban Consortium for Technology Initiatives. Institutional Framework for Integrated Highway-Transit Planning. Washington, D.C.: Public Technology, Inc., 1978.

amount of money required for computer time and personnel engaged in UTPS-related planning activities. This is included in the Unified Work Program and funded from UMTA Section 9 technical studies money, FHWA PL or HPR money, or other sources. The cost of sending personnel to UTPS training seminars is an allowable administrative expense under Section 9. The UTPS package itself is free to public agencies.

Chapter II

CONTACTS AND CURRENT PROGRAMS

CONTACTS

Responsibility for transportation impact forecasting programs on the federal level is shared by various offices in the Urban Mass Transportation Administration and the Federal Highway Administration. Please note that Urban Mass Transportation Administration (UMTA) staff is housed in two offices:

- Departmental Headquarters (DOT)
  Nassif Building
  400-7th Street, S. W.
  Washington, D. C. 20590

- TransPoint Building (TRPT)
  2100-2nd Street, S. W.
  Washington, D. C. 20590

Also, please note that the code following each name is for identification and should be included in written correspondence.

Program activities and contact persons are listed below:

Urban Mass Transportation Administration

- Office of Planning Methods and Support

  Develops new capabilities for UTPS and other planning tools, disseminates UTPS. Contact: Robert B. Dial, UPM-20, DOT-Room 9307, (202) 426-9271.

- Office of Technology Development and Deployment - Operational Technology Development Program.

  Develops planning guidelines and tools for use with paratransit. Contact: Ed Neigut, UTD-22, TRPT-Room 6104A, (202) 426-8483.

Federal Highway Administration

- Office of Highway Planning - Urban Planning Division, Technical Support Branch.

  Develops new capabilities for UTPS and other planning tools. Maintains PLANPAC and BACKPAC, the FHWA planning batteries. Does research on travel behavior. Contact: David S. Gendell, HHP-22, DOT-Room 3233, (202) 426-0182.

CURRENT PROGRAMS

Office of the Secretary - The Office of the Secretary in cooperation with UMTA and the U. S. Department of Housing and Urban Development financed the Bay Area Rapid Transit (BART) Impact Program which is administered by the Metropolitan Transportation Commission, the regional transportation planning body for the nine county San Francisco Bay Area. The BART Impact Program is a five year comprehensive study and evaluation of the impacts of BART, San Francisco Bay Area's new rapid transit system.

The BART Impact Program covers the entire range of potential rapid transit impacts, including impacts on traffic flow, travel behavior, land use and urban development, the environment, the regional economy, social institutions and life styles, and public policy. The incidence of these impacts on population groups, local areas and economic sectors will be measured and analyzed. The benefits of BART, and their distribution, will be weighed against the negative impacts and costs of the system in an objective evaluation of the contribution that the rapid transit investment makes toward meeting the needs and objectives of this metropolitan area. It is expected that the impact assessment methodologies and certain of the assessment findings will be useful to other urban areas contemplating major transportation investments. A final report is expected during 1979. Contact: Helen Doo, Headquarters Coordinator, P-12, DOT-Room 10301, (202) 426-4303.

Federal Highway Administration and Urban Mass Transportation Administration -

AVAILABLE PLANNING TOOLS

Brief descriptions of many of the various types of planning tools currently available from UMTA's Office of Planning Methods and Support and FHWA's Urban Planning Division are included on the following pages. The information for these descriptions was provided with the cooperation of UMTA and FHWA staff. For more information on any of these items, please contact Lee Jones or Irene Engelhaupt, UMTA, UPM-20, DOT-Room 9307, (202) 426-9271, or David S. Gendell, FHWA, HHP-22, DOT-Room 3233, (202) 426-0182.

A. UTPS Software and Documentation

1. Network Analysis - Transit

UNET, the transit network program creates or updates a description of the transit network. Its inputs are link data which describe the physical transit network and line data which describe all transit routes. Outputs include transit system characteristics: route miles, required number of vehicles, vehicle hours and daily cost, detailed transit line descriptions for input to the path building program (UPATH) and loading program (ULOAD), and printer plots of selected lines and links.

INET, the integrated network program, reads a highway network and transit line data and writes a transit network description for use by the path building program (UPATH) and the loading program (ULOAD) for further analysis of transit service. INET greatly simplifies transit network coding by accessing the coded highway network output by the highway network builder (HR). Outputs include transit system characteristics: route miles, required number of vehicle crews, vehicle hours, energy consumption, and pollutants. In addition, INET can be used in the determination of headways, construction of line schedules, and the estimation of operating costs.

UPATH, the transit path builder, reads the network description from UNET and outputs a description of shortest interzonal paths between all or selected zones in the system. The criteria for determining the shortest path includes fare, distance, waiting times, and transfer penalties. Output includes matrices of zone-to-zone fares, distances, composite impedances, and a transit paths file for input to the minimum path summary program (UPSUM).

UPSUM is the transit path analyzer which reads each minimum path from UPATH and outputs zone-to-zone impedance matrices. These matrices show component parts of the trip on the minimum path between all zone pairs in the system. Component parts include transit running times by mode, walk time, total out-of-vehicle time, transfers, and total travel time, all of which are used as input to demand models in UMODEL.

ULOAD, the transit passenger loading program, loads trip tables (as output by UMODEL) on the transit network using a set of minimum paths. ULOAD summarizes, reports and/or plots the results of this load. Outputs include a description of the O/D demand for selected segments of the transit network.

USTOS, the station-to-station transit volume analyzer, reports passenger flows between selected nodes (stations) in the system. Based on transit paths and trip tables, outputs include station-to-station trip matrices and access/egress station matrices for each zone-to-zone trip, as well as summaries of access and egress volumes by mode for each station.

2. Network Analysis - Highway

HR, the highway network data collection program, creates or updates a highway network from link data cards. These data describe link distances, travel time, facility type, number of lanes and other characteristics for input to the highway assignment program, UROAD. Outputs include a data file describing the highway network for other programs (e.g., UROAD, NAG), and printer plots of the network and its associated attributes.

UROAD, the highway analyzer and assignment program, finds shortest (and other) paths based on any combination of time, distance, or tolls. It also assigns trips to the highway network using a state-of-the-art route-choice equilibrium algorithm, or other techniques at the user's option. Its inputs include the network (from HR) and highway trip tables (e.g., as output by UMODEL or AGM). The program permits the user to select from a variety of capacity restraint and multipath loading techniques (including "selected link"). Besides an updated historical record with link and turn volumes, UROAD outputs O/D trip matrices for selected links, impedance matrices, selected paths, link loadings and speeds, VMT, VHT, pollution emission and energy consumption estimates, and plots describing any of the above. Sub-areas of the regional network may be treated in much greater detail using the micro assignment option in UROAD. This allows intersection controls to be represented realistically and traffic flows and delays more accurately estimated.

NAG, the network aggregation program, performs three separate functions: (1) extracting network supply and travel demand information for a subarea of a region, ("windowing"), (2) aggregating travel demand information as a function of the distance from the subarea being analyzed ("focusing"), (3) displaying travel demand information on an abstract network representation ("abstracting").

NAG Windowing yields a subarea network from an historical record with trip tables truncated at the point they cross the subarea boundary. This subarea can then be updated to produce a finer level of detail, and trip tables expanded to reflect smaller zones. Inputs include an HR and trip tables and outputs include an updated network and reports similar to those in UROAD.

NAG Focusing is a zonal aggregation technique that permits the user to obtain approximate traffic flows within a subarea without the need for a complete regional assignment. By determining which origin zones outside the designated subarea are to be aggregated to districts or superdistricts, focusing effectively reduces the number of origin zones to be treated, and hence reduces the cost of subsequent assignments.

NAG Abstracting is a procedure for assigning trip tables to an abstract, computer generated grid-and-diagonal network. The resulting link flows, which represent desire-line volumes, are then plotted in the form of bandwidth or numerical printer plots, which can then be examined to ascertain the spatial nature of travel demand.

3. Demand Estimation

UMODEL, the demand model program, accommodates virtually any user-specified direct demand or mode choice model. A "default" direct demand model is available in UMODEL for the user who requires first-cut estimates and lacks the time to construct and calibrate his own model. Inputs include user-provided Fortran-coded subroutines, as well as zonal and matrix data. Outputs consist of modal trip tables, disaggregate datasets, or calibration files which can be used by programs ULOGIT and UREGRE.

UREGRE, the regression program, reads either raw data or calibration files (as output from UMODEL) and performs linear multiple regressions according to a set of user-provided model specifications. Outputs include regression parameters, goodness-of-fit measures and residual analyses.

ULOGIT, the logit calibration program, calibrates models of the linear logit form, a particularly useful model for mode choice forecasting. Using a calibration file produced from UMODEL, it uses a maximum likelihood estimation technique to estimate parameters. Outputs include parameter estimates, plots, and goodness-of-fit statistics.

AGM, the gravity model program, automatically calibrates and forecasts trip distributions. Inputs include trip tables and, optionally, friction factors and zone-to-zone adjustment factors. Outputs include calibration and/or forecasting results, with comparison plots of estimated and observed trip tables and trip length frequency distributions.

UCEN70, the census data processing program, reads U. S. Bureau of Census "count" tapes and produces both a zonal data file (ZFILE) and printed reports of use-selected subsets of the data provided on these tapes. Capabilities include both the aggregation of tracts to districts or the splitting of tract data to zones using either internal or user provided splitting fractions.

4. Matrix Operations and Evaluation

MBUILD, the matrix building program, constructs matrices from input origin-destination survey records or from calibration files, as output from UMODEL. The detection of erroneous and illogical values is facilitated by a large editing and screening capability. Trip factoring or data recoding is accomplished through the use of user-specified lookup tables. Output consists of trip tables and edit summaries as well as detailed raw data disclosures.

UMATRIX, the data manipulation program, performs arithmetic and functional operations on matrices and zonal data. Capabilities such as multiplication, division, addition, and subtraction, as well as special functions such as transportation and exponentiation, are available. The use of logical expressions (if A then B else C) allow for matrix zonal modification and permit a variety of demand analysis, system evaluation

and data preparation chores to be done easily. A plotting feature enables the posting of matrix row or zonal data at zonal centroid coordinates.

The input and output of zonal and matrix data allows the user to readily apply a great variety of trip generation, mode choice and auto occupancy models. A "lookup table" capability facilitates the input of "new" zonal data as well as the modification of matrix and zonal data cell values. In addition, special functions provide the basis for data aggregation and stratification.

UMCON, the matrix conversion program, creates, merges or extracts matrices. Its inputs can include trip tables and impedance matrices in card format or as output by the IBM 7090 BPR programs, HUD transit programs, the FHWA/PLANPAC battery and UTPS programs. Matrix modification capabilities include scaling matrices to new row and column totals (Fratar-like process) and the alteration of individual matrix elements. Outputs are trip tables in any of the above formats.

USQUEX, the matrix expander and compressor, is used to change the size of matrices. It can compress or "districtize" a larger matrix to a smaller size by combining or rearranging rows and columns. It is able to expand a matrix by assigning fractions of certain rows and columns to new zones. Inputs are matrices and outputs include matrices and output zone/district trip-end fraction cards.

UFMTR, the matrix formatting program, has the capability to print or to plot the contents of matrices. Outputs are only reports and include row-by-row listings of table contents, selected row displays, plots of trip length frequency distributions, and scattergrams comparing two matrices.

5. Sketch Planning

CAPM, the community aggregate planning model, is a highway sketch planning tool designed for the rapid estimation of impacts of various policy alternatives. It can address several issues including the location, magnitude, and functional type of urban highway investments; highway operating strategies; and future land development policies. Inputs include trip-ends and lane miles of freeways and surface arterials. Default values and functions distribute demand, resulting in such system performance measures as construction and maintenance costs, volumes, speeds, fuel consumption, and pollutants.

B. Other Items Available on UTPS Tapes

UINTRO: The "UTPS Introduction" is a manual that provides first level orientation and information on UTPS documentation, available programs, manuals, UMTA/FHWA training sessions, and related guidance.

REFMAN: The "UTPS Reference Manual" describes various control cards, software system description, data file formats, catalogued procedures, and program writeup

NETWORK: The "Network Development Manual" descibes transit network coding techniques.

DEMAND: The "Demand Model Selection Manual" describes procedures and criteria used in the selection of appropriate demand estimation strategies for particular planning problems.

SUBRTNS: The "UTPS General Purpose Subroutine Documentation" is the documentation for all subroutines used in UTPS and available to its users.

DATASETS: Test datasets are used in various phases of the "UTPS Case Study" described in the "UTPS Users Guide."

C. Users Guides and Case Studies

1. UTPS Users Guide and Case Study includes a technical review of the urban transportation planning process as well as a comprehensive case study. The UTPS case study serves three functions. First, it provides the user with a quick and simple method of testing all UTPS computer programs to insure their operation on his installation. Second, the test case allows the user to become familiar with the inputs, program control, and outputs of each program through their execution. Finally, the case study affords the user a comphrehensive view of how the programs fit together in application to the analysis of a transportation system.

2. Vehicle Trip Demand Model Calibration involves an example application of UTPS programs to calibrate trip generation and trip distribution models for predicting internal auto vehicle trips. This application is generally appropriate for smaller urban areas where transit is not a major consideration.

3. UMODEL Users Guide (with case studies) contains a detailed explanation of the functioning of UTPS program UMODEL, as well as 16 case studies which detail typical planning applications of the program. In addition, a "default" travel demand model resident in UMODEL is described in detail, both in theory and in function.

4. ULOGIT Users Guide includes a description of the logit model which is becoming popular in travel demand forecasting (especially mode choice modelling) as well as a discussion of disaggregate models in general. Also included is a case study which details the logit model calibration process with UTPS program ULOGIT as well as the model's application and checking with other programs.

5. CAPM Users Guide gives a summary of the algorithms used in CAPM (community aggregate planning model), the important assumptions made in development of the model, and the implications of these assumptions for sketch planning applications. A number of example applications are included to demonstrate appropriate approaches to sketch planning problems.

6. CAPM Case Study details the application of CAPM in an air quality study. The case study highlights data preparation, emission inventory, analysis of control strategies, and interpretation of results. Special emphasis is given to the use of CAPM to do quick response analyses of various short range transportation alternatives.

D. Manuals (available where noted from National Technical Information Service Springfield, Virginia 22161)

1. Characteristics of Urban Transportation Systems (CUTS) provides a single reference source for the most important evaluation performance characteristics of five contemporary urban transportation systems (rail, bus, highway-automobile and mixed-mode, pedestrian assistance systems, and people mover systems) in a format that lends itself to easy reference. This handbook does not deal explicitly with passenger demand, but assesses only the supply or performance characteristics of urban transportation systems. (Available on UTPS tape or through National Technical Information Service [NTIS] - PB # 245-809, $7.00.)

2. Characteristics of Urban Travel Demand (CUTD) complements the CUTS manual and provides a comprehensive and easily accessible consolidation of information relative to the many dimensions and aspects of urban travel behavior and transportation systems usage. It contains urban area aggregate and disaggregate transportation demand data, cross checks of the conventional transportation planning process, and suggests simplified procedures for estimating or validating urban transportation demand.

3. Introduction to Urban Travel Demand Forecasting enables transportation planners and analysts to utilize UTPS effectively. It is a comprehensive overview of the metholdology of travel forecasting, the analytical tools, available and their appropriateness for typical problems. Input requirements, outputs needed for proper evaluation, and appropriate levels of effort for various stages of analysis are also discussed.

4. Traveler Response to Transportation System Changes seeks to bring under one cover a compendium of knowledge based on past observation and estimation of traveler responses to different types of transportation system change. It is intended to aid transportation planners and decision-makers by providing familiarization with results obtained elsewhere with respect to ten types of transportation change: pool/bus priority lanes, variable work hours, car pooling encouragement activities, bus pools/van pools, area auto restraints, auto facility pricing, transit scheduling/frequency, bus routing/coverage, transit fare changes, and transit marketing/amenities.

5. Transportation System Evaluation Indicators develops evaluation measures based on local objectives to help transportation improvements. Sets of objectives are developed for each of four perspectives, including a community consensus from which planning and decision-making are done. There are also the perspectives of the user of transportation services, the non-user, and the operator of transportation services. Subsets of evaluation indicators so developed are more fully described in terms of data requirements, potential stratifying variables, methodology, and applicability. (NTIS - PB # 221-572, $6.00.)

6. Transit Corridor Analysis: A Manual Sketch Planning Technique describes a coarse technique for quick, first evaluations of short and long range plans for urban line-haul transit systems. This manual, non-computerized technique does not provide a single, definitive solution, but can provide for each system alternative measures of demand, performance, and impacts. (Available by June 1979.)

7. Analyzing Transit Options for Small Urban Communities is a three volume manual which provides an analytical framework and supporting analytical techniques to assist state and local planners and decision makers in the analysis of transit options in communities generally smaller than 200,000. Sufficient information is provided in the manual to permit the small urban area to conduct its own analysis without resorting to outside assistance.

8. Simplified Aids for Transportation Analysis is a continuing set of manuals detailing various procedures addressing various problems in urban transportation analysis. Gathered from transportation planners across the country, the analytical procedures described in each of six volumes are shortcut, manual approaches to the study of specific urban transportation problems, from parking requirements at site traffic generators to scheduling of transit vehicles.

9. Downtown People Mover (DPM) Planning Manual documents the state-of-the-art in planning data and methods with specific emphasis on the relationship between critical system design issues and demand, impact, and cost estimation for proposed DPM level of service. The manual contains considerable data and reference sources as a summary of existing system experience.

10. The Urban Transportation Planning System (UTPS): An Introduction for Management describes the computerized planning tools of the UTPS package, including such management considerations as who can benefit from using the package and the resource requirements and support necessary for effective utilization. The information is presented as non-technically as possible, and is enhanced by the use of several UTPS applications in real-life planning situations.

11. Innovation in Public Transportation provides detailed information on the research, development, and demonstration projects sponsored and funded by the Urban Mass Transportation Administration and which were active in Fiscal Year 1977. Planning methods research and special planning

studies are also included. Information is presented on both a program and project level. Copies may be obtained from the Technology Sharing Program Office (DTS-151) of the Transportation Systems Center, Kendall Square, Cambridge, MA 02142. Phone (617) 494-2486.

12. Dual Mode Transit Planning Case Study (2) (7 volumes) analyzes the operation, economics, and impact of dual mode transit systems in two urban case study settings--Milwaukee, Wisconsin and Orange County, California. A dual mode system utilizes vehicles capable of operating both automatically on a reserved guideway and manually over streets and highways. The methodologies illustrate ways of treating complex modal interfaces and operating strategies.

13. Modeling Demand-Responsive Feeder Systems in the UTPS Framework provides an analytical framework for planning door-to-door feeder service for low density areas. A methodology is provided for incorporating these systems into the transit network analysis modules of UTPS. A basic knowledge of UTPS is assumed. (Available from NTIS - refer to number UMTA-MA-06-0049-78-9.)

E. Audio-Visual Instruction

1. An Overview of Urban Transportation Planning (slide/tape) reviews the basics of the urban transportation planning process within the framework of the joint FHWA/UMTA regulations of September 1975. Among the items described in the presentation is the transportation system management (TSM). The presentation is designed for persons who are unfamiliar with transportation planning and travel forecasting. (Available on loan from UMTA or FHWA regional offices.)

2. An Introduction to Urban Travel Demand Forecasting (slide/tape) provides an overview of forecasting using the traditional planning process as a basis. The topics covered include what forecasting is, how it fits into a planning scenario, what the data requirements are, and an example of the travel demand forecasting process. Also available is a self-instructional text of the same title. (Available on loan from UMTA or FHWA regional offices.)

3. USS Transit Station Simulation (film) introduces potential users in the planning community to the capabilities and basic principles of operation of the USS Transit Simulation program. (Available on loan from UMTA, UPM-20.)

4. USS Transit Station Simulation - Case Study of the Metro Center Station (slide/tape) provides a practical example of the application of the USS Transit Station Simulation model to the analysis of a transit station, showing detailed data requirements, procedures, and typical results obtained. (Available on loan from UMTA, UPM-20.)

F. Standardized Research Datasets

1. Shirley Highway Datasets (1971, 1974) are disaggregate travel data sets suitable for use in research on travel behavior and demand modeling. The data were collected as part of the Shirley Highway Express Bus-on-Freeway Demonstration Project which was sponsored jointly by UMTA and FHWA. The data result from two surveys--one in 1971, the other, in 1974--of commuters in the Shirley Highway Corridor. (Available from UMTA, UPM-20.)

2. Baltimore Travel Demand Dataset (1977) was specifically designed to facilitate further research into the theory and application of individual choice models. Towards this end, several unique kinds of data were collected. Among these are (1) perceived attributes of travel modes; and (2) alternative destinations. A stratified random sampling technique was used to ensure a sample of transit users large enough to support demand model estimation. Data were obtained from a total of 970 households. (Available from FHWA, HHP-22.)

G. Highway-Oriented Planning Tools

1. FREQ3CP (Simulation of Freeway Priority Strategies)

Developers: University of California for Federal Highway Administration

DOT Contact: Robert Redmond, FHWA, HHP-33, (202) 426-0210

Function/Purpose: Priority strategies for buses and carpools on freeways, including ramp meter bypass lanes.

Type and Description: The computerized model FREQ3CP is written in American National Standard (ANSI) Fortran. The model was developed and tested on an IBM 360/65 (O.S.) and a CDC 6400. It runs in 170K on an IBM 360.

Minimum Required Inputs: Demand characteristics: Ramp origin-destination tables and passenger car and bus occupancy. Freeway characteristics: capacity, weaving, speed-flow and ramp characteristics.

Outputs: Evaluation measures of effectiveness such as freeway travel time and delay in vehicle hours and passenger hours; volume/capacity ratio; vehicle desnity; speed; queue lengths and storage rates. The optimization submodel selects a priority entry control strategy; a set of allowable ramp meter rates and priority cut-off levels.

Status: Operational, available from FHWA's Urban Planning Division.

2. MAGTOP (Management of Traffic Operations Computer Program)

Developers: Developed for New York State Department of Transportation. Converted into ANSI FORTRAN for Federal Highway Administration.

DOT Contact: Perry A. Davison, FHWA, HHP-30 (202) 426-0210

Function/Purpose: The system has been designed to assist the traffic engineer in developing traffic operations improvements. The system stores, summarizes, analyzes and displays traffic operations data.

Type and Description: Computer program written in ANSI FORTRAN with IBM 360/370 extensions where necessary. Runs in 190K on IBM 360.

Minimum Required Inputs: Depends on required output. Data includes: network description; physical characteristics; volume counts; speed/delay runs; and accident data.

Outputs: Modules are included to calculate capacities, signal offset analyses, statistical analysis and collision diagram analysis. Other modules provide reports on volume counts, speed/delay, accidents, volume/capacity, signal timing and physical character.

3. FHWA Carpool Matching Program

Developers: Federal Highway Administration

DOT Contact: Robert Redmond, FHWA, HHP-33 (202) 426-0210

Function/Purpose: The program provides lists of potential carpoolers to other potential carpoolers and also has buspool and vanpool planning capabilities.

Type and Description: The computer program is written in American National Standard COBOL and thus should be readily transferable to environments other than the IBM 360/65 (O.S.) under which it has been developed and tested. Runs in 100K on IBM 360.

Minimum Required Inputs: The input data cards require such information as the participant's name, address, home and work grid coordinates, and reporting and departing times.

Outputs: Master list is a list of information on participants having a common destination. Mail list is same as master except matched according to arrival and departure times. The grid density matrix gives a visual representation of the number of participants by home grid, work grid and times.

4. Land Use and Arterial Spacing in Suburban Areas

Developers: Gruen Associates

DOT Contact: George Schoener, FHWA, HHP-24 (202) 426-0150

Function/Purpose: Simplified guidelines for estimating major street system sizes and spacing in respresentative suburban areas. The guidelines supplement conventional methods of traffic forecasting and circulation planning in cases where technical resources are very limited or quick estimates for alternative development proposals are needed.

Type and Description: Manual technique based on a relationship between suburban development densities and per-mile traffic volumes. Adjustment factors are provided for different project size and density combinations, level of traffic service, car ownership, transit use, nonresidential-residential mix and freeway diversion. Additional relationships are provided for special generator analysis (e.g., airports, universities, hospitals and others).

Minimum Required Inputs: Residential population, dwelling units, autos or income, residential labor force, number of jobs, peak hour transit usage and special generator characteristics (e.g., number of employees, size in acres and others).

Outputs: An estimate of traffic volumes per mile within the suburban area and the associated lane requirements.

5. Guide to Urban Traffic Volume Counting

Developers: Wilbur Smith & Assoc. for FHWA's Urban Planning Division.

DOT Contact: Michael Smith, FHWA, HHP-24 (202) 426-0150

Function/Purpose: Sampling methods for estimating vehicle miles of travel (VMT) and statistical guidelines for counting traffic at given locations and across screenlines and cordon lines.

Type and Description: Manual with limited computer processing.

Minimum Required Inputs: Highway link inventory (for VMT estimation).

Outputs: Specification of traffic count placement for estimating VMT and traffic volumes.

Status: Traffic counting manual available in draft form from FHWA's Urban Planning Division. The draft manual is currently being tested in several urban areas. After testing is complete, substantial revision of the manual is expected.

H. Useful References (by subject area)

For further information on any of these publications, get in touch with the UTPS contacts noted.

1. General

"Urban Transportation Planning - General Information," March 1972, available from FHWA, HHP-20, Washington, D. C. 20590. Chapters I through VI of this reference provide very useful technical information on several phases of the analytical planning process.

"A Review of Operational Urban Transportation Models," DOT, April 1973. NTIS - PB #222-109 $6.75. This provides a good, recent review of models of land use, travel demand, network analysis and some evaluation aspects.

"Evolution of Urban Transportation Planning," DOT, April 1976. Available from R. Dial, U.S. DOT, UPM-20, Washington, D. C. 20590.

"Urban Transportation Planning," Roger L. Creighton, University of Illinois Press, 1970. A good basic textbook.

2. Data Collection

"Urban Origin-Destination Surveys," 1973. Available from FHWA, HHP-20, Washington, D. C. 20590.

"Urban Mass Transportation Travel Surveys," FHWA, August 1972. Available from Government Printing Office, Stock No. 5001-0037, $2.10.

"Guidelines for Designing Travel Surveys for Statewide Transportation Planning," FHWA, May 1976. Available from FHWA, HHP-12, Washington, D. C. 20590. Sound advice for urban as well as statewide surveys.

3. Network Coding and Trip Assignment

"UTPS Network Development Manual" (on UTPS tape), covers transit network coding for use in UTPS programs.

"Traffic Assignment," FHWA, August 1973. Available from FHWA, HHP-20, Washington, D. C. 20590. Covers aspects of traffic assignment and some network coding issues.

4. Demand Estimation

"Introduction to Urban Travel Demand Forecasting," UMTA, March 1974. "Summary" - NTIS - PB #236-847/AS $3.75. "Volume I - Demand Modelling" - NTIS - PB #236-848/AS $9.25. A comprehensive text on modern demand modeling approaches, with case studies in application.

"Guidelines for Trip Generation Analysis," FHWA, June 1967 (Reprinted April 1973). Available from FHWA, HHP-20, Washington, D. C. 20590.

"Calibrating and Testing a Gravity Model for Any Size Urban Area," FHWA, October 1965 (Reprinted March 1975). Available from FHWA, HHP-20, Washington, D. C. 20590.

"Modal Split, Documentation of Nine Methods for Estimating Transit Usage," FHWA, December 1966. Out of Print. This has been widely distributed and should be available from a transportation library.

"Estimating Auto Occupancy, A Review of Methodology," FHWA, 1972. Available from Government Printing Office, Stock No. 5001-0035, $0.95.

"Demand Model Selection Manual" (On UTPS Tape). This is a brief guide to the criteria to be considered when structuring a demand estimation phase of a planning study.

"Statewide Travel Demand Forecasting," FHWA, November 1973, current techniques and practices in estimating demand for statewide systems. Available from FHWA, HHP-12, Washington, D. C. 20590.

"Urban Trip Distribution Friction Factors," FHWA, November 1974. A synthesis of gravity model friction factors for various city sizes and trip purposes. Useful in developing synthetic models or as starting "F"s for gravity model calibration. Out of Print. Reprint available soon from FHWA, HHP-20, Washington, D. C. 20590.

"Trip Generation by Land Use," Maricopa Assn. of Govts., Maricopa County, Arizona, April 1974. A synthesis of trip generation rates for deffering land uses. Useful in developing synthetic models, checking models or site planning. Available from FHWA, HHP-20, Washington, D. C. 20590.

"Trip Generation Analysis," FHWA, August 1975. Available from FHWA, HHP-20, Washington, D. C. 20590.

"Land Use and Arterial Spacing in Suburban Areas," FHWA, May 1977. Available from FHWA, HHP-20, Washington, D. C. 20590. A quick method for analyzing land use-arterial capacity relationships.

"Applications of New Travel Demand Forecasting Techniques to Transportation Planning, A Study of Individual Choice Models," FHWA, March 1977. Available from FHWA, HHP-20, Washington, D. C. 20590. An understandable treatment of disaggregate approaches to travel demand.

5. System Evaluation

"Introduction to Urban Travel Demand Forecasting," UMTA, March 1974. "Volume II - Evaluation" - NTIS - PB # 236-849/AS $4.75.

"Transportation System Evaluation Indicators," UMTA, April 1973. NTIS - PB # 221-572 $6.00. This is a comprehensive review of the types of criteria that are used in system evaluation and how they may be measured and presented.

"Characteristics of Urban Transportation Systems" (On UTPS Tape). This is a manual for planners giving parameters of cost, speed, capacity, emissions, energy use, etc. for conventional auto and transit modes. A very useful, continuously updated handbook. Also available from NTIS, PB # 245-809, $7.00.

"Methods of Evaluation of the Effects of Transportation Systems on Community Values" by Stanford Research Institute, for U.S. Department of Housing and Urban Development, April 1971. Analytical methods for community impact analysis. Available from NTIS, PB # 199-954, 343 pages, price (paper) - $9.50, (micro-fiche) - $2.25.

"Traveler Response to Transportation System Changes; A Handbook for Transportation Planners," FHWA and UMTA, February 1977. Available from FHWA, HHP-20, Washington, D. C. 20590. An excellent guide to past experience with system changes like carpooling, auto fare zones, transit route changes and using "T.S.M." type options. A video tape on this handbook is also available on loan from FHWA or UMTA regional offices.

Chapter III

ANNOTATED BIBLIOGRAPHY

This bibliography was compiled primarily from sources included in the Transportation Research Information Service (TRIS) network of the U. S. Department of Transportation as edited and supplemented by the staff of Public Technology, Inc., and provides additional references to those ntoed in Chapter II. This bibliography endeavors to give a sampling of the available literature rather than an exhaustive list of all sources of information on the topic.

GENERAL

Holmes, Edward H. Coordination of Urban Development and the Planning and Development of Transportation Facilities. Report for U. S. Department of Transportation, Federal Highway Administration. Washington, D. C.: U. S. Government Printing Office, March 1974. (Stock No. 500 1-00076, $2.50)

This report presents the results of an investigation of planning practice in cities in England, Scotland, Spain, Switzerland, France, Germany, Denmark, Sweden, Australia and Canada. The cities were selected not as necessarily representative of the general situation prevailing in those countries but as examples of effective practice in one or more aspects of the area of investigation: (1) the manner in which the technical aspects of planning are coordinated or related; (2) the coordination in timing and financing in areas of transportation and general planning as they are undertaken; (3) the sources of funds for transportation improvements; (4) the legal requirements and administrative practices that either require or permit desirable coordination; and (5) the extent and manner of involving public (citizen) approval and support of programs in the decision-making.

Lee, Jr., Douglass B. "Requiem for Large-Scale Models." Journal of the American Institute of Planners, Vol. 39, No. 3, May 1973, pp 163-178.

The purpose of this paper is to evaluate, in some detail, the fundamental flaws in attempts to construct and use large models, and to examine the planning context in which the models, like dinosaurs, collapsed rather than evolved. The conclusions can be summarized in three points: (1) In general, none of the goals held out for large-scale models have been achieved, and there is little reason to expect

anything different in the future. (2) For each objective offered as a reason for building a model, there is either a better way of achieving the objective (more information at less cost) or a better objective (a more socially useful question to ask). (3) Methods for long-range planning--whether they are called comprehensive planning, large-scale systems simulation, or something else--need to change drastically if planners expect to have any influence in the long term.

McGrath, D.C. "Appropriate Relationships Between Comprehensive Planning and Transportation Planning for the 1970's." Transportation (Neth), Vol. 1, No. 4, March 1973, pp 403-18.

Transportation planning and comprehensive planning have evolved as separate and frequently conflicting fields of professional activity. The results of the current separatism are apparent in a pattern of local injunctions against highway projects, belated analyses of a comprehensive range of environmental and socio-economic factors inherent in highway construction and wide-spread public demand for a reassessment of the true costs and benefits of highway systems. Organizational and structural prescriptions are offered to achieve integrated relationships between transportation planning and comprehensive planning institutions to achieve the potential benefits of both.

Moore, W.T., F.J. Ridel and C.G. Rodriquez. An Introduction to Urban Development Models and Guidelines for their Use in Urban Transportation Planning. Washington, D.C.: U.S. Government Printing Office, October 1975. (Stock No. 050-001-00108-0, $2.80)

This report focuses on the urban development model as an operational tool in the urban transportation planning process. The basic purposes are to provide (1) a general background on the development and use of urban development models, (2) an understanding of the basic principles involved and their operational characteristics, (3) an ability to make enlightened decisions on the evaluation and choice of a model and (4) information on the practical application of the models. Practical considerations are emphasized rather than the more complicated questions of theoretical concepts and techniques which are more appropriate for research and development exercises. Although by nature the urban development model is suitable for many applications in comprehensive planning, research, and other areas, this report will deal primarily with those models and the aspects of the models that are of concern in urban transportation planning.

Eight urban development models are described and evaluated in this report. The descriptions touch on the background, theory, capabilities, input and output requirements, calibration and software of each model. The evaluations also include a discussion of the model's potential usefulness in urban transportation planning studies.

National League of Cities and U.S. Conference of Mayors, Skidmore, Owings and Merrill and Development Research Associates. Transit Station Joint Development. Report No. DOT-OS-20021 for U.S. Department of Transportation and U.S. Department of Housing and Urban Development. Washington, D.C.: U.S. Dept. of Transportation, May 31, 1973.

This report examines the institutional, economic, legal, engineering and design problems associated with joint development of transit stations. Station sites in Oakland, Chicago and New York were used for case studies.

The objectives of the project were to assist representatives of local agencies in the preparation of draft applications to UMTA for funds to do joint development planning and to provide a report identifying possibilities for, and constraints to, transit station joint development. This report includes the city applications and summarizes the major findings and conclusions regarding the status of transit station joint development.

U.S. Department of Transportation. A Review of Operational Urban Transportation Models. Washington, D.C.: U.S. Department of Transportation, April 1973. (NTIS PB 222-109)

This provides a good, recent review of models of land use, travel demand, network analysis and some evaluation aspects.

Wachs, M. "Social, Economic and Environmental Impacts of Transportation Systems-Resource Paper", Highway Research Board Special Report #143. Washington, D.C.: Highway Research Board, 1973, pp 76-113.

A conceptual framework for classifying and identifying impacts that can be addressed through demand modeling is presented. The framework is used to analyze specific issues and options for more effective integration of demand modeling, and to analyze the impacts of transportation systems. Within this framework, specific opportunities for the establishment of linkages between impact analysis and demand modeling are presented. Based on the framework, recommendations are made for a series of research tasks aimed at operationalizing the linkages between demand analysis and concern for the environmental, social and economic impacts of transportation systems.

Linkages between travel demand models and first-order impacts are examined, and the measurement of differential accessibility levels is discussed. The need is indicated for greater disaggregation in demand modeling. The linking of demand models to first-order air quality and noise impacts is outlined. Short-term and longer-term research recommendations are proposed.

FORECASTING

Metropolitan Transportation Commission. Impact of BART on Transportation and Travel--Interim Service Findings, Interpretive Summary. Berkeley, California: MTC, July 1976.

This summary report is from the Transportation System and Travel Behavior Project of MTC's BART Impact Program. The goal of the Transportation Project is to analyze BART's effects on the travel habits of Bay Area residents and its interaction with other models of transportation. This report gives the results of preliminary analyses of BART's patronage and patrons; effects on other modes of travel; and costs, deficit and energy consumption.

Roberts, P.O. "Demand Forecasting for Long-Range and Contemporary Options-Resource Paper", Highway Research Board Special Reports, #143. Washington, D.C.: Highway Research Board, 1973.

The need for long-range forecasts is discussed, problems with the current urban transportation planning process and travel demand forecasting models are described and proposals for improving the overall transportation planning process are presented. The discussion of forecasting models focuses on those components of the overall system that deal directly with the demand and network equilibrium portions of the process. The lack of policy responsiveness, improper selection of attributes for modeling demand, inadequate determination of equilibrium flows and the importance of activity-system models to long-run demand are detailed. Specific recommendations regarding the improvement of forecasting models include the use of available demand-model knowledge to develop policy-responsive, behavioral, causal, short-run demand models; integration of supply and demand models in better equilibrium computations; development of activity-systems models that can be used to support longer range use of demand models; and development and incorporation of performance measures useful in decision-making.

Ruitter, E.R. "Analytical Structures-Resource Paper," Highway Research Board Special Reports #143. Washington, D.C.: Highway Research Board, 1973, pp 178-208.

A research program on analytical structures for travel demand forecasting is formulated. Extended definitions of demand models are presented and some alternative structures that have been applied to the travel demand forecasting problem are listed. The factors that must be considered in deciding on appropriate analytical structures for travel demand forecasting are discussed and a number of areas of necessary research are identified. The final section of the paper unifies suggestions for research into an integrated program in the analytical structure of travel demand forecasting.

Schalppi, M.L. and J.W. Dickey. Quadatt II: A Transportation Planning Tool. Blacksburg, Virginia: Virginia Polytechnic Institute, 1973.

Quadatt II (Quick and Dirty Analysis Technique for Transportation-second version) is a computerized transportation planning model which attacks the problems stemming from the high cost of data collection and computer time and the difficulty in interpreting and translating model output by simplifying the data collection process and outputs of the model. Quadatt II requires comparably little input data which may be obtained from readily available source such as the Census Bureau, planning agencies and highway departments. Costs are also decreased by gauging the computer execution time in seconds rather than in hours and by eliminating calibration. The understanding of the user is facilitated by presenting the output in a highly documented, tabular form. The principal purpose of Quadatt II is to restore credibility to computer-aided transportation planning models, to assist in metropolitan policy formulation, to increase understanding of the urban system and to prepare an atmosphere for developing more sophisticated planning models.

Scholl, R.A. and J.W. Dickey. On Developing a Model for Coordinating Multi-Modal Transportation Planning with Land-Use Planning. Blacksburg, Virginia: Virginia Polytechnic Institute, 1973. (NTIS PB 233 900/AS.)

This paper addresses the issue of developing a model which provides a methodological approach to multi-modal planning which would be coordinated with land use planning. The research in this paper focuses on the task of integrating multi-modal considerations into the land use allocation technique called TOPAZ (Technique for the Optimum Placement of Activities in Zones), a computer process which was created to provide a workable tool to aid in sketch-plan generation and analysis. In order to solve these problems, the planning of an optimal locational arrangement of land-use involves consideration of: (1) health and safety hazards; (2) proximity of modes; (3) compatibility with the community; (4) economic feasibility considering land values and costs; (5) practicality from a cost-revenue point of view; and (6) livability and general attractiveness. The technical application of the TOPAZ program to these particular problems is discussed in detail.

Baker, K. W. and J. D. Gruendler. "Case Study of the Milwaukee-Green Bay Interstate Corridor Location," Highway Research Board Special Reports #138. Washington, D. C.: Highway Research Board, 1973, pp 51-4.

A computer program was developed to be used in a corridor location study, simultaneously weighting the social, economic and environmental factors of a large area to determine the most acceptable location for a transportation facility. The first step was the development of a data bank (through a reference system based on the Universal Transverse Mercator Projection) capable of a quantitative and qualitative inventory of existing and future resources throughout the total area of 4,500 sq. miles. The basic data storage unit which is a 1-KM square or cell (of which there are more than 9,000 in the study area) is detailed. The 130 data items were structured as natural characteristics (hydrological, ecological, physiographical and pedological) and cultural characteristics (existing and projected land use, population and communications). Relative weights were assigned to each determinant. The computer application is capable of simultaneously considering many variables as location parameters. This computer-oriented program has proved effective in the corridor location process.

Worrall, R. D., S. H. Brounstein and R. W. Whitaker. Conceptual Design for Urban Transportation Planning Information System. Washington, D. C.: Peat, Marwick, Mitchell and Co., 1973. (NTIS PB 221 594.)

This report outlines a generalized conceptual design for an information system designed to service the continuing urban transportation planning process. It focuses particularly on the surveillance requirements of a continuing operations plan as defined in Federal Highway Administration Instructional Memorandum 50-4-68, "Operations Plan for 'Continuing' Urban Transportation Planning," and on the development of a system design appropriate to the resources of a typical transportation planning agency in an area of 50,000-5,000,000 population. Particular emphasis is placed on the effective use of data derived from existing local agency operating and administrative records. Separate sections of the report deal with (1) Data requirements for continuing transportation planning; (2) Information system design criteria; (3) Conceptual structure of a transportation planning information system; (4) Potential data sources; (5) Geocoding; (6) Computer requirements and software support; (7) System operation, administration and funding; and (8) Relationships to other systems.

ENVIRONMENTAL IMPACTS

Alan M. Voorhees and Associates, Inc. Guidelines to Reduce Energy Consumption Through Transportation Actions. Report for U.S. Department of Transportation. Washington, D.C.: U.S. Dept. of Transportation, May 1974. (NTIS PB 235 983/AS0)

This document is intended to serve as an aid to local transportation planners, traffic engineers and administrators in incorporating energy conservation considerations into the transportation planning process, especially short-range transportation planning.

Various types of low cost, short-term transportation actions are summarized and their potential for reducing energy consumption is estimated. Summary tables which array the actions in terms of relevant institutional and legal considerations and socio-economic and environmental effects are presented. Interrelationships between the energy consumption reduction potential of groups of actions are discussed, and a process for formulation of coherent packages of such actions is presented.

Guidelines are presented for evaluating and formulating these action packages for large (1,000,000 and over population), medium (250,000 to 1,000,000) and small (50,000 to 250,000) urban areas. The example criteria for evaluating the transportation actions for inclusion in an urban area package are: short lead time, minimal institutional obstacles to implementation, favorable public opinion and high energy reduction.

Baker, J.L., et al. A System to Evaluate the Environmental Impacts of Highways in Georgia. Columbus, Ohio: Battelle Columbus Laboratories, 1974.

The environmental evaluation system described in this user's manual provides a tool to conduct analyses of environmental impacts of highway projects in Georgia. The system provides a technique for identifying non-site-specific environmental concerns at the regional level during early systems planning and a technique for assessing site-specific impacts of particular projects. The system is designed to produce information not only for preparing environmental impact statements but also for integrating environmental considerations into the planning, design, construction and maintenance functions executed by the Georgia Department of Transportation (GDOT).

Cambridge Collaborative, Inc. Prediction and Control of Rail Transit Noise and Vibration-A State-of-the-Art Assessment. Report for the Transportation Systems Center. Washington, D.C.: U.S. Department of Transportation, April 1974. (NTIS PB 233 363/AS)

This report contains the results of a critical review of current technology for the prediction and control of urban rail transit noise and vibration, with primary emphasis on the parameters affecting propagation paths. Tools for the prediction of wayside noise and vibration adjacent to both at-grade and elevated transit track, ground-borne noise propagation from subway tunnels and noise in cars and in stations are included.

In addition, several noise and vibration control techniques are evaluated, including resilient rail fasteners, floating slabs, noise barriers, elevated structure enclosures, structural damping and acoustical treatment of stations and tunnels.

Appendices include a model for predicting wayside noise, methods for prediction of noise from rails and ties, propagation of noise and vibration through soil, ground vibration levels due to surface operations and tunnel wall vibration data. References are provided.

Clark, Mildred, ed. "Assessing Transportation-Related Air Quality Impacts." Proceedings of the Conference on Transportation-related Air Quality Impacts. Washington, D.C., October 22-24, 1975. Washington, D.C.: National Academy of Sciences, 1976

A series of papers from two workshops (photo-chemical oxidant models and non-reactive models) dealing with the state-of-the-art in modeling for assessment of air quality impacts from operational highways.

Metropolitan Transportation Commission. The Environmental Impacts of BART - Interim Service Findings: Interpretive Summary, MTC, Berkeley, California, July 1976.

This report summarizes and interprets the preliminary findings of the Environment Project of the BART Impact Program. The summary report describes BART's regional effects (on air quality, urbanization, and natural features) and local effects (noise, visual effects, vibration, air quality, and social impacts). The sources of the impacts and the impacted sites are identified and the effects of expanding service are forecasted. The final section discusses the implications of these findings for the planning of other urban transit systems.

COMMUNITY IMPACT

Hibbard, T., F. Miller and L.B. Wallerstein. "Economic Analysis and the Environmental Overview-Suggestions for Project Recommendations by Local Governments", Transportation Research Record No. 490. Washington, D.C.: Transportation Research Board, 1974, pp 10-19.

This paper suggests a framework for organizing potential project impacts with emphasis on the development of an environmental overview before project recommendations are made and an understanding of the relationship between the effects considered in the overview and those included in traditional economic analysis. Effects on road users and nonusers are analyzed to determine whether they are treated explicitly or implicitly in benefit-cost analysis or whether they should be placed in such categories as natural resources and environmental quality, community impacts, leisure and recreation and economic effects. A technique for rating and weighting the project effects is outlined in order to facilitate the formulation of project recommendations.

Ingram, Gregory K. and Gary R. Fauth. TASSIM: A Transportation and Air Shed Simulation Model, Vol. 1, Case Study of the Boston Region. Report for U.S. Department of Transportation Contract No. DOT-OS-30099-5. Cambridge, Massachusetts: Harvard University, May 1974.

The TASSIM model integrates an urban transportation planning model, vehicle emission factors and simple air diffusion models into a simulation framework that can be used to analyze the air quality effects of transportation policies. The model is spatially disaggregated and is compatible with data sources available in many metropolitan areas. This volume briefly describes the structure of the model and then analyzes several model applications in Boston that simulate the air quality effects of transportation controls, land use and stationary source policies. The transportation control policies are evaluated in a cost-effectiveness framework. The final sections consider possible extensions of the model and outline the model's computational aspects.

Volume 2, Program User's Guide, is a programming guide to the model that describes the model's structure in detail and explains procedures necessary to calibrate it to areas other than Boston.

Manheim, Marvin L. et al. Transportation Decision-Making: A Guide to Social and Environmental Considerations. National Cooperative Highway Research Program Report 156. Washington, D.C.: Transportation Research Board, 1975.

This report presents an integrated approach for systematically incorporating social, economic and environmental factors into transportation planning and decision-making. Professionals participating in system and project development will find parts of the report tailored to their needs. Transportation administrators will find sections of the report cover a number of policy and institutional implications associated with implementation of the procedural recommendations. Those involved in both project studies and agency management will find the overview of the proposed approach to be helpful in considering (a) the coordination of federal, state, regional and local institutions; (b) the issues of equity; (c) the amelioration of negative impacts; (d) the easing of mobility problems for the transportation disadvantaged; and (e) the determination of costs that include social and environmental costs.

Metropolitan Transportation Commission. BART Impact Program--Report Catalog. Contract No. DOT-OS-30176. Washington, D.C.: U.S. Department of Transportation, July 1976.

This report catalog identifies and includes an abstract of each report prepared to date under the BART Impact Program. The early pre-BART perishable data collection projects were reported via two series of final reports known as the BART I and BART II series. Reports in subsequent phases of the program were issued as Working Papers, Planning Documents, Technical Memoranda and Final Reports.

This report catalog will be updated periodically and is available through NTIS. All reports identified in the catalog are also available through the National Technical Information Service (NTIS), U.S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161.

Nelson, K.E. and T.D. Walsko. Transportation Noise - Impacts and Analysis Techniques. Lemont, Illinois: Aymne National Laboratories, 1973. (NTIS PB 226 806).

Computerized models that can be used by transportation engineers, planners and environmentalists to assess the impacts of transportation noise problems generated by highway and airport facilities are presented. The characteristics of transportation noise are discussed in terms of generation, effects and impacts, measurement and control. The economic, physiological, psychological and societal effects of urban noise are described in detail.

Sharpe, C.P., R.J. Maxaian and A.M. Voorhees. "A Methodology for Computation of the Environmental Capacity of Roadway Networks," Highway Research Record #394. Washington, D.C.: Highway Research Board, 1972.

In evaluating alternative transportation systems for the Urban Corridor Demonstration Program in Louisville, Kentucky, it became necessary to develop a procedure that would directly correlate the transportation system with the environment through which it passes. A methodology was developed whereby street segments were stratified based on roadway and land use characteristics. People residing, working, or shopping adjacent to these street "prototypes" were questioned in such a way as to develop an annoyance index for each prototype. This annoyance index related people's perceptions of noise, air pollution and safety to the level of traffic on the street. Through previous questionnaires, the environmental criteria of noise, air pollution and safety were found to be most significant when related to traffic. Similar street prototypes with various levels of traffic were studied and annoyance and traffic volume were then developed for each prototype. From these relationships, an "environmental capacity", expressed in vehicles per day, was established for each roadway segment in the study area. These results were used to evaluate the effect on the environment of various transportation improvements.

U.S. Department of Transportation. Environmental Assessment Notebook Series: Highways. (DOT P5600.4) Washington, D.C.: U.S. Government Printing Office, 1975. (USGPO Stock No. 050-000-00109-1; $21.00 for seven-part set, sold in sets only; U.S. Government Printing Office, Washington, D.C. 20402).

The Notebook Series seeks to better integrate the transportation planning process (which involves establishing the need for proposed highway and other transportation improvements and identifying feasible alternatives including modal, location and design options) and the environmental impact assessment process (which involves the identification, measurement and evaluation of impacts associated with various transportation alternatives).

The Notebook Series describes techniques for conducting social, economic and physical impact analyses, as a means of facilitating and improving the quality of the environmental assessment process and organizing the findings in a readily usable form. This set contains the following notebooks:

Summary
1. Identification of Transportation Alternatives
2. Social Impacts
3. Economic Impacts
4. Physical Impacts
5. Organization and Content of Environmental Assessment Materials
6. Environmental Assessment Reference Book

U.S. Department of Transportation. Final Manual--Special Area Analysis. Washington, D.C.: U.S. Dept. of Transportation, March 1973.

Special Area Analysis is an attempt to encourage the consideration of social and environmental factors in the planning of transportation systems for urban areas by providing the analytical tools to begin addressing some of these social and environmental issues. This package includes a manual describing the basis for the analysis of noise, air quality, accessibility and dislocation impacts. The methodology and computer software to perform the analysis are also given. This package is offered as the first step from which various urban areas will refine analytical techniques suited to their own problems.

LAND USE

Cousins, Kathryn and R.E. Heightchew, Jr. Land Use and Transportation, Technical Study Memorandum No. 11. Washington, D.C.: Highway Users Federation, March 1975.

This study examines recent experience with techniques to coordinate transportation facilities with surrounding land uses. The purpose is to determine which techniques are most promising and to gain support for those that will enable transportation needs to be met which best support community development objectives.

This report is written to help public officials, developers, planners and engineers concerned with transportation. It describes planning and land reservation methods that will least disrupt the community and that will help provide other desired community facilities to make transportation facilities more useful as well as acceptable.

Five common elements were identified for successful coordination between land use and transportation: cooperative attitude among professionals; existence of local land use plans; implementation of land use plans, multijurisdictional cooperation; and competent and adequately staffed agencies.

Libicki, Martin C., Urban Analysis Program, Office of Transportation Planning and Analysis. Land Use Impacts of Major Transit Improvements: An Assessment for Current Information. Washington, D.C.: U.S. Dept. of Transportation, March 1975.

The purpose of this paper is to compile and analyze information on the effects of major transit improvements on land use to determine what is currently known about these effects. Major transit improvements are restricted to rail rapid transit projects completed in the United States and Canada since the Second World War. Improvements include: the Toronto and Montreal subway systems in Canada; the Cleveland system and the Chicago subway extensions (1950's); the new BART lines in San Francisco; the Lindenwold line in Philadelphia (1960 on); and, the southern extension of the Boston MBTA into Quincy.

System Management Contractor. Transit System Impacts on Urban Land Use. Report No. 96264-9032-00 for Regional Transportation District. Denver, Colorado: Regional Transportation District, February 1975.

A review of available literature on the impacts of mass transit projects on land use was done to provide information on which to base evaluation of transit alternatives for Denver. The study concluded that there are a set of factors which, independent of the presence or absence of a particular type of transit system, may account for or very strongly control the system's perceived impact. While these factors may strengthen the potential for development, they alone cannot create the development or impact. Various political, socio-economic and physical factors must also come into play.

The following factors were identified as particularly relevant to Denver:

1. local government policies affecting development.

2. development trends and forces, including an area's vitality, attractiveness, population growth and the general economic conditions of the larger area served by transit.

3. market forces -- primarily the availability and cost of land for development.

4. basic physical characteristics of the area being served -- including the quality of the immediate environment, the nature of the surrounding area, and general locational attributes.

5. the former relative accessibility of the area and the change induced by transit.

Technical Council Committee 643. Informational Report: Land Use and Transportation System Evaluation: A Conceptual Framework. Traffic Engineering, Vol. 45, No. 10, October 1975.

This report, a summary of the state of the art with respect to the evaluation of transportation and land use alternatives, examines the consequences of transportation facilities from the standpoint of the

operating agency, the system users and the non-users. The basic assumption of this report is that transportation is a service and not an end in itself. The committee has attempted to develop a conceptual framework for the identification and measurement of several key criteria for the design and evaluation of transportation facilities.

While transportation planners are to some extent aware of the non-users consequences of transportation investment decisions, the measurement and evaluation of such impacts are other matters. The committee attempts to bring together transportation, land use and social and environmental evaluation criteria to assess the consequences of transportation investment decisions on the system users, the system non-users and the operating agency.

Ward, Jerry D. and Norman G. Paulhus, Jr. Suburbanization and Its Implications for Urban Transportation Systems. Report No. DOT-TST-74-8. Washington, D.C.: U.S. Dept. of Transportation, April 1974. (NTIS PB 239 819/AS).

The result of an internal DOT analysis, this document examines the structure of modern American cities to highlight the changes in travel patterns which they produce, and the capabilities of existing transportation systems to meet these needs. The paper points out that center-city fixed-route transit systems common today are often really mismatched to the diffused spatial pattern of suburban areas, especially since conventional transit systems cannot economically serve low-density suburbs. Flexible-route, demand-responsive (Dial-a-Ride) bus systems can extend transit service to suburban regions and make express transit services accessible to suburban residents. These low-density services should feed the express bus or rail lines at transfer points which are an integral part of shopping malls or other activity centers. In the high-density regions, adequate circulation service must be provided by minibus, jitney, or where traffic warrants personal rapid transit or people-movers.