EVALUATION PLAN

FOR THE SANTA MONICA FREEWAY

PREFERENTIAL LANE PROJECT

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PREFACE AND ACKNOWLEDGMENTS

This evaluation plan is designed to measure the impacts of reserving the median lane in each direction on the Santa Monica Freeway for the exclusive use of buses and other vehicles carrying three or more occupants. The Santa Monica project is one of a series of preferential lane projects currently scheduled for implementation in the Los Angeles area within the next two years.

This evaluation plan has been prepared in the Los Altos, California offices of SYSTAN, Inc., under Purchase Order TS10187 and Contract No. DOT-TSC-1084, as part of the Service and Methods (SMD) Program sponsored by the Urban Mass Transportation Administration (UMTA) of the United States Department of Transportation (DOT). Roy E. Lave, Jr. served as SYSTAN's project manager and John W. Billheimer was principal investigator. Howard Simkowitz of DOT's Transportation Systems Center (TSC) served as technical advisor on the project, while Joe Goodman of UMTA was the project monitor for the SMD Program.

The evaluation plan reflects the work of many of the local agencies participating in the demonstration. In particular, the data collection section is heavily indebted to the monitoring and evaluation plan prepared by Gary Bork and John Kenan of Caltrans' Freeway Operations Branch, and to the demonstration grant application prepared by Gerald Squier of the Southern California Rapid Transit District (SCRTD). Jerry Baxter and Charles Boyer helped to coordinate the diverse elements of Caltrans' participation in the evaluation plan, and Pat Conway served a similar function for SCRTD. Other local agency representatives participating in the preparation of the evaluation plan were Lieutenant William Russell of the California Highway Patrol (CHP), Robert Ayer of the Santa Monica Municipal Bus Lines (SMMBL), and Sergeant Nate Parnell of the Los Angeles Police Department (LAPD). C.B. Fredrickson, Robert Camou and Ed Rowe of the Los Angeles Department of Traffic (LADT) helped to review the initial draft of the evaluation plan.

The interplay of evaluation objectives, operating considerations, public response, and political concerns accompanying any demonstration project imbues such projects with a constantly shifting profile. For example, the implementation date for the Santa Monica Freeway preferential lane project has in the past been shifted from June 15, 1975 to September 29, 1975 to the current date of March 15, 1976. This rescheduling reflects a variety of concerns including operational readiness, funding availability, Federally-imposed work regulations, the timing of the Christmas holidays and school vacations, and the duration of the Los Angeles rainy season.

The constantly shifting profile of a demonstration project requires a dynamic evaluation plan capable of adapting both to changes in the demonstration itself and to lessons learned as the demonstration progresses. To accommodate these prospective changes, this plan has been issued in loose-leaf form; each page is dated and pages of individual sections are numbered consecutively to allow updating of the plan. From time to time, pages will be issued by SYSTAN to registered recipients of the plan. A reader who acquires a plan after initial issue should write to SYSTAN to obtain a listing of its current content. Modifications will be issued upon request.

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1.0 EVALUATION PLAN

1.1 Overview

As part of a demonstration project conducted jointly with the Southern California Rapid Transit District (SCRTD), the City of Santa Monica, the California Highway Patrol (CHP), and the Los Angeles Police Department (LAPD), District Seven of the California Department of Transportation (Caltrans) has proposed to reserve the median lane in each direction on the Santa Monica Freeway for the exclusive use of buses and high-occupancy vehicles carrying three or more occupants. The conversion of the median lane to a reserved lane is scheduled to take place on March 15, 1976 and will be accompanied by the introduction of preferential entry provisions for high-occupancy vehicles and the initiation of seven new express bus routes by the SCRTD and one new route by the Santa Monica Municipal Bus Lines.[1]

The proposed demonstration project is expected to have a wide range of impacts in a variety of areas, including air quality, transit ridership, freeway and arterial congestion, traffic safety, travel times, vehicle occupancy, energy consumption and public opinion. These impacts are of vital interest to a number of agencies at the federal, state, and local levels. Since the dedication of an existing freeway lane to high-occupancy traffic is a controversial measure with impacts that are at present incompletely

[1] A complete description of the proposed alterations of highway traffic flow patterns may be found in the December 12, 1974 Caltrans report TF-54 entitled Freeway Operation Traffic Report.

understood, it is essential that the full range of these impacts be identified and measured with a degree of statistical precision that will ensure the greatest possible level of understanding, both in the area served by the Santa Monica Freeway and in other communities considering the creation of similar preferential freeway lanes. To this end, the Urban Mass Transportation Administration of the United States Department of Transportation (UMTA) has agreed to sponsor a detailed evaluation of the impacts of the proposed preferential lane as part of its Service and Methods Demonstration (SMD) Program. This evaluation plan represents the first step in the planned evaluation process.

1.1.1 Objectives

Specific local objectives of the Santa Monica Freeway Preferential Lane Project are listed below:

- To explore and evaluate concepts aimed at increasing vehicle occupancy on heavily traveled urban freeways by creating incentives to encourage public transit ridership and carpooling;
- To improve air quality in the Los Angeles South Coast Air Basin by reducing the number of low-occupancy vehicular trips;
- To contribute to the local and national goals of energy conservation by optimizing passenger trips through public transit ridership and carpooling;
- To reduce existing peak hour congestion delays on the Santa Monica Freeway by increasing the ratio of travelers to vehicles using the facility;

- To improve transit reliability and reduce transit travel times by providing an exclusive lane for bus and carpool travel;
- To achieve a better understanding of public attitudes toward auto use, carpooling, transit ridership and preferential lanes, and to trace the effect of these attitudes on mode choice behavior; and
- To assess the benefits and costs of a variety of alternative concepts to providing preferential freeway treatment for high occupancy vehicles and acquire a better understanding of the law enforcement and traffic safety implications of each concept.

These local objectives fulfill the following broad objectives of the SMD Program:[1]

- To reduce trip times for transit travelers:
- To increase transit reliability;
- To reduce transportation congestion; and
- To improve transit vehicle productivity.

1.1.2 General Evaluation Strategy

This evaluation plan has been designed to provide a quantitative assessment of the ability of the proposed demonstration to meet the above objec-

[1] Transportation Systems Center, "Background Information for Service and Methods Evaluations," attachment to procurement request No. TSC/230-0076-RN, Cambridge, Massachusetts, December 1974.

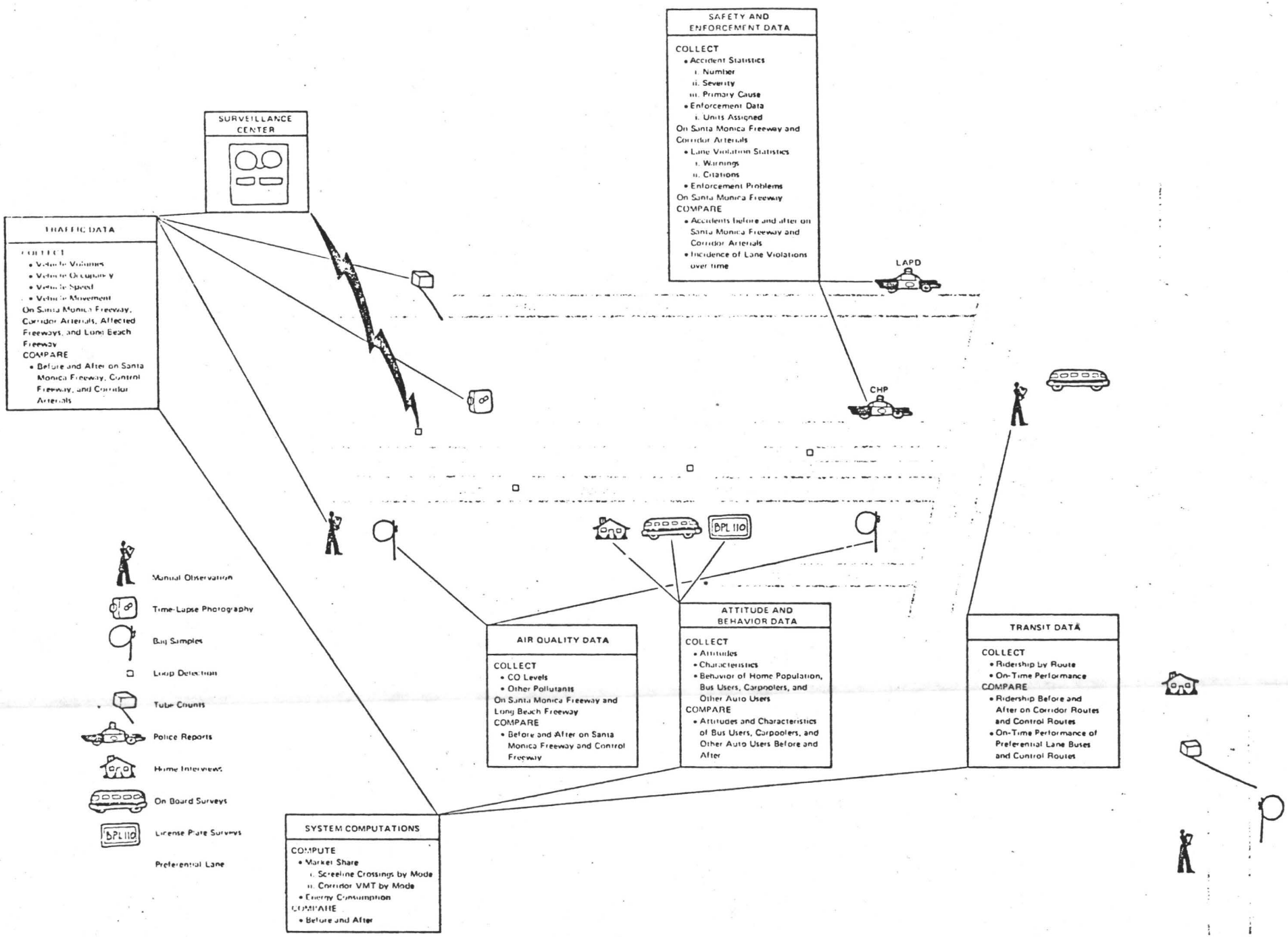
tives. The plan describes the variables that best characterize these objectives, identifies factors which mitigate or amplify the anticipated demonstration impacts, specifies the instruments to be used in collecting data, describes the populations to be measured, identifies statistical tests and analytic procedures, schedules measurement and analysis activities to coincide with demonstration activities, describes potential threats to the validity of demonstration findings, and suggests methods for increasing the transferability of results to other areas.

Relationships between variables, control activities, measurement strategies, and analytic procedures are expressed through the medium of an experimental design that attempts to:

- Measure the existence and magnitude of changes in such attributes as traffic congestion, vehicle occupancy, vehicle speeds, transit ridership, air quality, and accident levels;
- Identify the extent of the changes attributable to the preferential lane project; and
- Identify those characteristics or factors (police enforcement, public attitudes, etc.) that reinforce or mitigate the changes.

Exhibit 1.1 presents a graphic overview of the proposed evaluation process. This exhibit shows each of the categories of data to be sought, itemizes the major data elements within each category, depicts the data collection instruments to be employed, and specifies certain of the critical comparisons to be

Exhibit 1.1 OVERVIEW 'ALUATION PROCESS



made in analyzing the collected data. The major categories of data sought in the demonstration evaluation are classified as follows:

- Traffic Data;
- Transit Data;
- Air Quality Data;
- Safety and Enforcement Data; and
- Attitude and Behavior Data.

The experimental design relies on a variety of different data sources, including manual observations, computerized traffic surveillance, mechanical traffic counters, air bag samples, police reports, bus operating records, home interviews, on-board surveys, and license-plate based postcard surveys. The precise uses of the data acquired from these sources are described in later sections of this plan.

Certain of the bus routes and one freeway in the study area that are not likely to be affected by the preferential lane demonstration have been designated as control routes to provide a basis for analytic comparisons. These comparisons will be combined with before and after measurements in identifying system changes. Control routes for the Santa Monica Freeway Preferential Lane Project include the #11 route of the SMMBL, the #34 and #36 routes of the SCRTD, and the Long Beach Freeway south of the Los Angeles Central Business District.

1.1.3 Interagency Responsibilities

1.1.3.1 Federal Participants. At the Federal level, participants in the Santa Monica Freeway Preferential Lane Demonstration evaluation include UMTA, the Transportation Systems Center (TSC), an evaluation contractor selected by these two agencies, the Federal Highway Administration (FHWA), and a survey contractor selected by this agency. The UMTA Project Manager is responsible for overseeing and guiding all aspects of the demonstration. TSC assists UMTA in its activities and monitors the efforts of the evaluation contractor, approving the evaluation plan and reviewing all reports. SYSTAN, Inc., the evaluation contractor selected by UMTA and TSC, will monitor the implementation of this evaluation plan, coordinate local data collection efforts, perform specialized data collection tasks, assist in the design of survey instruments, reduce data, analyze project results, and prepare interim and final reports. The FHWA, through its contractor, Market Facts, Inc., will conduct a concurrent series of "before and after" home interview surveys designed to ascertain attitudes toward transit and carpooling and to establish a behavioral data base to be used in analyzing changes in CBD-oriented travel resulting from the demonstration project.

1.1.3.2 Local Participants. A number of local agencies have been jointly responsible for planning the operational phase of the demonstration project and for designing many individual elements of the evaluation plan. These agencies, which will also be responsible for project implementation and most of the data collection efforts supporting the proposed evaluation, are listed below.

- State of California, Department of Transportation (Caltrans)

  General Responsibilities: Construction, operation and maintenance of California highways.

  Specific Project Data Collection Responsibilities: Vehicle volume measurements, vehicle occupancy counts, speed runs, time lapse photography and aerial photography on the Santa Monica Freeway and corridor arterials; fuel consumption estimates; air pollution measurements; and carpool user survey.

- Southern California Rapid Transit District (SCRTD)

  General Responsibilities: As the major transportation carrier for Los Angeles County, the SCRTD will be responsible for implementing seven new express bus routes as part of the demonstration project.

  Specific Project Data Collection Responsibilities: "Before and After" point checks on existing lines affected by the new service; measurement of patronage and reliability of new lines and control routes; conducting of on-board surveys.

- City of Santa Monica--Santa Monica Municipal Bus Lines (SMMBL)

  General Responsibilities: As the major transportation carrier for Westside Los Angeles, the SMMBL will introduce one new express bus route and modify several existing routes to feed this route.

  Specific Project Data Collection Responsibilities: SMMBL will collect data similar to that collected by SCRTD, i.e., point checks on affected existing lines before and after start of the project; measurements of patronage and reliability of new lines and control routes; and surveys of passengers on new service.

- California Highway Patrol (CHP)

  General Responsibilities: Enforcement of traffic laws on California highways.

  Specific Project Data Collection Responsibilities: Preferential lane enforcement, collection of freeway accident data, maintenance of records of warnings and citations issued for lane violations; recording of enforcement levels and problems.

- Los Angeles Police Department (LAPD)

  General Responsibilities: Law enforcement in Los Angeles, including the enforcement of traffic laws on surface streets.

  Specific Project Data Collection Responsibilities: Collection of accident data on city streets, recording of special enforcement needs created by project implementation.

° Los Angeles Department of Traffic (LADT)

General Responsibilities: Operation and maintenance of surface streets in Los Angeles.

Specific Project Data Collection Responsibilities: Vehicle volume counts and speed runs on surface access streets perpendicular to the corridor; processing of accident data collected by the LAPD.

° Office of the Mayor of Los Angeles

General Responsibilities: Participation in the planning of project marketing and implementation; monitoring of public response to the preferential lane.

Specific Project Data Collection Responsibilities: Assist evaluation contractor in collecting public response data.

1.2 Demonstration Description[1]

1.2.1 Concept

The proposed preferential lane would be established by reserving an existing lane on one of the world's most heavily traveled freeways, the Santa Monica Freeway, for the exclusive use of buses and carpools. The lane nearest the median in each direction, for a distance of 12.6 miles between Lincoln Boulevard (California 1) in Santa Monica and the Harbor Freeway (California 11) in Los Angeles, will be reserved for buses and other vehicles carrying three or more people. The preferential lanes will be created by means of special signing and painted pavement markings and will be in operation 24 hours a day, seven days a week.

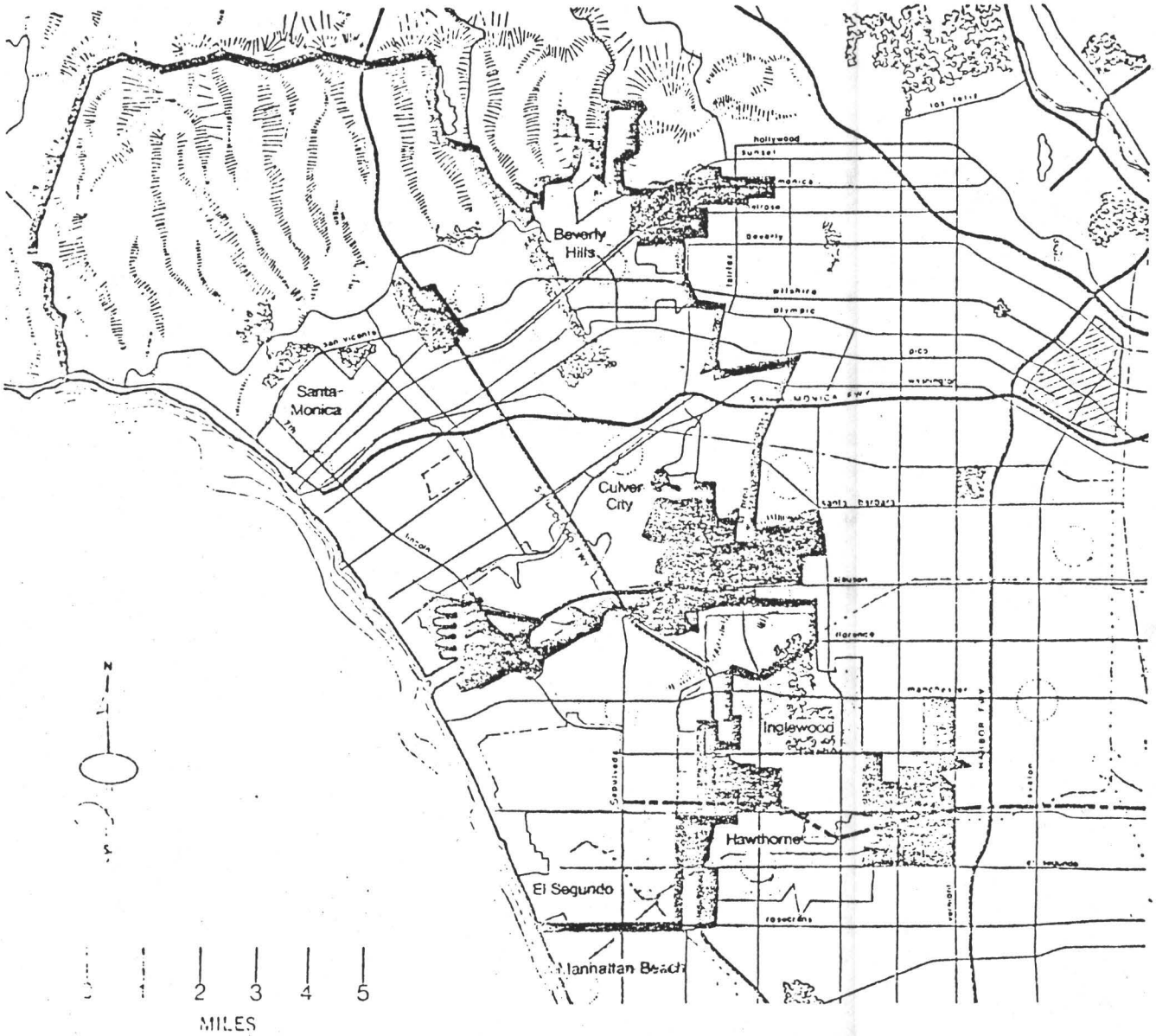
1.2.2 Area Affected

A map of the affect area appears in Exhibit 1.2. The project will be conducted in western central Los Angeles County, California, a fully-developed

[1] This section summarizes the major aspects of the proposed demonstration. A more detailed description of the plans for implementing the preferential lane and providing supporting bus service may be found in Part IV (Program Narrative) of the Demonstration Grant Application prepared by SCRTD.

EXHIBIT 1.2

OUTLINE OF PROJECT AREA



(Source: Project Grant Application)

NOVEMBER, 1975

urban area. Specific areas to be affected will be the Los Angeles Central Business District (CBD) and the Westside area of Los Angeles, bounded by La Cienega Boulevard on the east, the Pacific Ocean on the west, the Los Angeles International Airport on the south, and the Santa Monica Mountains on the north.

1.2.3 Ancillary Programs

A number of complementary programs are included in the demonstration, as described below. These will all contribute to the impact of the preferential lane, but their individual contribution will not be assessed separately. In interpreting the results of the demonstration, other jurisdictions must consider these ancillary programs and the preferential lane as comprising the entire demonstration and, if they plan a preferential lane without the accompanying programs, the expected impacts must be modified accordingly.

1.2.3.1 Marketing. Increased carpool formation and transit usage will be encouraged by an aggressive marketing program, supplemented by the use of a computer matching system for carpool formation. The marketing program will be accompanied by an intensive public information program designed to educate drivers of single-occupancy automobiles and carpool vehicles in the safe and orderly use of the preferential lanes. Additional details regarding the marketing activity accompanying the preferential lane project may be found in the marketing plan prepared by the marketing subcommittee of the Joint Project Board.*

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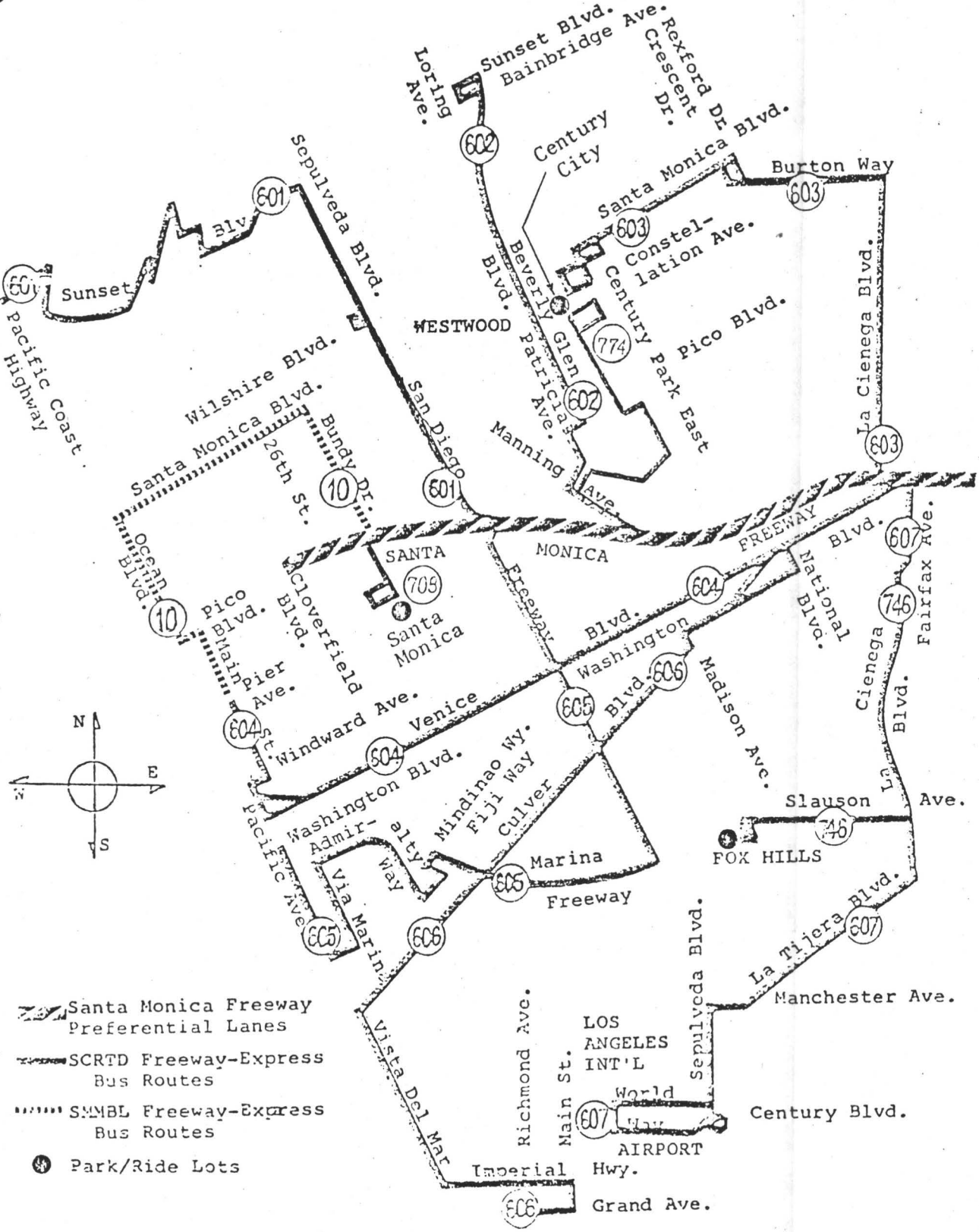
*Marketing Plan, Santa Monica Freeway Preferential Lane Project, Marketing Subcommittee of the SCRTD-CALTRANS Joint Project Committee; March 1975 (revised August 1975).

1.2.3.2 Bus Service. Increased transit usage will be encouraged by a proposed 400 percent increase in the amount of express bus service currently being operated between the Westside area of Los Angeles and the Los Angeles CBD. A total of eleven new freeway-express bus routes will be operated over the preferential lanes between the Westside area and the Los Angeles CBD. Three of these routes will originate at newly established park/ride lots in the Westside area and the other eight will operate as multi-stop routes, picking up passengers along the major arterial streets in the Westside area. Exhibit 1.3 maps the location of the new freeway-express bus routes. These routes will be supplemented by existing local lines, which will act as feeders, and four new feeder and crosstown services. Additional information regarding all bus routes serving the preferential lane project may be found in the SCRTD Project Grant Application.

1.2.3.3 Park/Ride Lots. Three park/ride lots will be established in conjunction with the establishment of express bus service on the preferential lane. The proposed lot sites are well located from an operational standpoint, and provide good geographic coverage of the project area. They are all paved and can be prepared for operation in a short time with very little modification to the existing improvements. Lot locations are listed below and are illustrated in Exhibit 1.3.

EXHIBIT 1.3

FREEWAY — EXPRESS BUS ROUTES



(Source: Project Grant Application)

LOCATION	AUTO CAPACITY
1. Fox Hills (south of Slauson at Marina Freeway)	200
2. Century City (southeast corner of Olympic Boulevard and Avenue of the Stars)	300
3. Southeast Santa Monica (corner of Centinela and Ocean Park Boulevard)	220

1.2.3.4 Metered Access. To assure a reasonable measure of free flow at all times on the freeway, general traffic lane on-ramp volumes will be controlled as necessary by metering signals. Metering rates will be adjusted to compensate for the increased freeway congestion accompanying the preferential lane project. Buses and carpools will be privileged to bypass the ramp meters at selected on-ramps as an added incentive to these modes of travel. Although for the purposes of preferential lane use a carpool will be defined as a vehicle containing three or more persons, vehicles containing two or more persons will be allowed to use preferential access lanes on the freeway on-ramps. This procedure conforms to current practice on metered access ramps in the Los Angeles region.

1.3 Experimental Design

1.3.1 General Concepts

As defined by the UMTA SMD Program, the primary functions of an evaluation plan are:

1. To establish well-defined project evaluation objectives;

2. To develop a formal statistical framework for obtaining results with national application; and

3. To present findings in a manner that is meaningful and understandable to transit operators, transportation planners, and city administrative officials in other localities across the country.

The formal statistical framework that relates project objectives to measured impacts and attempts to ensure the validity and relevance of the measuring process is referred to as an "experimental design."

In terms of UMTA's SMD Program, an "experimental design" is a "....structured, time-phased plan to permit a quantitative evaluation of an urban transportation demonstration project." This usage of the term "experimental design" is somewhat broader than the strict statistical definition, which connotes the existence of a controlled environment for evaluating the outcome of structured research inquiries.

1.3.1.1 Questions Addressed by Experimental Design. An experimental design is intended to answer three questions. These are listed below in increasing order of importance and difficulty.

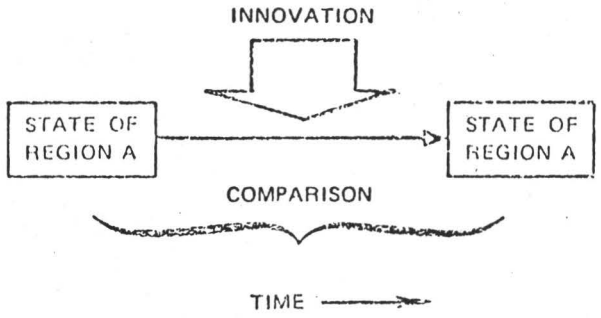
1. Is there a change? What is the magnitude of the change?
2. What part of the change is attributable to the transport innovation(s) which comprise the demonstration?
3. What characteristics or factors (of the innovation, individuals, or the society, culture, economy) reinforce or mitigate the change?

The first issue is whether or not there is a change. The subsidiary question addresses the magnitude of the change. If there is change, the analytical task is one of determining what portion of it is attributable to the innovation. Moreover, to aid in assessing the transferability of demonstration results to other regions, it is also important to identify those factors that contribute to, allow, reinforce, impede, or mitigate the change. For example, if income level is a prime determinant of bus usage, knowledge of this relationship will allow other cities to estimate ridership.

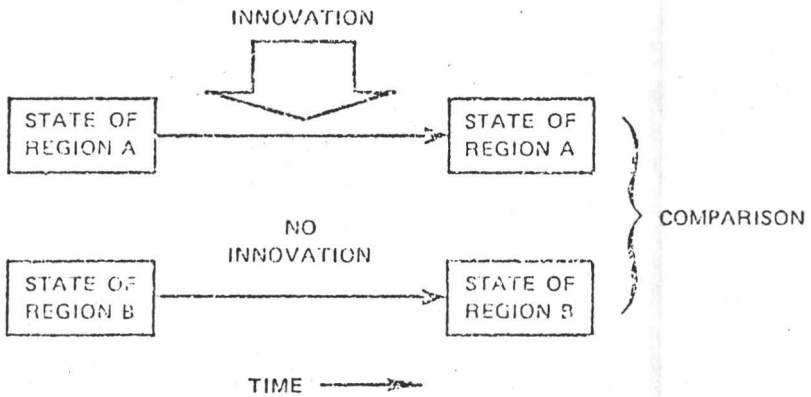
1.3.1.2 Comparison Strategies. The chief purpose of the experimental design is to identify, verify, and measure demonstration-related changes in the impact areas cited in the demonstration objectives. Changes, or impacts, are discerned by measuring key variables, the so-called dependent variables, which describe the characteristics of the total transportation network, its users, the transportation-related environment, and the other potential impact areas. The level of these measured variables at any point in time is called the state of the system. It is not necessary to describe the entire state for each test of hypotheses, but only those relevant variables; that is, those that change or explain change.

System changes, or impacts, may be measured by different types of comparisons. Three general comparison strategies are common: Comparisons at different points in time; comparisons of different geographic regions or population groups; and comparisons between real and hypothesized systems. These three common comparison strategies are rendered in schematic form in Exhibit 1.4.

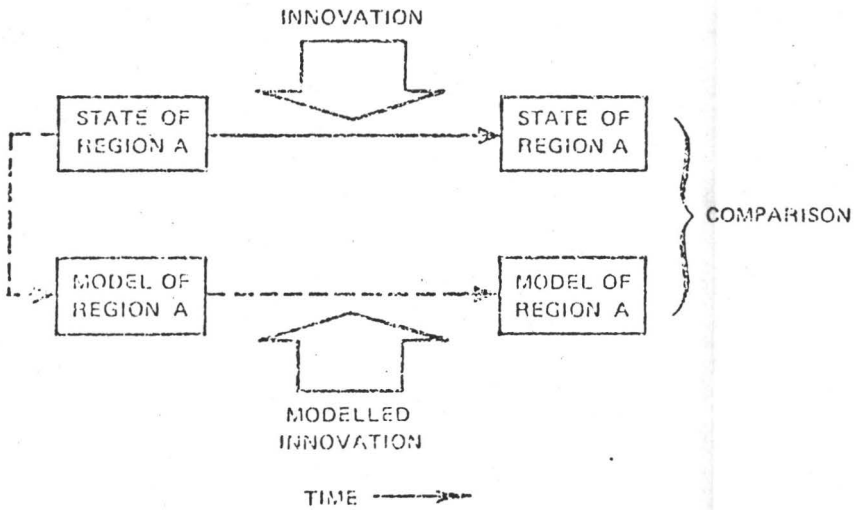
EXHIBIT 1.4-ALTERNATIVE COMPARISON STRATEGIES



(a) BEFORE AND AFTER APPROACH



(b) CONTROL REGION APPROACH



(c) MODELING APPROACH

The first approach, illustrated in Exhibit 1.4(a), compares system states before and after the introduction of the innovation -- the post hoc ergo propter hoc approach. The methodological difficulty with this approach is that changes may be caused by many factors and it is difficult to distinguish transportation-induced changes from changes caused by other factors.

This difficulty suggests a second comparative approach which would relate the study region to a totally similar region which does not receive a transportation innovation (Exhibit 1.4(b)). The second region is analogous to the traditional experimental control group. It is assumed that the two regions are subject to the same forces except for the transportation innovation, and that comparing both communities will reveal the effects of the innovation alone. The methodological difficulty with this approach is that no two regions are absolutely comparable.

The third comparative approach is based on the concept that if one innovation (i.e., corridor improvement) were not introduced, another would have been (i.e., fixed guideway rapid transit). Therefore, the correct comparison is to relate the state of the community "after" the various alternatives have been introduced. Since it is seldom possible to introduce several major innovations in distinct time frames, this comparison requires a model of the community "after" the hypothetical introduction of those alternatives which are not actually implemented. Because the modeling of communities is not an exact science, this approach can hardly be said to be free of methodological difficulties.

Since none of these comparative approaches is totally satisfactory in itself, a particular demonstration may use a combination of these approaches, attempting to apply the most appropriate approach as a function of the characteristics of each situation. In the Santa Monica Freeway Preferential Lane Demonstration, the "before and after" and "control group" strategies will be employed to provide a basis for comparative evaluations. In most instances, system measurements will be made immediately before the establishment of the preferential lane, repeated four weeks after project implementation, and repeated again six to nine months later. Certain key variables (including traffic congestion, express bus ridership, and accident frequency) will be monitored continuously following project implementation. In addition to these "before and after" measurements, control groups have been established for evaluation purposes. The Long Beach Freeway from the San Diego Freeway to the Santa Ana Freeway has been selected as a control since it is not likely to be affected by the Santa Monica Freeway Demonstration and carries buses as well, without preferential treatment. All specified traffic and transit data will be accumulated for the control freeway as well as for the Santa Monica Freeway project.

The control freeway will provide an additional basis for comparing the effects of a preferential lane as well as a hedge against external threats to the evaluation (i.e., a gas crisis) which might obscure the meaning of "before and after" data.

The Long Beach Freeway carries two SCRTD bus lines without preferential treatment. These are the #36 Los Angeles-Long Beach Flyer and the #54 Los

Angeles-Lynwood service. These two bus routes will be established as control routes to help screen out the impact of external events on transit patronage. The San Bernardino express bus service, which is monitored continuously as part of another UMTA demonstration, provides another source of comparative control statistics. In the city of Santa Monica, the #11 line, a crosstown line whose ridership is monitored closely by the SMMBL, will provide an index of transit ridership independent of that connected with the preferential lane project.

1.3.1.3 Elements of Experimental Design. There are eight elements of a complete experimental design. These are:

1. A statement of well-defined objectives specifying the intent of the demonstration in terms of what is to be learned. The objectives are most usefully stated as hypotheses concerning the presumed impacts of the innovation.
2. A description of the variables to be measured that are believed to best characterize, or model, the impacts. In the language of statistics, these are called the dependent variables.
3. Identification of the factors which mitigate or amplify the impacts; that is, the independent variables.
4. A description of the source of the measured data and the measuring instruments.
5. A description of populations upon which the measurements are taken.
6. A plan for the statistical computations and tests to be performed on the data.

7. A time schedule of the measurement and analysis activities.

8. A description of the various factors which may limit the validity of the findings.

1.3.2 Experimental Design Tableaus

A complete experimental design will describe the relationships between each of the eight factors listed above. One means of describing these relationships is a tabular array, or tableau. Exhibits 1.5 through 1.9 contain five tableaus designed for the evaluation of the Santa Monica Freeway Preferential Lane Project. These tableaus are organized by the following impact areas:

1. Transportation System (Exhibit 1.5)
2. Travel Behavior (Exhibit 1.6)
3. Environment (Exhibit 1.7)
4. Safety (Exhibit 1.8)
5. Attitudes (Exhibit 1.9)

Each tableau contains nine columns, the contents of which are described below:

Impact Attribute (Column 1). This column refers to the impact related to the identified objective by its generic name. For example, reliability is a generic name for several attributes considered within the demonstration program. Part of the design is to interpret this generic name in terms of specific measurable variables, the dependent and independent variables.

Hypothesis (Column 2). The central item in the methodological approach is the hypothesis. Each hypothesis is related to an impact and attempts to answer one of the questions: WHAT, HOW MUCH, WHY or HOW. Thus, the term hypothesis has a somewhat broader connotation than is sometimes used in the process of statistical inference.

EXHIBIT 1.3 EXPERIMENTAL DESIGN TABLE
TRANSPORTATION SYSTEM

LOCATION: SANTA MONICA FREEWAY PREFERENTIAL LANE — IMPACT AREA: TRANSPORTATION SYSTEM

ATTRIBUTE	HYPOTHESIS	DATA				ANALYSIS	STATISTICAL TEST	COMMENT
		DEPENDENT VARIABLE	INDEPENDENT VARIABLE	POPULATION	MEASUREMENT INSTRUMENT			
System productivity	No increase in average vehicle occupancy	Car occupancy		Freeway users and control	Occupancy counts	Compare occupancy before and after and S.M. Freeway vs control	t-test, ANOVA	
	No change in passenger throughput in the corridor	Passenger throughput per unit time	Metering rules; accidents; time of day	Santa Monica Freeway corridor	Occupancy counts and point checks	Compare throughput before and after	t-test, ANOVA	
System speed	Travel times do not change	Average speed	Metering rules; accidents; time of day	Preferential lane users, other SM Freeway users, corridor arterial users, access street users.	Speed runs	Compare average speed before and after and compare Preferential lane with other S.M. Freeway lanes	t-test, ANOVA	
Congestion	Time to achieve lanes does not change over time	Time to achieve preferential lane -bus -carpool	Time since opening metering rules	Traffic flow over some time period	Time lapse photography	Compare time over time	Durbin Watson	
	No change in daily vehicle throughput	Volume of vehicles	Time of day -- Time since opening	Freeway and corridor streets	Screen-line counts	Compare before and after	t-test, ANOVA	will also test shape and duration of peak flows
	No change in peak traffic	Vehicle count in 5 minute intervals		S.M. Freeway and control	Counts from monitoring system	Compare peak 5 minute intervals before and after and S.M. Freeway to control	t-test	
	No change in total vehicle delays	Vehicle minutes of delay under 55 MPH	Time of day	S.M. Freeway	Counts from monitoring system	Compare total delays before and after	t-test	

EXHIBIT 1.5 EXPERIMENTAL DESIGN TABLE TO TRANSPORTATION SYSTEM (continued)

IMPACT AREA: DATA ACQUISITION FOR PREFERENTIAL LANE [illegible] IMPACT AREA: TRANSPORTATION SYSTEM

ACTIVITY	HYPOTHESIS	DATA				ANALYSIS	STATISTICAL TEST	COMMENT
		DEPENDENT VARIABLE	INDEPENDENT VARIABLE	POPULATION	MEASUREMENT INSTRUMENT			
[illegible]	No change in distribution of headways	Vehicle count in 5 minute intervals		S.M. Freeway and control	Counts from monitoring system	Compare distributions and correlate before and after	x^2 and t-test	
Queue [illegible]	No change in on-ramp queue lengths	Vehicle queue lengths in 15 minute intervals	Metering rates	Vehicles in preferential and non-preferential lanes on metered on-ramps	Manual counts	Compare queue lengths and average delays before and after Compare queue lengths with speed on access routes-test for correlation	t-test, ANOVA Regression analyses	
Transit performance (reliability)	Transit performance does not improve	On-time performance		Preferential lane buses; other freeway buses (control) off freeway buses	Point checks	Compare before and after and freeway with control	t-test	
Park and Ride Lot Usage	Lot Usage does not change over time	Vehicles parked in Park and Ride lots	Time since opening	Park & Ride lot users	Vehicle counts	Compare lot occupancy over time	Durbin-Watson	

EXHIBIT 1.6 - [illegible]
TRAVEL [illegible]

INNOVATION: IMPACT AREA: TRAVEL BEHAVIOR

ATTRIBUTE	HYPOTHESIS	DATA				ANALYSIS	STATISTICAL TEST	COMMENT
		DEPENDENT VARIABLE	INDEPENDENT VARIABLE	POPULATION	MEASUREMENT INSTRUMENT			
Modal choice (Market share)	Market share does not change (as measured by trips)	Trips -auto - 1 -auto - 2 -carpool -bus -park & ride		Users of the corridor, CBD workers	Screen line counts, point checks, occupancy counts, household survey, on-board survey	Compare share before and after	ANOVA	"Share can be defined in several ways: as trips, passenger, mileage, etc. Three measures to be employed will be share of screenline crossings, VMT share, and share of CBD trips.
		Passenger miles by mode		Affected population	Screen line-count, & household survey, on-board survey	Compare before and after	ANOVA	VMT to be calculated from trips and O/D data. If total corridor users does not change, "affected" population is same as "corridor users"
Route choice	Route choice does not change	Total travelers by route		Users of the corridor	Screen line counts, point checks	Compare before and after	t-test	
		Total vehicles by route		Users of the corridor	Screen line counts	Compare before and after	t-test	
		Percent diverted from old routes		Bus passengers in corridor	Point checks, on-board survey	Estimate No.	Estimate, no test	
Auto driving behavior	Observed violations do not change over time	Observed violations	Time since opening preferential lane enforcement level	Freeway users	Observation -- Police reports	Compare incidence over time test for time correlation	Durbin-Watson	
	Citation rate does not change over time	Cited violations a. deliberate b. ignorance	Time since opening preferential lane enforcement level	Freeway users	CHP records	Compare incidence over time test for time correlation	Durbin-Watson	
	Violations do not change with enforcement levels	Observed violations of preferential lane and access ramps	Police units assigned to Santa Monica Freeway beats	Freeway users	Observation	Compare violation and enforcement levels, test for correlation	ANOVA	

EXHIBIT 1 [illegible]

INNOVATION:

IMPACT AREA: TRAVEL BEHAVIOR

ATTRIBUTE	HYPOTHESIS	DATA				ANALYSIS	STATISTICAL TEST	COMMENT
		DEPENDENT VARIABLE	INDEPENDENT VARIABLE	POPULATION	MEASUREMENT INSTRUMENT			
Route & Mode Choice	No significant change in trip	Trips by mode and route		Corridor users	Household or telephone survey (license based)	Compare tables in percent before and after	Cochran Q (household or x^2 (license based)	After is "before" panel plus new sample
	Levels of diversion to new bus routes do not change with time savings	Diversion to new bus routes from existing transit and auto by origin and destination	Existing travel times by auto and bus	Riders on new bus routes	On-board surveys	Compare diversion levels with time savings, Test for correlation	Regression analyses	

EXHIBIT 1.7 EXPER[illegible]

- LNY [illegible]

INITIATIVE:

IMPACT AREA: ENVIRONMENT

ATTRIBUTE	HYPOTHESIS	DATA				ANALYSIS	STATISTICAL TEST	COMMENT
		DEPENDENT VARIABLE	INDEPENDENT VARIABLE	POPULATION	MEASUREMENT INSTRUMENT			
Air quality	Demo has no impact on CO pollution at any point in corridor	CO levels	Traffic volume and speed -- different measurement points	Environment on Santa Monica freeway and streets in corridor	Caltrans monitoring station and portable samplers	Compare before and after	t-test or ANOVA	Could also calculate polution from speed and volume or VMT and vehicle mix
	Air quality does not change with traffic volumes	CO levels	Traffic volumes in vicinity of air bag samplers	Corridor environment	Air quality monitoring stations, portable samplers, volume counts	Compare CO levels and corresponding traffic volumes before and after and test for correlation	Regression analysis	
Energy use	Energy use does not change	VMT by fleet composition		Traffic using Santa Monica Freeway corridor	Volume counts (screen line) and O/D tables by route and mode from surveys	Compare before and after	t-test	Calculate VMT from other measures

EXHIBIT 1.8 EXPERIMENTAL DESIGN TABLEAU
- SAFETY

INNOVATION:

IMPACT AREA: SAFETY

ATTRIBUTE	HYPOTHESIS	DATA				ANALYSIS	STATISTICAL TEST	COMMENT
		DEPENDENT VARIABLE	INDEPENDENT VARIABLE	POPULATION	MEASUREMENT INSTRUMENT			
Safety	Accident rate does not change	Number of accidents	Locations (freeway and surface streets	Corridor users	Police reports	Compare accidents before and after test for time correlation "after"	Random speed test for independent samples or t-test Durbin-Watson	
	Severity of accidents do not change	Severity -damage -injuries -fatilities	Locations (freeway and surface streets	Corridor users	Police reports	Estimation		
	Primary causes of accidents do not change	Percentage of accidents by primary cause	Locations (freeway and surface streets	Corridor users	Police reports	Compare causes before and after	Random speed test for independent samples or t-test	

INNOVATION:

IMPACT AREA: ATTITUDES

ATTRIBUTE	HYPOTHESIS	DATA				ANALYSIS	STATISTICAL TEST	COMMENT
		DEPENDENT VARIABLE	INDEPENDENT VARIABLE	POPULATION	MEASUREMENT INSTRUMENT			
Public attitudes	Attitudes toward preferential lane do not change	Favorable and unfavorable media responses level of phone complaints, bus inquiries, general information requests, commuter computer inquiries	Time following implementation	area newspapers callers using central phone number	news clippings monitor calls to central phone bank	Classify calls (complaints, info requests, car pool requests, etc	No test, 100% sample. t-test	Record responses and retain for comparison with responses to later preferential lane project Accompany quantitative report with qualitative description based on participation in volunteer phone answering activity
	Attitudes toward transit do not change	Questionnaire responses	Awareness of demo.	CBD destined corridor users and control group	Household survey	Compare before and after responses	McNemar significance of changes	
						Compare after users to control	x^2	
	Attitudes toward carpooling, transit, and autos do not vary with mode choice	Questionnaire responses		CBD destined corridor users and control group	Household survey and license plate and on-board surveys	Compare responses of different user groups	McNemar significance of changes	

In keeping with traditional statistical methodology, hypotheses offered for testing in the tableaus have been stated as null hypotheses; that is, as assumptions which will be rejected if observed changes are found to be statistically significant.

Since the use of null hypotheses often results in statements which appear to contradict the purpose of the demonstration, for presentations to non-technical persons it is desirable to restate the hypotheses as questions to be answered by the evaluation.

Dependent Variables (Column 3). The dependent variables are those quantitative or scaled measures which reflect the impact of the monitoring system.

Independent Variables (Column 4). Independent variables are those which modify or otherwise affect the level of the measured dependent variables. These variables are of two types: controlled and uncontrolled. The uncontrolled independent variables are those beyond the influence of the demonstration. The controlled independent variables are those which can be altered by the demonstration evaluator in an attempt to discover the levels which best achieve the desired objectives. Each change in a controllable independent variable will normally trigger another measurement on a sub-set of the dependent variables.

Population (Column 5). The population is that group of entities which is measured or sampled to determine the state of system variables. Control populations are also specified in the tableau.

Measurement Intruments (Column 6). Measurement instruments are the devices which identify the levels of system variables. These are described in detail later in this section.

Analysis (Column 7). The analysis describes the general means of determining the statistical significance of any observed change. For example, it may be described as the comparison of two variables at different points in time, or the analysis of the relationship of sets of variables.

Statistical Test (Column 8). The statistical test includes the specific statistical technique that is used to perform the analysis.

Explanations (Column 9). This column contains comments and clarifying notes.

1.3.3 Data Collection

This subsection contains the data collection plans prepared by each of the local agencies responsible for assembling the information to be used in evaluating the proposed Preferential Lane project.

1.3.3.1 Traffic Data Collection (Responsible Agencies: Caltrans and LADT).

A. Vehicle Volume Counts (Corridor

Vehicle volumes in the study corridor will be measured by Caltrans immediately before project implementation, and at four weeks and six to nine months after project implementation along the selected screenlines which will intersect the Santa Monica Freeway and major parallel arterials. The screenlines will be established along Sepulveda Boulevard, La Cienega Boulevard, and Western Avenue. The intersecting major arterials will be:

a. Rodeo Road/Exposition Boulevard;
b. Jefferson Boulevard;
c. Culver Boulevard;
d. Adams Boulevard;
e. Washington Boulevard;
f. Venice Boulevard;
g. Pico Boulevard;
h. Olympic Boulevard;
i. Santa Monica Boulevard; and
j. Wilshire Boulevard.

These screenlines are depicted in Exhibit 1.10.

Additional vehicle volume counts will be taken at other freeway locations as described below. These freeways (except for the control freeway) are expected to be impacted by the project to the extent that a shift in volumes may occur initially, due to a redirecting of travel during the commute trips.

FREEWAY	LOCATION
Santa Monica	1. Cloverfield Street 2. Overland Avenue 3. Crenshaw Boulevard 4. Western Avenue

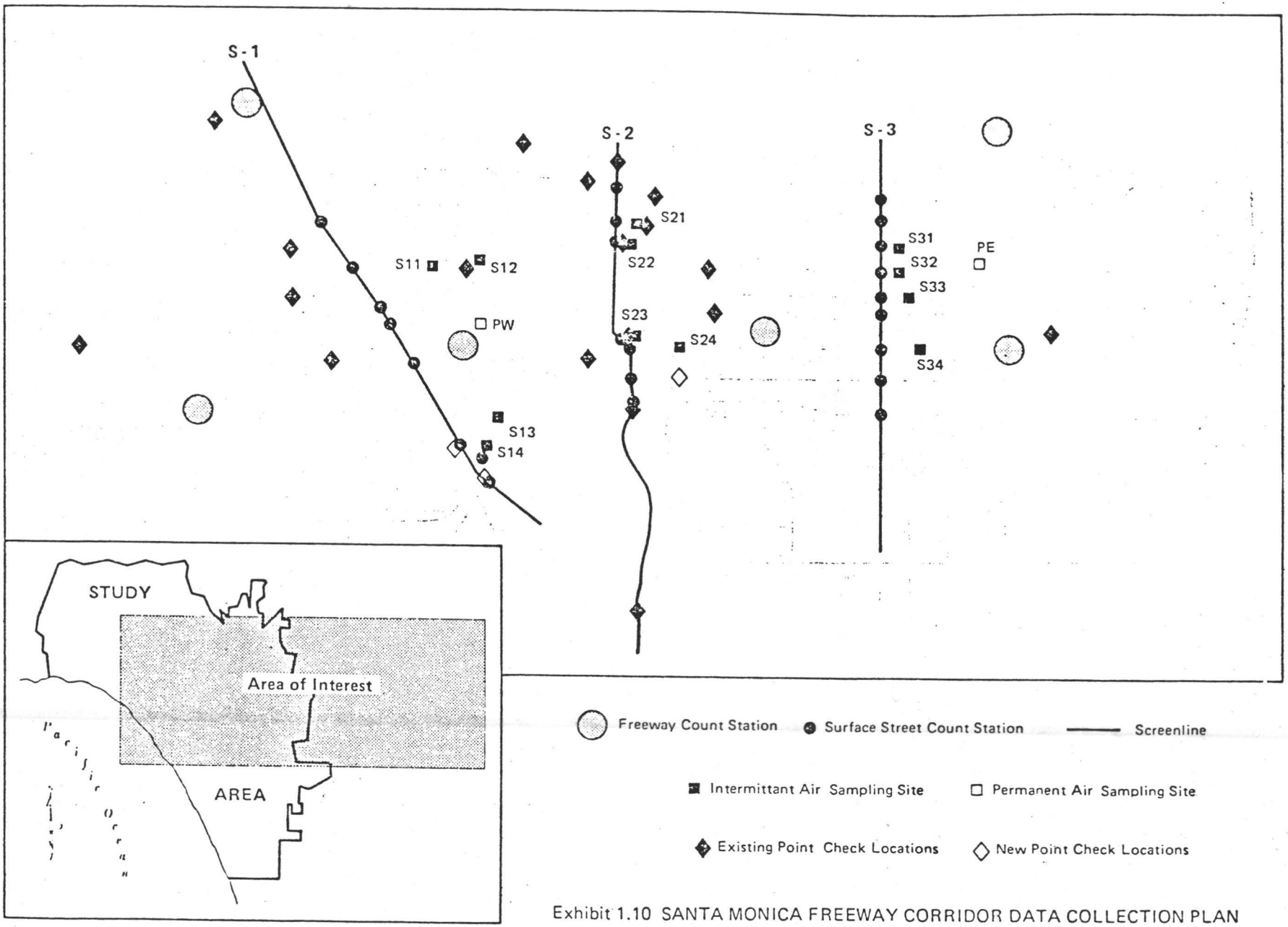


Exhibit 1.10 SANTA MONICA FREEWAY CORRIDOR DATA COLLECTION PLAN

Harbor	Adams Boulevard
Ventura-Hollywood	Edgewater Street
San Diego	Sunset Boulevard
Long Beach	Gage Avenue

In addition to the vehicle volume counts made by Caltrans on the Santa Monica Freeway, adjacent freeways and corridor arterials, the LADT will monitor vehicle volumes on certain of the north-south streets providing access to the Santa Monica Freeway. It is anticipated that storage problems may occur at certain of the metered on-ramps, causing waiting vehicles to interfere with the flow of traffic on the access streets feeding these ramps. A combination of manual and tube counts will be made on a sampling of those streets most likely to be affected by increased queue lengths. It is anticipated that storage problems may occur at the following on-ramps:*

EASTBOUND (A.M. PEAK)	WESTBOUND (P.M. Peak)
Lincoln Boulevard (Santa Monica)	20th Street (Hoover Street)
Cloverfield Boulevard (Santa Monica)	Vermont Avenue
Bundy Drive	Arlington Avenue
La Cienega Boulevard (Southbound ramp)	Fairfax Avenue
Washington Boulevard	La Cienega Boulevard

*As identified in a letter dated April 21, 1975 from S.S. Taylor, General Manager of the Los Angeles Department of Traffic to Haig Ayanian, District Director of Transportation for Caltrans, and subsequent conversations with LADT representatives.

Crenshaw Boulevard

Robertson Boulevard

Crenshaw Boulevard

Western Boulevard

Local streets monitored by both Caltrans and LADT will be hand-counted and tube-counted. The tube counts will be 24-hour counts and hand counts will record total volume and occupancy through the normal three-hour peak hour periods. All volume counts will be broken down into 15-minute intervals. Volume counts on the Santa Monica Freeway and Harbor Freeways can be extracted from the computer in five-minute intervals. Counts on other freeways not in the "loop" will be hand-counted to determine volume and occupancy.

Manual counting on freeways will be done 23 minutes out of each 30-minute period and adjusted to provide a total volume and occupancy count. Manual counting on surface streets will be continuous. At least two days of sampling shall be required for each street on which traffic volumes are measured. Sample size considerations are discussed in more detail in Appendix A.

B. Vehicle Occupancy Counts. Vehicle occupancy counts will be made by Caltrans on the Santa Monica Freeway and corridor arterials, and on the Harbor and Long Beach Freeways just before project implementation and again four weeks and six to nine months later on the assumption that it will take approximately six months or more before a significant shift to car-pooling can be detected by measurement.

Vehicle occupancy in the preferential lane will be monitored during the peak period through the first, fourth, and sixth weeks following project implementation, and again two months and six to nine months later to determine the incidence of lane violations by automobiles with one or two occupants.

C. Speed Runs. Speed runs will be made by Caltrans at peak periods along the Santa Monica, San Diego, Ventura-Hollywood and Long Beach Freeways, plus Santa Monica corridor arterials before project implementation and again approximately four weeks and from six to nine months after implementation. Following project implementation, speed runs on the Santa Monica Freeway will be made in both the preferential lane and the unreserved lanes. To provide a suitable basis for comparison, two sets of speed runs will be made on the Santa Monica Freeway prior to project implementation. One set will be made in the median lanes, while the second set will be made in the remaining lanes, excluding the median lanes. At least 24 speed runs will be made on each designated freeway and arterial in obtaining speed and delay data. Speed data on the Harbor Freeway will be obtained from the 42-mile loop computer.

Speed runs on parallel corridor arterials should include those segments of the arterials most likely to become congested when the preferential lane is implemented. A network assignment routine undertaken by LADT has predicted critical volume to capacity ratios equal to or greater than 0.9 on the following segments of parallel corridor streets.*

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*Previously cited letter from S.S. Taylor to Haig Ayanian.

EASTBOUND (A.M. PEAK HOUR)

Olympic Boulevard (Robertson Boulevard to Vermont Avenue)
Pico Boulevard (Sepulveda Boulevard to La Brea Avenue)
National Boulevard (Overland Avenue to Robertson Boulevard)
Venice Boulevard (Robertson Boulevard to Arlington Avenue)
Washington Boulevard (Crenshaw Boulevard to Vermont Avenue)
Rodeo Road-Exposition Boulevard (Arlington Avenue to Vermont Avenue)

WESTBOUND (P.M. PEAK HOUR)

6th Street (Vermont Avenue to La Brea Avenue)
Santa Monica Boulevard (Beverly Hills to Sepulveda Boulevard)
Olympic Boulevard (Vermont Avenue to Bundy Drive)
Pico Boulevard (La Cienega Boulevard to Bundy Drive)
Venice Boulevard (Crenshaw Boulevard to Sepulveda Boulevard)
Washington Boulevard (Vermont Avenue to La Brea Avenue)
Adams Boulevard (Vermont Avenue to La Brea Avenue)
Exposition Boulevard-Rodeo Road (Vermont Avenue to La Cienega Boulevard).

Speed and delay runs will be made by the LADT on certain critical north-south access streets before project implementation, approximately four weeks after implementation, and again from six to nine months later. These speed and delay runs will be made on the same population of cross streets on which volume counts are made. Section B above lists candidate cross streets which may be subjected to traffic delays caused by spillover from saturated on-ramps. Speed runs on cross streets will be made for distances of at least 1/2 mile in the vicinity of the metered on-ramps. At least 24 speed runs should be made on each segment of access road. This corresponds to runs at 15-minute intervals during two three-hour peak periods.

b. On-Ramp Queue Lengths. Caltrans will measure queue lengths on each metered access ramp at 15-minute intervals during peak hours on at least two days during the period before project implementation, immediately following imple-

mentation, approximately four weeks later, and again from six to nine months later. In keeping with current practice, measurements will be made following any major adjustment in metering rates. Queue lengths will be measured in both reserved and unreserved access lanes and combined with the metering rate to compute mean delays at each on-ramp. Queue length information will also be correlated with speed and delay information on access streets and route diversion statistics in an attempt to gain additional insights into the overall impact of the preferential lane project on traffic flow in the vicinity of the Santa Monica Freeway.

E. Time-Lapse Photography. Time-lapse photography designed to record weaving movements and lane changes will be used by Caltrans to record preferential lane operation at four separate locations (Cloverfield Street, Overland Avenue, Crenshaw Boulevard and Western Avenue) just before implementation, on the first day, again four weeks later, and at subsequent intervals as operational conditions dictate.

F. Aerial Photography. Caltrans personnel, using a CHP helicopter, will take 35-millimeter aerial photographs of the Santa Monica Freeway and corridor arterials before project implementation, on opening day, three weeks later, six to nine months following implementation, and at intervening intervals as operational conditions dictate. These photographs will supplement existing data collection activities, particularly those activities focusing on congestion and ramp queueing, and will provide a useful visual means of interpreting and presenting project results.

1.3.3.2 Air Quality Data (Responsible Agency: Caltrans). The purpose of monitoring air pollutants for this project is to detect any changes in air quality due to changes in traffic volumes, patterns, and operating modes resulting from implementation of the project. Since carbon monoxide (CO) is a primary pollutant emitted in large amounts by motor vehicles, changes in air quality may be indicated by statistical analyses of the CO data collected.

The changes in CO emissions from vehicles are likely to occur on the freeway itself and on major city streets which parallel the freeway and are used by rush-hour commuters. Therefore, CO samplers are to be placed on the freeway and on those city streets. To help establish a baseline CO level for before/after comparisons, bag sampling has already begun.

In addition, Caltrans will coordinate its research van activities and other mobile vans to develop air quality data for evaluation.

A. Permanent Bag Samplers. Two permanent CO bag samplers have been established, one near the west end and one near the east end of the project. The purpose was to establish temporal and spatial ambient CO levels far enough away from the freeway to sample pollutants emitted on both corridor streets and the Santa Monica Freeway. The samplers are automatic, collecting 24 one-hour bag samples which are then reduced at the District Laboratory by Non-Dispersive Infra-red (NDIR) analysis on a week-day monitoring schedule.

B. Portable Bag Samplers. Twelve sampling sites, four on each of three screenlines roughly perpendicular and straddling the freeway, have been established to monitor CO levels on city streets. One-hour bag samples from 6:00 a.m. to 6:00 p.m. are collected at each of four sites operating simultaneously on one screenline. The screenlines are sampled in succession (line one, then line two, then line three, return to line one and repeat) following the same schedule as the permanent bag samples. Samples then are taken to the District Laboratory for NDIR analysis.

C. Research Van. Several air pollutants, including CO, will be collected from multi-level probes in the freeway median. During the operational periods the research van will remain at a permanent site.

D. Mobile Vans. Several air pollutants will also be monitored by a mobile van alternating between the permanent bag sampling sites every other sampling day. Traffic counts on city streets, coordinated by the Freeway Operation Branch of Caltrans, are scheduled during September and October, 1975. The intermittant bag sampling schedule will be modified during traffic count days so that air sampling will always occur on days when traffic is being counted. Statistical analyses will show trends or relationships between traffic characteristics and air pollutant emissions.

E. Site Locations. Locations of all sampling sites are shown on the attached map (Exhibit 1.10). Specific descriptions of bag sampling sites are given below. In addition, air quality data will be monitored at an appropriate

site on the Long Beach Freeway (control freeway) utilizing automatic bag sampling.

I. 24-Hour Continuous CO Bag Samplers

SITE	LOCATION
PW	Palms Recreation Center 2950 Overland Avenue Recreation and Parks Department City of Los Angeles
PE	Terrace Park Pico Boulevard and Bonnie Brae Street Recreation and Parks Department City of Los Angeles

II. 12-Hour Intermittent CO Bag Samplers

SITE	LOCATION
S11	Northeast Corner of Olympic and Selby @ Pedestrian Undercrossing
S12	Rancho Park Golf Course Parkway in front of Clubhouse
S13	Venice Boulevard Median 300 Feet West of Motor Avenue
S14	La Ballona Elementary School 10915 Washington Boulevard
S21	Carthay Center School Olympic Boulevard at Carrillo
S22	Pico Rents Northeast Corner Crescent Heights Boulevard and Pico Boulevard
S23	Venice Boulevard Median Just South of Route 10
S24	Westside Neighborhood Park Fairfax and Adams
S31	Hobart Boulevard School Olympic Boulevard and Hobart Boulevard

S32	Catholic Girls' High School Kingsley Drive and Pico Boulevard
S33	Normandie Playground Venice Boulevard and Normandie Avenue
S34	Catholic School Adams Boulevard and Vermont Avenue

1.3.3.3 Transit Patronage and Performance Data (Responsible Agencies: SCRTD and SMMBL). Changes in transit ridership that occur because of the improved bus service will be documented by point checks taken on existing routes before implementation of the improved service and twice afterward. Patronage on the new routes will be regularly monitored. Checkers monitoring ridership will also record the on-time performance of the routes monitored.

A. SCRTD Data Collection. Point checks will be made on existing lines that operate within the study area at locations beyond the points at which diversions to the new service are expected to occur, so that ridership reductions past these points can be attributed to a diversion to the new service.

It was originally proposed that the checks be taken on two weekdays within the same week. In order to increase accuracy, the sample size discussions in Appendix A propose that the number of observations be doubled, with counts taken on four weekdays. Point checks will be taken during peak hours only on those lines that would be affected by new service operating only during peak hours. On those existing lines where there is the possibility of diversion to the

new service during mid-day hours, it will be necessary to conduct all-day checks. The points at which checks are to be made on existing routes are listed in Exhibit 1.11.

EXHIBIT 1.11

SCRTD POINT CHECK PROGRAM - EXISTING LINES

Point Check Location	Line Checked	Duration of Check	Checkers Required
Wilshire and Fairfax	83	6-9 A.M.; 4-7 P.M.	1
Wilshire and Federal	83	6 A.M. - 7 P.M.	1-1/2
Olympic and Fairfax	4	6-9 A.M.; 4-7 P.M.	1
Bundy and Santa Monica	4	6 A.M. - 7 P.M.	1-1/2
Wilshire and Robertson	21	6-9 A.M.; 4-7 P.M.	1
Venice and National	21	6-9 A.M.; 4-7 P.M.	1
Burton and La Cienega	27	6-9 A.M.; 4-7 P.M.	1
Rodeo and La Cienega	27	6 A.M. - 7 P.M.	1-1/2
Pico and La Cienega	27	6-9 A.M.; 4-7 P.M.	1
Sepulveda and Century	51	6 A.M. - 7 P.M.	1-1/2
La Cienega and La Tiejera	51	6 A.M. - 7 P.M.	1-1/2
Sunset and Church Lane	601	6-9 A.M.; 4-7 P.M.	1
Venice and La Cienega	606-604	6-9 A.M.; 4-7 P.M.	1
Sepulveda and Culver	606	6-9 A.M.; 4-7 P.M.	1
Sepulveda and Venice	604	6-9 A.M.; 4-7 P.M.	1
Venice and Grand	604	6-9 A.M.; 4-7 P.M.	1
Pico and Rimpau	26	6 A.M. - 7 P.M.	1-1/2
Washington and La Brea	12	6-9 A.M.; 4-7 P.M.	1
Jefferson and La Brea	9	6-9 A.M.; 4-7 P.M.	1
Total			22

(Source: SYSTAN and SCRTD Project Grant Application)

In addition to the locations listed in Exhibit 1.11, point checks will also be made at the downtown stop nearest the freeway entrances and exists for control lines #34 and #36. Arrangements will be made to obtain corresponding data from the ongoing monitoring of the San Bernardino Busway. In addition, the new lines will be monitored for changes in patronage. This will be accomplished by setting up a point

check at Venice Boulevard and Grant Avenue in Los Angeles. This is the first stop for all freeway-express buses before entering or after leaving the Santa Monica Freeway. Patronage on the new express lines will be monitored very closely shortly after start-up, with checking activity tapering off as patronage on the lines stabilizes. For planning purposes, it is recommended that there be two checks per week every other week for the first four months, and one check per month for the remaining eight months. It is further assumed that at least five additional checks will be necessary to validate point checks made in anticipation of a September 29, 1975 implementation date and monitor the impact of exogenous events occurring during the demonstration.

B. SMMBL Data Collection. The collection of data by SMMBL will be similar to that collected by SCRTD, and will complement it. Point checks will be made on existing lines that are likely to be affected by the new freeway-express lines. Because of the complexity of the freeway-express service that is to be operated in SMMBL's service area, checks at several points will be taken in an attempt to locate the point of diversion.

Each of the proposed SMMBL point checks will be taken on four separate weekdays, and then averaged to improve accuracy. The point checks will be taken during the months before implementation of the project, during the month following implementation, and six to nine months following implementation.

Existing routes on which patronage diversion is expected during mid-day hours will be checked all day; other points will be checked only during morning and evening peak hours. The points at which existing routes are proposed to be checked are given in Exhibit 1.12.

EXHIBIT 1.12

SMMBL Point Check Program - Existing Lines

Point Check Location	Lines Checked	Duration of Check	Checkers Required
Pico & Rimpau	7-12-13	6 AM - 7 PM	1-1/2
Pico & La Cienega	7-12	6-8:30 AM - 5-7 PM	1
Pico & Beverly Glen	7	6-8:30 AM - 5-7 PM	1
Pico & Bundy	7	6 AM - 7 PM	1-1/2
Lincoln & Montana	3	6:30-8:30 AM 5-7 PM	1
Sunset & Chautauqua	9	6:30-8:30 AM 5-7 PM	1
Total			7

Source: Demonstration Grant Application

In addition to the buses listed in Exhibit 1.12, point checks will also be made on the #11 crosstown line as part of a continuous monitoring of the lines' performance. Patronage on SMMBL's new routes will also be monitored on a regular basis for changes in ridership. SMMBL's one freeway-express line #10 will be monitored by SCRTD at their check-point at Venice & Grand in Los Angeles. It was first estimated that at least three point checks would be needed on the proposed crosstown line #14 on Bundy/Centinela,

but because of the many ways that this route could be used in combination with the freeway-express routes, it was concluded that a better check on ridership would be obtained with a "riding check" (e.g., a computation of the number of passengers boarding and alighting at each stop or during each trip). The riding checks will be conducted from 7 A.M. to 6 P.M.

Although the four feeder and crosstown lines will be monitored continuously throughout the one-year length of the project, it is not necessary to check these lines will the same rrequency as the freeway-express lines. It is instead proposed that the feeder/crosstown lines be checked only once each month for a total of twelve checks.

1.3.3.4 Safety and Enforcement Data Collection (Responsible Agencies: CHP and LAPD). The CHP will assemble freeway accident data, maintain records of enforcement levels, record citations and warnings issued for lane violations, and identify enforcement problems associated with preferential lane operation. The LAPD will assemble accident data on surface streets in the corridor and maintain records of enforcements levels following project implementation.

A. Accident Data. Accident on the Santa Monica Freeway are normally assembled from the reports of CHP officers. The proposed preferential lane project covers seven designated CHP beats and two command areas, Central Los Angeles and Western Los Angeles. Accidents on the seven beats affected by the project will be recorded by number, severity (property damage, injury, or fatality), and primary

cause. Monthly summaries will be prepared classifying accidents by direction of travel and time of day. In cases in which an accident vehicle was attempting to enter or leave the preferential lane at the time of the accident, this fact will be noted by the reporting officer.

Accident data on surface streets in Los Angeles are assembled by LAPD and classified as follows:

a) Serious Injury;

b) Slight Injury (contusions);

c) Complaint of Injury;

d) Property Damage; and/or

e) Fatality.

Additional accident data recorded by the reporting officers and computerized by LAPD include primary cause, time of day, and nearest intersection. Daily summaries and monthly reports are provided covering each LAPD division. For the purposes of the preferential lane study, the best source of accident data is the quarterly accident summary report produced by the Los Angeles Department of Traffic (LADT) with information supplied by LAPD. This report lists accidents by key intersections for the last four quarters and for three years preceding the last four quarters. In addition, it is possible to obtain an accident location analysis report giving a six-year history of accidents at any intersection within the jurisdiction of LAPD. Since most of the intersections within the study area fall within this jurisdiction, no additional surface street accident data is required for the preferential lane evaluation beyond that already being collected by LAPD.

B. Enforcement Data. In the case of the CHP, the number of units assigned to each of the seven freeway beats covered by the preferential lane project will be recaptured from daily schedules of manpower assignments. Knowledge of the number of CHP units assigned to the Santa Monica Freeway during project implementation is necessary both in interpreting lane violation data and in portraying the social costs of the project.

At least six LAPD divisions (Divisions 1, 2, 3, 7, 8 and 14) are likely to be affected by the preferential lane. Information regarding manpower assignments in the vicinity of the Santa Monica Freeway will have to come from the captain of each division, since the divisions operate autonomously.

Data on the number of warnings and citations issued for violations of the preferential lane and freeway access ramps will be maintained by the CHP. Since warnings are not usually recorded separately and citations are not usually tallied by beat, the maintenance of these records will require a slight modification of normal recording procedures. Beat officers will maintain separate tabulations of warnings and citations issued for preferential lane violations, along with an individual assessment of the probable cause of each violation (i.e. ignorance, confusion, or deliberate non-compliance). These tabulations will be collected and summarized by the desk sergeant responsible for reviewing the daily reports of beat officers. In addition, any special enforcement problems resulting from the introduction of the preferential lane shall be reported by beat officers to their superiors and included in the evaluation process.

1.3.3.5 Attitude and Behavior Surveys. (Responsible Agencies: FHWA, Caltrans, SCRTD, SMMBL) Three separate surveys of attitudes and behavior will be undertaken in the course of the evaluation:

1. A "before and after" home interview survey will be conducted by the FHWA.
2. A license-plate based postcard survey of carpoolers will be conducted by Caltrans after the preferential lane has been in operation for six to nine months.
3. An on-board survey of bus users will be conducted by SCRTD and SMMBL within nine months following project implementation.

The information content and design of these surveys needs to be carefully coordinated. The most critical of the coordination requirements concerns the "before and after" home interview survey sponsored by FHWA. This survey, which will be the first to be conducted on the evaluation process, addresses a different sample population and somewhat broader issues than the remainder of the evaluation plan.

A. The FHWA Home Interview Survey. The FHWA, through its consultant, Market Facts, Inc., will conduct a study entitled "Measuring the Effects of System Operating Policies on the Travel Behavior and Desires of Individuals." This study, which will consist of a series of "before and after" home interviews, is designed to ascertain attitudes toward transit (and car-pooling) and to establish a data base on behavior to be used to identify changes resulting from project implementation. In addition, the FHWA wishes to assess attitudes toward other short term, non-capital intensive innovations. This latter objective is of general interest, but not essential to the objectives of the

preferential lane demonstration. As currently planned, the main ingredient of the home interview survey of importance to the demonstration is the plan to capture "before" attitudes, in an attempt to relate these attitudes to subsequent mode choice decisions.

The target population of interest to FHWA consists of those users and potential users of the Santa Monica freeway destined for the CBD. This population is defined in a geographic sense to consist of persons living within approximately 1-1/2 miles (the actual distance varies due to census tract configuration) of the freeway. Originally, census tracts having an incidence of travel to the CBD of less than 5% of the total population were not to be considered in order to reduce the screening necessary. This essentially meant that the sampling frame did not extend past a fixed distance from the CBD and excluded much of the Westside study area of interest in the preferential lane demonstration. With UMTA funding, however, the sampling frame has been extended to include communities further away from the CBD that are also included in the preferential lane study area. A control group is similarly being selected from an area within 1-1/2 miles of the other major freeways.

Local jurisdictions sponsoring the demonstration are interested in all users of the corridor, which includes substantial numbers of users not destined for the CBD, but who rather use the link for longer trips. (It is estimated that travelers destined for points outside the CBD comprise more than 85% of the users of the Santa Monica Freeway.) FHWA believes that the typical pattern of traffic in most cities is hub-like into a CBD and hence this flow is the most important for assuring transferability of the results in Los Angeles to other cities. Nevertheless, a broader sample encompassing all freeway users would

be desirable for local purposes as well as for transferability considerations.

If travel times are decreased by the preferential lane, it can be expected that trips on the freeway will have origins at greater distances from the CBD. Since this phenomenon has an impact on VMT and may have land use impacts in the longer term, it is desirable to build the proper data base now for possible future analysis. This is not done with the original geographic limitation and perhaps not accomplished with the extended geographic sampling frame.

The fact that the proposed census-tract sampling procedure isolates a sample population that is decidedly different from the population addressed by other measurements (vehicle flows, auto occupancy counts, etc.) makes it difficult to relate household survey data to the remainder of the demonstration evaluation, which is directed toward all freeway users. For demonstration purposes, the proposed plan will yield useable information regarding the attitudes of a certain segment of the public, but the relationship of this segment to the broader class of all freeway users is not easy to ascertain. To help relate these two sample populations and to provide additional information of interest in the demonstration evaluation, the proposed telephone screening survey used to isolate CBD-destined travelers for home interviews has been lengthened somewhat to elicit O/D and mode choice information from a sampling of those travelers using the Santa Monica Freeway corridor whose places of employment lie outside the CBD.

The approximate sample size of the proposed home interview survey as planned by FHWA and augmented by UMTA funding are as follows:

	Target	Control
Single Occupant Auto Drivers	800	800
Carpool Drivers	200	200
Carpool Passengers	200	200
Bus Users	200	200

The sample is to be identified by an estimated 46,000 phone calls selected at random to identify commuters to the CBD. Householders qualifying as CBD commuters will be asked to supply information in an extensive home interview covering existing travel behavior, attitudes toward different transit modes, paired comparisons of different modal attributes, and subjective rankings of different low-capital transportation improvements. In addition, O/D and mode choice information will be elicited from 2,000 corridor users with destinations outside the CBD.

Because of the multiple objectives of the FHWA study, the home interview questionnaire, which requires approximately one hour to administer, includes much more information than is required for the purpose of the demonstration evaluation. Questions on modal attitudes are more than adequate for the needs of the preferential lane evaluation. Because the survey will not be taken until the public information program has started, respondents will be queried regarding their awareness of the preferential lane project. It is further recommended that a question regarding the source of the respondent's knowledge of the demonstration be included to determine whether the information was obtained from mailings, phone calls, radio announcements, leaflets, local newspapers, freeway displays, word of mouth, or some combination of these sources. Additional questions related to the project should probe the respondent's knowledge of existing and proposed bus service and his perceptions regarding

the relative seriousness of preferential lane violations.

B. Caltrans Postcard Survey of Carpoolers. Once a relatively steady state[1] has been achieved following project implementation, Caltrans will conduct a license-plate based postcard survey of carpoolers using the preferential lane. The primary purpose of this survey is to determine the extent of the modal shift and VMT reduction brought about by the preferential lane. To achieve plus or minus five percent accuracy with 95 percent confidence, the license plate survey will be designed to develop a sample base of approximately 1000 carpool vehicles, 500 from peak hours and 500 from off-peak hours.[2] License plates will be photographed at four locations in the carpool lane of the Santa Monica Freeway, and the sample selected in accordance with the procedures outlined in Appendix A of this report.

The questionnaire used in polling carpoolers will be designed jointly by Caltrans and SYSTAN, Inc. and will be coordinated with the questionnaire used in on-board surveys and the initial travel behavior section of the proposed home interview survey. Data obtained from carpoolers will include:

origin-destination information

number and relationship of carpoolers

trip frequencies

parking charges

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[1] Steady state is defined as the condition when the major behavior changes due to the preferential lane have occurred; that is, travelers have learned how to use the lane or buses, or have arranged carpools, and enforcement is at its normal level.

[2] In the event that fewer than 500 carpoolers use the preferential lane during off-peak hours, a 100% sampling plan will be instituted.

door-to-door travel times

trip history prior to preferential lane project

driver income level

attitudes toward transit and lane violations

C. SCRTD and SMMBL On-Board Surveys. To determine the characteristics of users of the new bus service, a questionnaire will be distributed to riders on SCRTD's freeway-express bus routes and SMMBL's freeway-express buses, feeder buses and crosstown buses. Primary responsibility for the design of the questionnaire will rest with the UMTA/TSC evaluation contractor, SYSTAN, Inc., but questionnaire content will be carefully coordinated with other planned attitude and behavior surveys and reviewed by SCRTD and SMMBL. Personnel from the respective bus companies will administer the questionnaire once a steady level of transit ridership has been achieved. Ideally, the survey will be timed to coincide with the carpool postcard survey. Data obtained from transit riders will include:

origin-destination information

trip frequency

door-to-door travel times

trip history prior to preferential lane project

income level

attitudes toward transit and lane violations

auto availability

D. Additional Monitoring of Public Attitudes and Reactions. Several additional preferential lane projects are scheduled for implementation in the Los Angeles area within the next few years. The Santa Monica Freeway project is likely to generate more public reaction than any of the other proposed projects,

because it is the first of the scheduled projects to be implemented and because it entails the denial of an existing lane to some drivers. The projected surveys will be designed to explore these attitudes. In addition to the surveys, specific plans have been made for monitoring and recording responses in the media (editorials, letters to the editor, talk show comments, etc.). Members of Caltrans' Public Relations Department commonly read all major daily newspapers in the Los Angeles area and have agreed to maintain a separate file for information related to the Santa Monica Freeway. In addition, SYSTAN personnel will review the Los Angeles Times and the Santa Monica Evening Outlook, both for transportation information and for news of exogenous events that might affect the demonstration.

Caltrans will make arrangements with a Los Angeles media-monitoring firm to monitor both radio and television broadcasts and provide transcripts of all references to the Santa Monica Freeway Project. Monitoring will be continous and all-inclusive throughout the month preceding implementation and the first month following implementation. Thereafter, the firm will provide transcripts of items of exceptional interest in accordance with their existing relationship with Caltrans' Public Relations Department.

In cooperation with the Los Angeles Mayor's Office, a central telephone number (213/520-8111) has been established to provide Los Angeles residents with information on bus schedules, car-pooling, alternative routes, and preferential lane use. The telephone number, which will also provide a channel for the expression of public opinion, will be answered by volunteers and personnel from Caltrans, SCRTD, and Commuter Computer. SYSTAN personnel have participated

in the planning of telephone center operations and have developed a summary sheet for use by telephone operators. This summary sheet classifies incoming calls with regard to the general nature of the response (positive or negative), the type of information requested, user identification (area of residence and current mode of transportation), and the final disposition of the call. Information obtained from these sheets will be tabulated by SYSTAN and the Mayor's Office. In addition, a SYSTAN representative will be available in the telephone answering center during critical periods (i.e., the days following the initiation of the marketing campaign and the week before and after project implementation) to monitor incoming calls and to obtain a first-person sample of public reaction.

Information requests for carpool information received by Commuter Computer will be monitored before the demonstration is publicized, during the publicity period, and following project implementation. Telephone center requests for information from SCRTD, SMMBL, and Caltrans will also be monitored during the publicity period and the period immediately following implementation. The names and addresses of callers receiving the general project information packet prepared by the marketing subcommittee will also be recorded for possible future contact.

1.3.4 Data Analysis

Details of the analytic comparisons to be undertaken using the data collected in the course of the evaluation appear in the tableaus of Exhibits 1.5 through 1.9. These comparisons have been summarized in the overview of Exhibit 1.1. This section discusses certain aspects of the data analysis plan which may not be apparent in the tableaus, either because they are implicit in the evaluation plan or because they require a more detailed treatment than is permitted by the tableau format. These aspects include considerations of statistical significance, the definition of modal market shares, the analysis of computerized traffic flow records, and the exploration of cause and effect relationships.

1.3.4.1 Statistical Analysis. The analytical approach to demonstration evaluation developed in this report is based on a structured statistical framework for formulating and testing hypotheses. Much study effort has been devoted to the development of statistically significant testing procedures, the estimation of confidence intervals, and the use of factor analysis to identify concomitant changes in variables. This concern for statistical significance will be reflected throughout the demonstration's evaluation. It should be recognized that the acceptance of hypotheses indicates only the substantiation of their plausability under specific experimental conditions. The validity of inferences drawn from these hypotheses must rest, to a large extent, on the experimental sample size and the correct interpretation of these experimental conditions.

In some instances, data may seem to imply the answers to the questions, What? and Why? (or Why Not?) in cases where statistical significance cannot be shown. This knowledge is useful in generating hypotheses for further consideration. Hence, certain study findings may be useful without being statistically significant.

Examples of the kinds of questions that will be analyzed by statistical methods appear below:

- Do the attributes of two entities differ as a result of transport innovations? (i.e., does vehicle occupancy differ before and after demonstration implementation?)
- Do two attributes change in a correlated fashion? (i.e., can a causal relationship be inferred between bus ridership and travel time?)
- Does a small group of variables explain or contain the information in a larger group? (i.e., is low income a surrogate for transit dependence?)

A positive answer to any of these questions is the basis for an inference regarding causality, which in turn may generate additional hypotheses for testing. A negative answer may be just as revealing.

Besides time and cost, two important quantitative elements in the selection of "appropriate" sample sizes are:

- Assurance that the accuracy of the collected data is within selected limits, and
- Assurance that specified changes in the data from one phase of the program to another be detected as significant or not significant, both at stated levels of confidence.

TSC is currently generating sample size guidelines for use by all UMTA demonstration evaluators. Once these guidelines have been developed, they will be incorporated in the experimental design to the maximum extent possible given the then-current state of project implementation. General sample size guidelines observed in past demonstration projects and used in developing this evaluation plan are listed below:

1. The accuracy of estimates of variable levels should be within plus or minus 5 percent with 95 percent confidence (the plus or minus 5 percent range around the estimated value will include the true value 95 percent of the time that this estimation procedure is used.)

2. If the true value of a variable (such as vehicle occupancy) shifts by 10 percent, the sample size should be sufficiently large so that the analyst fails to recognize that shift only 20 percent of the time (Type II error of .20) and might erroneously say that the shift has occurred, when it has not, only five percent of the time (Type I error of .05).

The above general guidelines were observed in developing data collection plans as part of the experimental design and in reviewing plans developed by local agencies as part of the demonstration grant application. For the most part, the data collection plans developed by local agencies fall well within the above confidence limits. Revised sampling plans have been recommended in cases in which local plans failed to provide the desired levels of statistical accuracy.

For all statistical analyses conducted in the course of a demonstration, the following information will be provided:

- A confidence limit for a given measure after it is computed from a sample, or
- The level of significance for any observed shift in a given measure from one phase of the program to another.

Appropriate tests for determining these levels of significance are identified in the experimental design tableaus (Exhibits 1.5 through 1.9).

1.3.4.2 Market Share Definition. A number of different definitions of modal market share are possible. At least three definitions will be employed in the proposed evaluation process. The first measure will focus on screenline crossings within the project area, the second on CBD-destined trips, and the third on the vehicle mileage consumed by corridor users. Each approach will attempt to define the market share commanded by the different modes of interest before and after project implementation. The three modes of interest in the market share computation are:

1. Carpoolers (three or more people per auto);
2. Non-carpooling auto users; and
3. Transit users.

A. Screenline Crossings. Crossings by mode at two of the three major project screenlines (Sepulveda Boulevard and La Cienega Boulevard) will be recorded before project implementation, three weeks after project implementation, and six to nine months following project implementation. Carpool and other automobile crossings will be measured at the third project screenline, Western Avenue. Each mode's share of total crossings will be computed at the Sepulveda Boulevard and La Cienega Boulevard screenlines. Because no major project-related changes in transit service are planned for the area east of La Cienega Boulevard, analysis of the Western Avenue screenline crossings shall focus on changes in automobile occupancy.

B. CBD Travel. Each mode's share of trips originating in the Westside project area and terminating in the Los Angeles CBD will be calculated before

and after project implementation. The primary source of data for this calculation will be the home-interview survey conducted by FHWA, which is directed exclusively at CBD-destined travelers. Several supplementing sources of information will be employed to locate the FHWA sample population with respect to the larger population encompassing all CBD-destined travelers and all Santa Monica corridor users. These include the recently completed Downtown Los Angeles Travel Surveys[1], the Ramp Usage Survey undertaken in 1973 by Caltrans[2], the biannual CBD corridor counts taken by the Los Angeles Department of Traffic, and the Postcard and On-Board Surveys planned as part of the project evaluation.

C. VMT Share. An attempt will be made to estimate the vehicle miles traveled by mode by corridor users before and after project implementation. The primary source of data supporting this estimate will be the telephone screening survey conducted by the FHWA to identify a sample population for home interviews. In addition to identifying CBD-destined workers for follow-up home interviews, the initial telephone survey will identify a separate population of workers who use the Santa Monica corridor to commute to places of employment located outside the CBD. Although this population will not be included in the home interview sample, sufficient information will be obtained by phone to support VMT computations. VMT estimates obtained in this fashion will be

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[1] Central Business District Employee Travel Survey, prepared for Southern California Rapid Transit District, Wilbur Smith and Associates, July 1975.

[2] Ramp Usage Survey, Eastbound Santa Monica Freeway, State of California Business and Transportation Agency, Department of Transportation, Los Angeles District 7, Freeway Operation Branch Report No. 73-6, July, 1973.

checked against estimates formed by combining the information obtained from before and after screenline counts, post card surveys, and on-board surveys, with the data base supporting the LARTS transportation model.* Since the cost of a "before and after" origin-destination survey cannot be justified if used solely for VMT estimations, the use of telephone surveys supported by updated tabulations from the LARTS model appears to be the most likely approach to VMT estimation. One drawback in the use of the LARTS model is the age of the data base, which was assembled in 1967. With suitable adjustment factors, however, this data base is deemed to be adequate for the purpose of estimating an aggregate statistic such as VMT.

1.3.4.3. Analysis of Computerized Traffic Flow Records. As part of the 42-mile freeway surveillance loop**, the Santa Monica Freeway is one of the most closely monitored in the world and presents unique opportunities for data analysis. Electronic surveillance of the 42-mile triangle formed by the Santa Monica, San Diego, and Harbor Freeways is accomplished through loop detectors placed in all four lanes at approximate three-mile intervals. Although the surveillance system was primarily devised to deal with problems of non-recurrent congestion caused by accidents and other unpredictable traffic incidents, the system provides a record of the day-to-day freeway congestion

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* Sorenson, Sterling A., and David W. Brewer, The LARTS Transportation Model: Description and Assumptions, Caltrans Technical Report Series tr/2, Los Angeles, January, 1974.

** A description of this project may be found in Green, Richard H., "The 42-Mile Freeway Surveillance Loop," Freeway Operations Dept., California Division of Highways, Los Angeles, CA, 1973.

conditions that can be stored for later analysis on either hard copy or computer tape. Examples of available computer printouts are shown in Exhibits 1.11 through 1.13. Respectively, these exhibits show hourly volumes at each recording station along the Santa Monica Freeway, speed records at five-minute intervals for a single station, and a computation of the vehicle delays encountered at sample stations throughout the day. The level of detail presented in these exhibits permits a far more detailed investigation of the precise impact of the preferential lane project on traffic flow than would be possible with daily or hourly mechanical counts of traffic. Records of traffic flow on the Santa Monica Freeway will be maintained on computer tape beginning at least one month prior to the demonstration and continuing throughout the demonstration.* In addition to before-after comparisons of traffic flow densities, the following investigations of detailed congestion attributes will be undertaken, using the recorded data:

- Before-after comparisons of total vehicle delay (defined as total vehicle minutes under 35 mph);
- Before-after comparisons of duration of peak traffic congestion (defined as the number of successive five-minute intervals under 50 mph and under 35 mph);
- Before-after comparisons of the shape of peak lane congestion (defined as the second moment of the 5-minute distribution of lane occupancy).

Additional comparisons will be developed as the study progresses.

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*The surveillance center computer is scheduled for relocation in mid-December, 1975, but should be back in service on March 15, 1976. Traffic data will be adjusted if the computer is not in service by the beginning of the evaluation period.

SANTA MONICA FREEWAY EASTBOUND HOURLY VOLUME TOTALS DIRECTION OF TRAVEL ===> 11/11/74

ENDING	STATION NUMBER 01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
	++	++	+++	-+-	-+-	++++	+-+-	+++++	+-+-	-+-	+-+--	++++	+-+-	+-+-	++++	+-+-
0100	204	181	503	214	203	584	0*	665	211	160	459	459	890	606	1348	565
0200	111	97	267	108	104	337	0*	365	129	73	217	190	410	302	674	281
0300	73	60*	181	82	72	213	0*	251	97	67	146	124	257	210	450	195
0400	55	50	130	53	55	155	0*	183	63	43	126	95	209	126	325	111
0500	52	48	134	46	46	168	0*	217	87	40	123	80	203	141	326	110
0600	196	179	436	167	163	571	0*	719	254	156	366	390	642	451	1031	418
0700	921	809	1835	687	650	2297	0*	2905	973	601	1681	2127	2986	2167	4192	1994
0800	2236	1981	3839	1300	1274	4546	0*	5209	1868	1074	2574	3182	4241	3086	6038	2927
0900	2160	1999	4065	1407	1347	4793	0*	5498	2138	1182	2971	3758	4920	3501	6989	3275
1000	1389	1267	2937	1109	1065	3611	0*	4154	1496	896	2460	3672	4267	3127	6319	2984
1100	1042	899	2470	948	934	3087	0*	3684	1254	776	2048	4109	3776	2696	5560	2604
1200	987	807	2346	917	868	3014	1*	3541	1149	743	2033	1327	3721	2644	5580	2551
1300	933	767	2340	900	884	2994	0*	3555	1220	729	2039	1286	3691	2552	5451	2448
1400	1052	872	2514	981	927	3129	0*	3597	1171	741	2027	1267	3736	2568	5493	2450
1500	1377	1176	2983	1126	1063	3634	0*	4090	1398	848	2316	1404	4130	2832	5941	2762
1600	1414	1234	3188	1191	1156	4019	676*	4787	1717	991	2599	1539	4571	3238	6664	3148
1700	1375	1196	2962	1109	1072	3922	1607	4876	1762	1031	2498	1473	4369	3092	6298	2932
1800	1200	1045	2925	1067	1019	3900	1639	4645	1803	1035	2232	1310	3884	2734	5739	2660
1900	793	691	2077	817	770	2699	1032	3226	1085	689	1636	1030	2845	2044	4417	2071
2000	599	527	1729	681	672	2226	816	2645	807	532	1313	878	2407	1642	3693	1608
2100	437	380	1212	498	481	1562	532	1823	570	379	889	619	1742	1176	2588	1102
2200	418	366	1148	462	458	1461	493	1683	519	335	849	582	1619	1127	2485	1075
2300	383	321	990	419	419	1199	458	1374	418	283	762	523	1459	964	2115	907
2400	231	193	765	330	307	963	329	1115	354	244	671	457	1197	825	1835	771
TOTALS	19638	17145	43916	16659	16009	55084	7583	64807	22543	13648	34975	32081	62174	43851	91451	41949

ENDING	17	18	19	20	21	22	23	24	25	26	27
	+-+-	+++++	+-+-	+-+-	+++++	+-+-+	+-++-	++++	+-+-	+-+-	+++++
0100	568	1457	776	595	1556	992	973	1230	571	549	1297
0200	283	773	423	313	851	559	532	736	321	303	760
0300	193	542	279	199	559	402	375	520	216	212	558
0400	107	382	206	144	402	293	289	402	164	154	440
0500	110	413	224	152	491	368	346	486	211	195	538
0600	406	1266	690	506	1405	931	982	1344	640	612	1464
0700	2001	4903	2423	2382	5310	3416	3564	4685	2405	2218	5084
0800	2865	7053	3394	3429	7696	5032	5081	6617	3346	3129	7105
0900	3197	7647	3671	3647	8246	5291	5119	6611	3292	2899	6463
1000	2897	6873	3252	3233	7146	4667	4671	5911	2927	2738	5709
1100	2537	6178	2965	2926	6530	4310	4374	5598	2799	2537	5515
1200	2509	6209	3022	2962	6632	4344	4421	5666	2870	2683	5752
1300	2387	6092	2924	2804	6340	4143	4233	5481	2729	2564	5519
1400	2369	6038	2916	2737	6461	4207	4279	5512	2709	2613	5622
1500	2688	6682	3163	3120	7078	4638	4758	6141	3112	2912	6167
1600	2990	7549	3375	3479	7880	5045	5078	6478	3289	3016	6549
1700	2896	7482	3308	3332	7870	4819	4774	6065	3041	2706	5901
1800	2572	6896	3102	3034	7365	4546	4453	5691	2771	2480	5580
1900	2029	5504	2682	2517	5880	3739	3781	4860	2366	2178	4735
2000	1544	4063	2025	1799	4301	2742	2800	3642	1815	1745	3678
2100	1079	2952	1467	1266	3086	2018	2031	2627	1253	1238	2740
2200	1026	2929	1498	1228	3091	1970	2004	2572	1241	1190	2671
2300	875	2391	1250	1018	2560	1692	1655	2181	1064	1017	2350
2400	746	2056	1111	904	2252	1453	1481	1950	928	838	2022
TOTALS	40894	104336	50045	47746	111008	71617	72054	93068	46080	42776	94219

EXHIBIT 1.13

Sample Surveillance Data

Hourly volume totals at surveillance stations along Santa Monica Freeway

SPEED VS. 5 MINUTE INTERVALS — SANTA MONICA FREEWAY - EASTBOUND — ON 09/20/74 FROM 0500 TO 1000

THERE ARE 3 ACTIVE LANES
FOR STATION 23

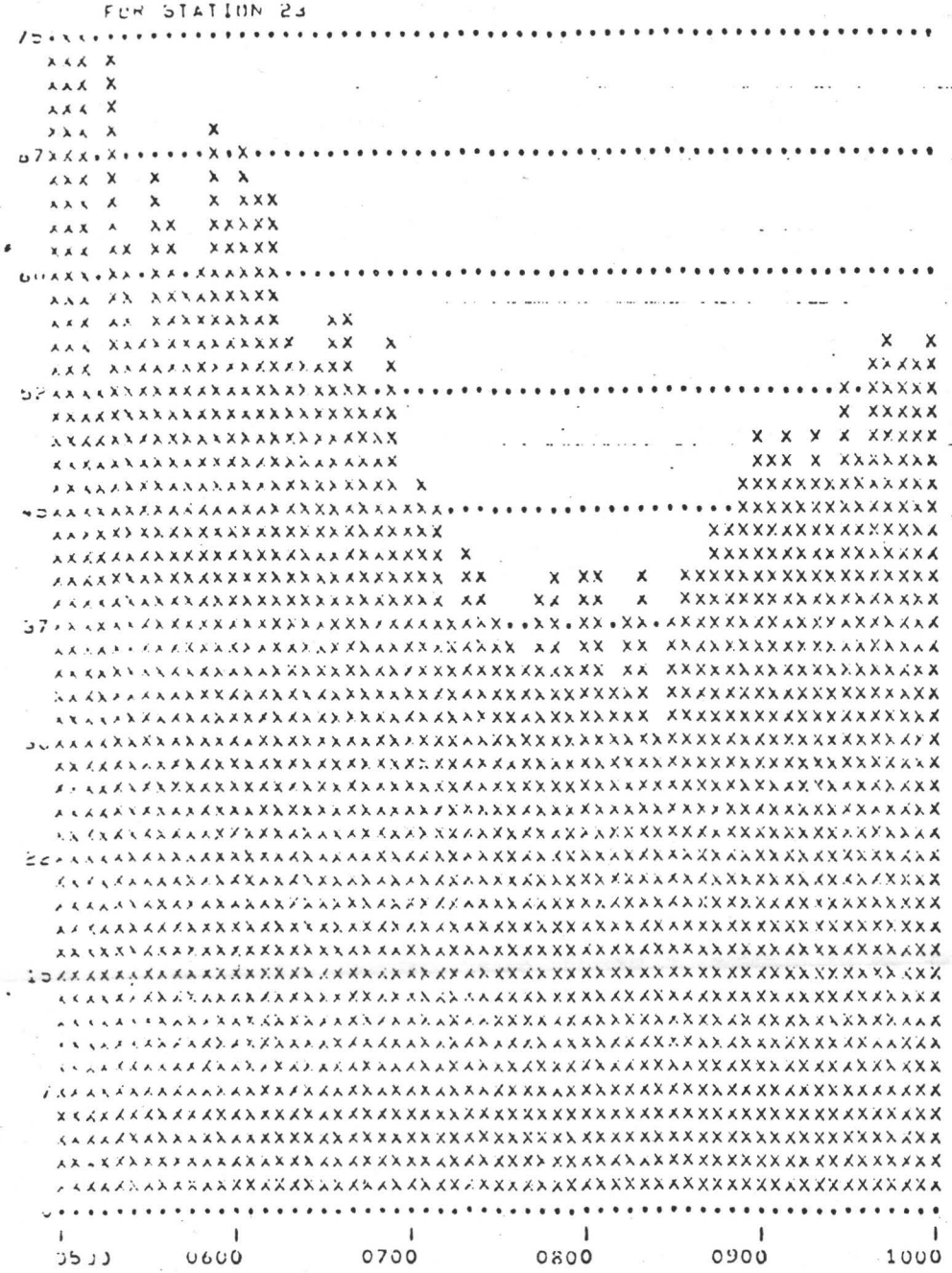

EXHIBIT 1.14

Sample Surveillance Data

Speed at 5 minute intervals at Santa Monica Freeway surveillance station

SANTA MONICA FREEWAY   EASTBOUND   VEH-MIN DELAY UNDER 35 MPH   DIRECTION OF TRAVEL ===>   1/ 6/75

TIME	STATION NUMBER 13	14	15	16	17	18	19	20	21	22	23	24	25	26	FWY TOTAL
0600		0	0	0	0	0	0	0	0	0	0	0	0	0	0
0605		0	0	0	0	0	0	0	0	0	0	0	0	0	0
0610		0	0	0	0	0	0	0	0	0	0	0	0	0	0
0615		0	0	0	0	0	0	0	0	0	0	0	0	0	0
0620		0	0	0	0	0	0	0	0	0	0	0	0	0	0
0625		0	0	0	0	0	0	0	0	0	0	0	0	0	0
0630		0	0	0	0	0	0	0	0	0	0	0	0	0	0
0635		0	0	0	0	0	0	0	0	0	0	0	0	0	0
0640		0	0	0	0	0	0	0	0	0	0	0	0	0	0
0645		0	0	0	0	0	0	0	0	0	0	0	0	0	0
0650		0	0	0	0	0	0	0	0	0	0	0	0	0	0
0655		0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700		0	0	0	0	0	0	0	0	0	0	0	0	0	0
0705		0	0	0	0	0	0	0	7	0	0	0	0	0	7
0710		0	0	0	0	0	25	53	36	0	0	0	0	0	114
0715		0	0	0	0	101	168	65	26	0	92	0	0	0	452
0720		0	0	0	38	144	73	56	115	54	223	0	0	0	703
0725		0	4	0	142	344	222	194	147	0	125	0	2	9	1189
0730		0	0	24	438	539	278	188	78	0	120	38	147	89	1999
0735		0	205	372	424	261	187	115	76	202	666	46	0	0	2576
0740		29	385	166	362	416	233	416	572	380	140	0	0	0	3097
0745		18	323	238	501	828	621	311	167	113	117	0	0	0	3257
0750		63	315	426	624	747	288	147	167	166	190	0	0	0	3333
0755		412	567	277	411	561	268	115	198	260	278	0	0	0	3307
0800		414	275	130	405	417	175	140	240	345	387	0	0	0	2928
0805		35	117	54	271	306	279	267	294	344	338	0	0	0	2345
0810		116	193	0	160	489	468	344	352	326	204	0	0	0	2654
0815		106	176	20	314	637	419	277	268	266	183	0	0	0	2670
0820		133	248	162	425	444	316	210	221	204	180	0	0	0	2563
0825		155	221	273	522	461	147	107	262	235	161	0	0	0	2644
0830		248	264	217	395	429	422	249	180	139	62	0	0	0	2605
0835		179	264	150	471	526	117	43	140	111	104	0	0	0	2105
0840		336	461	213	259	221	151	187	327	222	24	0	0	0	2401
0845		277	183	0	113	374	258	183	235	174	0	0	2	0	1799
0850		0	90	0	159	409	185	106	183	132	29	0	0	0	1293
0855		166	156	0	60	230	99	66	159	121	60	0	0	0	1079
0900		29	134	0	64	231	78	35	142	92	20	0	0	0	825
0905		0	0	0	0	177	118	41	149	102	14	0	0	0	601
0910		0	0	0	0	143	29	0	74	33	27	0	0	0	306
0915		0	0	0	0	0	0	0	98	4	0	0	0	0	102
0920		0	0	0	0	0	0	0	62	0	0	0	0	0	62
0925		0	0	0	0	0	0	0	0	0	0	0	0	0	0
0930		0	0	0	0	0	0	0	0	0	0	0	0	0	0
0935		0	0	0	0	0	0	0	0	0	0	0	0	0	0
0940		0	0	0	0	0	0	0	0	0	0	0	0	0	0
0945		0	0	0	0	0	0	0	0	0	0	0	0	0	0
0950		0	0	0	0	0	0	0	0	0	0	0	0	0	0
0955		0	0	0	0	0	0	0	0	0	0	0	0	0	0
STA TOTAL		2700	4661	2242	6778	9395	5624	3915	4997	4027	3744	84	151	98	
DAY TOTAL															49016

EXHIBIT 1.15: Sample Surveillance Data - Vehicle delays on Santa Monica Freeway

1.3.4.4. Causal Correlations. Most of the data analysis procedures described in the experimental design plan focus on the detection of statistically verifiable changes that stem from the introduction of a preferential lane on the Santa Monica Freeway. That is, they focus on the problem of defining WHAT HAPPENS as a result of the demonstration. In addition to determining WHAT HAPPENS, the analysis will also explore the underlying causes of the observed results. Several analytic comparisons will be undertaken to determine whether a statistical correlation exists between an observed effect and a presumed cause. The existence and nature of such correlations will be explored through the statistical tests outlined in Exhibits 1.4 through 1.8 and standard regression analysis. A number of the anticipated effects and presumed causes to be subjected to correlation tests are listed below:

Effect	Presumed Cause
°Diversion to New Bus Routes from Old Lines and Auto	°Time Savings by Route over Existing Lines and Improved Performance vis a vis Auto
°CO Levels at Monitoring Stations	°Traffic Volumes in Vicinity of Monitoring Stations
°Computer-detected Freeway Incidents	°Freeway Accidents
°Preferential Lane and Access Ramp Violations	°Enforcement Levels
°Diversion of single passenger autos from the Freeway to parallel arterials	°Congestion levels and ramp metering rates

Strong positive or negative correlations meeting the statistical confidence levels identified earlier will provide the basis for inferences regarding causality and quantitative measures of the extent of the correlation. Results indicating a lack of correlation between the effect and the presumed cause will prove equally enlightening.

1.4 Threats to Validity

In this context, validity is defined as the correctness of measured magnitudes or of inferred or deduced relationships. There are numerous factors which affect the ability to draw correct inferences or deductions. The function of the experimental design is to minimize or mitigate these threats to validity.[1] Although this is a paramount goal, the ability to accomplish this in a real setting (as opposed to a laboratory setting) is greatly constrained. Therefore, a second objective for the study design is to prepare a comprehensive listing of potential threats, so that hypotheses of causality may be made and tested with full knowledge of the factors which may limit the validity of the results.

In some cases, threats to validity may be lessened by scheduling measurements so they do not interfere with each other, to avoid external interference, or by the careful definition of control groups.

Threats to validity are viewed as falling into two groups, those that threaten internal validity and those that threaten external validity.

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[1] The name is due to Stanley and Campbell.
Campbell, Donald T. and Julian C. Stanley, Experimental and Quasi-Experimental Designs for Research, Rand-McNally & Company, Chicago, 1970.

Internal validity is the ability to discern correctly the impact of the demonstration on the host city. External validity is the relevance of correctly perceived demonstration impacts for predicting impacts of similar transport systems in other metropolitan areas. Lack of internal validity typically implies lack of external validity, except by coincidence. The converse is not necessarily true.

Threats to validity are not all statistical in nature; that is, the threats are not all the result of sampling considerations. Many may be traced to the process of measurement and its effect on the environment or on those variables being sampled. Others may be traced to the inability to isolate the demonstration's effects from the multitude of other factors which constantly change the environment and activities in a dynamic setting such as a city.

Definitions of fourteen common threats to validity appear below. The threats are classified into ten categories of threats to internal validity and four categories of threats to external validity, an extended version of those identified by Campbell and Stanley (1970).

1.4.1 Threats to Internal Validity

Exhibit 1.14 lists ten prominent threats to internal validity, together with examples of their applicability in the Santa Monica Freeway project and a summary of projected counter-measures. These ten threats are defined as follows:

EXHIBIT 1.16

SUMMARY OF POTENTIAL THREATS TO INTERNAL VALIDITY
AND PLANNED COUNTERMEASURES

Threats to Internal Validity	Applicable Examples	Planned Countermeasures
1. Exogenous Events	° Gas Crisis ° Summer School Holidays ° Rainy Season between October & April	° Use of Control Routes (Long Beach Freeway and Specific Bus Routes) Early scheduling of "after" observations to minimize time span in which an exogenous event might confound results ° Scheduling of observations to reflect comparable school periods ° Scheduling of observations
2. Maturation	° Transient Period of Adaptation ° Recent Decline in Accident Levels on Freeways and City Streets ° Population Increases	° Continuous monitoring of congestion and transit ridership will permit major observations to be scheduled after the transient learning period is over ° Awareness of trend and incorporation of awareness in evaluation process ° Use of Control Routes and Extrapolation of Current Trends
3. Measurement	° Possible influence of home interview on attitudes toward the preferential lane	° Identify interview subjects having prior knowledge of the demonstration
4. Time Interference	° Occupancy requirements on metered on-ramp bypasses will change with preferential lane introduction, tending to obscure the influence of the lane on carpooling. ° Lane closures due to median barrier construction	° No immediate countermeasures are planned, but subsequent Caltrans demonstrations on other L.A. Freeways should shed some light on the influence of access lane bypasses on carpooling ° Restrict lane closures to nighttime hours and low-volume weekend hours
5. Instrumentation	° Air bag sampling accuracy	°Supplement air quality measurements with emission computations based on VMT estimates
6. Variable Selection	° Citations as a proxy for lane violations	° Separate measurement of lane violations
7. Population Selection	° Differences in FHWA sample population of CBD-destined travelers and other sample populations of all corridor users	° Relate two separate populations through additional information obtained in FHWA telephone screening survey
8. Statistical Regression	° Not applicable	° Not applicable
9. Mortality	° Depletion of home interview sample between "before" and "after" interviews	° Increase "before" sample size and check to make sure lost population has same characteristics as remaining population
10. Selection Interaction	° Not Applicable	° Not Applicable

1. Exogenous factors include all external events, not associated with the transportation demonstration, which change attitudes or have a decided impact on life and the economy in the study region. One important exogenous factor that has confounded the evaluation of transportation demonstrations in recent years is the availability and price of gasoline. The possibility of a gas crisis is one of the most serious potential threats to the evaluation of the preferential lane project. A severe increase in the price of gasoline occurring after project implementation will tend to drive auto users to car pools and transit and obscure the precise impact of the preferential lane.

   The only sure means of controlling the effects of exogenous events is experimental isolation, which is not usually possible in transportation demonstrations. However, the establishment of the Long Beach Freeway as a control route should serve as an effective counter to a gas crisis and other exogenous events threatening to confound the evaluation process on the Santa Monica Freeway.

2. Maturation is the effect of time independent of specific events. It includes existing trends in population and economic growth and the effect of learning by users, operators, etc.: it is analogous to "wound healing." It may be difficult to distinguish between exogenous events and maturation, but generally exogenous events should be traceable to specific events and maturation should include long-run trends. Naturally, it is not essential to distinguish precisely as long as relevant factors in both categories are considered.

   In the case of long-term demonstrations, the effect of population growth must be accounted for in comparing before and after measurements. Although population increases are not expected to be a significant confounding factor in the Santa Monica Freeway demonstration, other instances of maturation need to be considered in planning the evaluation process. The most obvious instance is the length of time required for drivers to adapt to the preferential lane concept and for carpools to form and permanent mode choice changes to take place. The CHP expects to allow a two-week shakedown period before issuing citations, and past experience indicates that at least three months will be required before transit ridership levels reach a steady state. Continuous monitoring of congestion and transit ridership will permit major observations to be scheduled after this state has been achieved.

   Another factor to be considered in the evaluation process is the recent decline in traffic accidents throughout Los Angeles. Fatal accidents declined by 28% between 1973 and 1974, and total accidents declined by 4.5%. Two contributing causes in this decline are the 1974 gas crisis and the lowered freeway speed limits. This decline must be factored into any comparison of historical accident levels with post-project levels.

3. Measurement encompasses the effect of the act of measuring on the object of measurement, analogous to the Hawthorne effect in management or Heisenberg's Uncertainty Principle in physics. This is a relevant factor in attitude surveys of human populations wherein the survey itself may affect attitudes by sharpening awareness, etc. This is a potential threat to the validity of the "before" attitudes obtained from the home interview survey, since in many instances the interviewer will be the initial source of a subject's knowledge of the preferential lane project. Hence, it is important that the interviewer ascertain whether or not the subject had prior knowledge of the demonstration. From a marketing standpoint, it is also important to learn the source of that knowledge.

4. Time Interference refers to the interaction of two or more innovations which tend to obscure the individual effects of each. Even when innovations are separate in time, the transient response to each may interfere with a subsequent innovation. This threat to validity is best handled by separate scheduling of those innovations that are expected to interfere with one another. In some instances, of course, separate scheduling is impossible. For current users of the Santa Monica Freeway, the definition of a carpool employed on preferential access lanes is two or more persons per car. When the preferential median lane is established, this definition will change to three persons per car. It will be nearly impossible to determine whether subsequent changes in vehicle occupancy may be traced to preferential treatment on the access ramp, in the median lane, or both. However, subsequent Caltrans demonstrations on other L.A. freeways should shed additional light on the carpooling influence of preferential access lanes in the absence of a preferential median lane. Changes in ramp metering rates scheduled to coincide with project implementation pose a similar time interference problem.

5. Instrumentation refers to errors introduced by the measurement instruments, including hardware-introduced errors in devices such as traffic counters, biases introduced by interviewers or interview environment, or human errors in counting. Changes in the behavior of human data collection due to learning or boredom are included in this category although they are a class which combines instrumentation and maturation.

   On the Santa Monica Freeway, the high sampling rate made possible through the use of the surveillance computer permits the measurement of traffic volumes with a relatively small error rate (estimated at ± 5%). There is some concern, however, that the accuracy of the air bag sampling program for measuring air quality may be insufficient to detect incremental improvements. Accordingly, changes in emission levels will also be computed from estimates of vehicle mileage.

6. Variable selection is a threat caused by choosing a variable which presumes to measure a certain characteristic when, in fact, it does not. In the proposed project, for instance, it would be erroneous

to assume that the number of traffic citations issued, which is heavily dependent on enforcement levels, is a proxy for lane violations. Rather, it will be necessary to measure the level of preferential lane violations by separate observations.

7. Population selection describes all errors in observed variables attributable to sampling from a population which was not the one specified. It also includes errors in logic in assigning a characteristic to a group. The difficulty encountered in reconciling the FHWA sample population (freeway users destined for the CBD) with the sample populations used in the remainder of the study (all freeway users) falls into this classification. As CBD-destined commuters, the FHWA sample used in determining "before" attitudes will have a different set of travel options available to them than the majority of Santa Monica Freeway users. To help reconcile the two sample populations, the telephone screening survey used to isolate CBD-destined travelers for home interviews has been lengthened somewhat to elicit sample O/D and mode choice information from all users of the Santa Monica Freeway corridor.

8. Statistical regression is an effect due to selection of a population based on some previously measured characteristic which in itself is a sampled measurement subject to sampling errors. For example, if the income level for a certain geographic section is determined by sample and the sample happens to understate the true population income, subsequent measures of income in the region would probably display an increase in income when in fact it had not occurred. This factor is a special type of selection error combined with repeated measurements on the same variable. It contributes a second-order threat to experimental validity and is not judged to be a threat to the preferential lane evaluation.

9. Mortality defines all errors due to changes in the population being considered, such as changes due to migration. Since home interview surveys will be conducted before and after project implementation on the same segment of the population, mortality may be a factor in the preferential lane evaluation. It can be handled by determining if the population lost is significantly different from the one retained. If not, there is no problem. If it is, then great effort should be made to find the original population or, if this cannot be done, the bias of the remaining population should be noted.

10. Selection and interaction with other factors describes the situation in which different population groups have different levels of susceptibility to the effects of other threats to validity. For example, groups having low education levels may be influenced to a greater degree by repeated interviews than more highly educated groups, due to the awareness that such interviewing generates, a case of selection-measurement interaction. This threat is judged to be of secondary importance in the Santa Monica Freeway evaluation.

1.4.2 Threats to External Validity

All threats to internal validity also threaten external validity, but in addition there are two types of factors which specifically affect the transferability of demonstration results from one locale to another. The first is the uniqueness of any location, and the second (described as three separate threats below) stems from the fact that any experiment differs somewhat from a real situation. Specific threats to external validity may be categorized as follows:

1. Uniqueness of locale considers the question, "Does the demonstration locale have characteristics so unlike other regions that impacts measured there cannot be expected in, for instance, Washington, D.C. or Atlanta, Georgia?" The factors to be considered are geographic, demographic, economic and social. The Los Angeles metropolitan area is clearly unique for many reasons, including its sprawling geography, its population, and its heavy reliance on the automobile. A discussion of the effect of this uniqueness on the interpretation of evaluation results appears in Section 1.5, dealing with the transferability of demonstration results.

2. Knowledge of the experiment is a category considering the question, "Does knowledge that a major impact study exists affect citizen's responses to the demonstration?" Since it is unlikely that many Los Angeles citizens will be aware of the evaluation process, this threat is not likely to be a factor in explaining study results.

3. Experimental conditions considers the question, "Are there any arrangements affecting the demonstration because it is considered by some an experimental operation?" Such factors as the entire measurement process and media treatment would be included here. Since the preferential lane is not being publicized as an experimental demonstration, this potential threat does not apply to the present study.

4. Multiple changes of parameters applies in the situation where several operating parameters may be changed in order to measure user response over a range of conditions. This plan may have an effect on user response as they anticipate or react to a sequence of changes. This threat is not a worry in the Santa Monica Freeway evaluation, since no parameter changes are anticipated following project implementation.

1.5 Transferability of Results

1.5.1 Transferability to Other Urban Areas

Threats to external validity impair the ability of officials in other

locales to translate demonstration results for their own use. In developing an experimental design, however, it is not sufficient merely to avoid threats to external validity to ensure transferability of results. Rather, positive steps must be taken to provide a common basis for understanding on the part of transit operators, transportation planners, and city administrative officials in other localities across the country.

Several steps may be taken at the outset of a demonstration program to help ensure that program findings will be useful to other urban areas and governmental jurisdictions. These steps include:

1. Developing general and specific data within an urban classification scheme which "locates" the demonstration service area with respect to other urban area.
2. Establishing a structured framework for defining and measuring demonstration impacts which reflects the urban classification scheme (Item 1) and anticipates the questions of interest in other areas.
3. Defining system parameters and expressing impact findings in a manner that can be directly interpreted by other jurisdictions.

Each of these steps is discussed in the following sub-sections.

1.5.1.1 Collection and Classification of Regional Data. Because of the influence of such regional characteristics as population, income, geography, land use and employment on transportation systems and mode choice, it is important that the regional characteristics of the demonstration service area be identified, collected, and classified in a manner which permits comparison with other urban areas. The data collection process should focus on two types of

site-specific data:

1. General geographic, demographic, land use, and transportation system data. To the extent possible, these data should be assembled from sources available on a nationwide basis (i.e., income and population statistics from the Bureau of the Census, data from the 1974 National Transportation Study).

2. Data specific to the immediate demonstration surroundings (i.e., traffic flow densities on streets affect by a demonstration).

To facilitate comparisons among urban areas, a standard set of general classification data should be identified for all demonstration areas. TSC is currently developing such a set of data as part of a study designed to produce a general set of guidelines for all UMTA demonstrations. Examples of the types of site-specific data to be assembled as part of the demonstration evaluation appear below.

ILLUSTRATIVE DATA DESCRIBING GENERAL URBAN SETTING

Demographic Data	Source	Transportation Systems Data	Source
Population Densities	Census	Auto Ownership	Census
Income Distribution	"	Journey to Work (Mode and Distance)	Census
Employment Distribution	"		
CBD Employment Densities	"	Miles of Highway and Transit Routes Per Capita	1974 NTS[1]
Land Area	"	Average Trip Length and Time	"
Climate	Atlas	Car Occupancy	"
Major Terrain Features	"	VMT/Capita	"
Settlement Form	City Plan	Transit Ridership/Capita	"
Air Quality	EPA	Percent of Population Within 1/2 Miles of Bus Service	"
		Average Bus Systems Headways	"
		Passenger Miles/Seat Mile	"
		Average Bus Fares	"

[1]The National Transport Study undertaken by the U.S. Department of Transportation.

ILLUSTRATIVE DATA DESCRIBING IMMEDIATE DEMONSTRATION SURROUNDINGS

Data	Source
Traffic Flow Densities, Vehicle Occupancy, and Speed on Santa Monica Freeway and Corridor Arterials	Caltrans
Patronage History on Affected Transit Routes	SCRTD and SMMBL
Accident History on Santa Monica Freeway and Corridor Arterials	CHP and LAPD
Description of Traffic Control Systems in Demo Area	Caltrans
Origin/Destination Information for Santa Monica Freeway Users	LARTS Study, Caltrans Ramp Usage Study and FHWA Home Interviews
Metering Rates on Freeway On Ramps	Caltrans

Much of the information outlined above has already been assembled and presented in narrative form in Part IV-D of the demonstration grant application. Additional specialized data describing the urban setting and the immediate demonstration surroundings will be collected by the evaluation contractor, who will identify, assess, and report on those special features of the demonstration and its setting that are likely to have an impact on the transferability of results to other urban areas. In the case of the Santa Monica Freeway Demonstration, these features will include, but not be limited to, the following considerations:

° The Geographic Sprawl and Lack of a CBD Orientation in Los Angeles. Because of the scattering of trip origins and destinations throughout Los Angeles, relatively few users of the Santa Monica Freeway are destined for the CBD. Thus the results of the demonstration will have to be presented in a manner that permits interpretation by other cities

with greater proportions of CBD traffic. To the extent possible, attitudes and mode choices of CBD-destined travelers should be presented in separate tabulations and related to overall study findings. In the case of the home interview survey, which focuses exclusively on CBD-destined travelers, an attempt will be made to relate the survey population to the total population of freeway users.

° The Current Existence of Carpooling Incentives in Los Angeles. Certain carpooling incentives already exist in Los Angeles in general and on the Santa Monica Freeway in particular. Metered freeway on-ramps currently permit immediate access to vehicles carrying two or more occupants. From the standpoint of transferability, then, relative increases in vehicle occupancy brought about by the preferential lane may be lower in Los Angeles than in other cities with no carpooling incentives. The transient period required to adjust to the lane may also be shortened by familiarity with carpool concepts and the existence of such services as Commuter Computer.

° Computerized Surveillance and Electronic Displays. As part of the 42-mile computerized surveillance loop established by Caltrans, the Santa Monica Freeway is one of the most closely monitored in the world. The presence of centrally controlled electronic displays will enable motorists to learn of the demonstration project more quickly and adapt to changing traffic patterns, while the electronic surveillance system will permit the rapid detection and clearing of congestion caused by accidents and other unusual incidents. An attempt should be made to

assess and convey the effect of the surveillance and display system on project results. As one step in this assessment process, the home interview survey should attempt to determine the number of freeway users who first learned of the project through the electronic display system.

° High Incomes and Auto Dependence. As a result of the geographic sprawl of the city, Los Angeles residents generally travel further and are more dependent on their autos than residents of other U.S. cities. According to the 1970 census, 17.2 percent of all Los Angeles households had no cars, as compared with an average of 20.4 percent in representative metropolitan areas, while 37.7 percent of all households had two or more cars, as compared with a representative figure of 29.2 percent. These differences are undoubtedly more pronounced in the Westside study area, which contains some of the highest income areas in the U.S. The highest income area in Brentwood, where the median family income is $37,400 per year, but Pacific Palisades, Beverly Hills, Marina Del Rey, Playa Del Rey, and Fox Hills all rank as areas with exceptionally high incomes per capita. The demonstration analysis should address the impact of these factors on project findings.

° Los Angeles Climate. The temperate Southern California climate, which is not duplicated in many other U.S. cities, is another factor to be addressed in considering the transferability of results. Accompanying this climate are unusually high smog levels, and a consequent local

awareness and appreciation of the need for such traffic control measures as the proposed preferential lane.

- Ramp Metering. Traffic signals installed on the Santa Monica Freeway on-ramps are used to control the number and spacing of cars entering the freeway during the peak morning and evening hours. These signals limit entering traffic to a fixed rate of flow designed to allow the freeway to carry a maximum number of vehicles at speeds between 35 and 50 MPH. Vehicles in excess of this number are encouraged to avoid the wait at the ramp by using surface streets for their trip. Typically, this control strategy limits the number of short trips made on the freeway by presenting drivers making trips with enough of a wait at the ramp so that their total trip time is shortened by using surface streets.

The implementation of the reserved lane on the Santa Monica Freeway will be accompanied by changes in the metering rates on most freeway access ramps. These changes will be designed to alleviate the congestion caused by the proposed lane restrictions. Other communities contemplating the introduction of a preferential lane on a congested freeway should recognize that the ramp metering devices in Los Angeles will help to alleviate the freeway congestion caused by lane dedication. Because ramp metering changes will accompany the lane dedication, it will be difficult to infer the amount of congestion that would occur in the absence of these changes or in the absence of any metering devices. In an attempt to shed additional light on the interrelationships between ramp metering, freeway congestion, and the preferential lane, several measurements will be made at each on-ramp before and after project implementation. These measurements include ramp metering rates, vehicle volumes, queue lengths, and average delays.

1.5.1.2 Role of the Experimental Design. A carefully prepared experimental design promotes transferability by providing a structured framework which quantifies the concerns of interest in a particular demonstration. Experimental design tableaus such as those depicted in Exhibits 1.5 through 1.9 provide an index of the questions addressed in the demonstration and the parameters to be investigated in addressing these questions. Thus, an observer interested in a specific question on the impact of some system characteristic can scan the tableau columns listing hypotheses and dependent and independent variables to determine whether the specific question or characteristic is addressed by the demonstration.

If demonstration findings are to be of interest to other urban areas, the hypotheses to be tested in the demonstration must be of interest in these areas. Therefore, in formulating the experimental design, every attempt has been made to identify and test hypotheses of wide-ranging interest. As part of the evaluation review process, the hypotheses to be tested have been scrutinized from the standpoint of their applicability to other areas. The impact of those design parameters within the control of other regions (transit service levels, police enforcement requirements, metered access lane locations, etc.) will be investigated in detail.

1.5.1.3 Specifying System Variables. In developing and implementing the experimental design, every attempt has and will be made to specify measurements which are meaningful in other areas. In this regard, ratios indicating the relative magnitude of parameters (cost/mile, percentage of VMT reduction, percent of residents riding transit) are more easily interpreted by outside users than

gross statements of magnitude (total cost, absolute VMT reduction, peak-hour ridership).

1.5.2 Coordination with Other Los Angeles Preferential Treatment Projects.

The Santa Monica Freeway Demonstration is not the only preferential lane project planned for the Los Angeles area. In addition to the Santa Monica Freeway Demonstration, which establishes a preferential lane in an existing traffic lane, at least two additional preferential treatment concepts are scheduled for implementation within the next two years on the Golden State Freeway (scheduled for implementation in September 1976), and the San Diego Freeway (April 1977). These projects entail the evaluation of the following preferential lane strategies:

1. Preferential Ramp By-Pass Treatment
2. Concurrent Flow on an Improved Median Shoulder

Thus, the Santa Monica Freeway Demonstration is but one of a series of three projects designed to test distinct strategies for preferential treatment.*

To ensure that the Santa Monica, Golden State, and San Diego Freeway projects reveal the maximum amount of information regarding the relative merits of different preferential treatment strategies, these three projects should be incorporated in a single experimental design plan. In the meantime, this experimental design plan for the Santa Monica project has attempted to

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* More information regarding the full scope of the preferential treatment program planned for the Los Angeles basin may be found in the July 1974 Report of Caltrans District 7 entitled A Program for Preferential Treatment.

anticipate the evaluation needs of the broader analysis. To a certain extent, any complete, statistically structured, well-defined experimental design for a single project will be capable of incorporation into a broader analysis. In a further attempt to ensure that the Santa Monica evaluation will be capable of incorporation into a broader experimental design, the following steps have been taken:

(i) Control groups have been defined with the broader population in mind, so that future projects may share the same control groups.

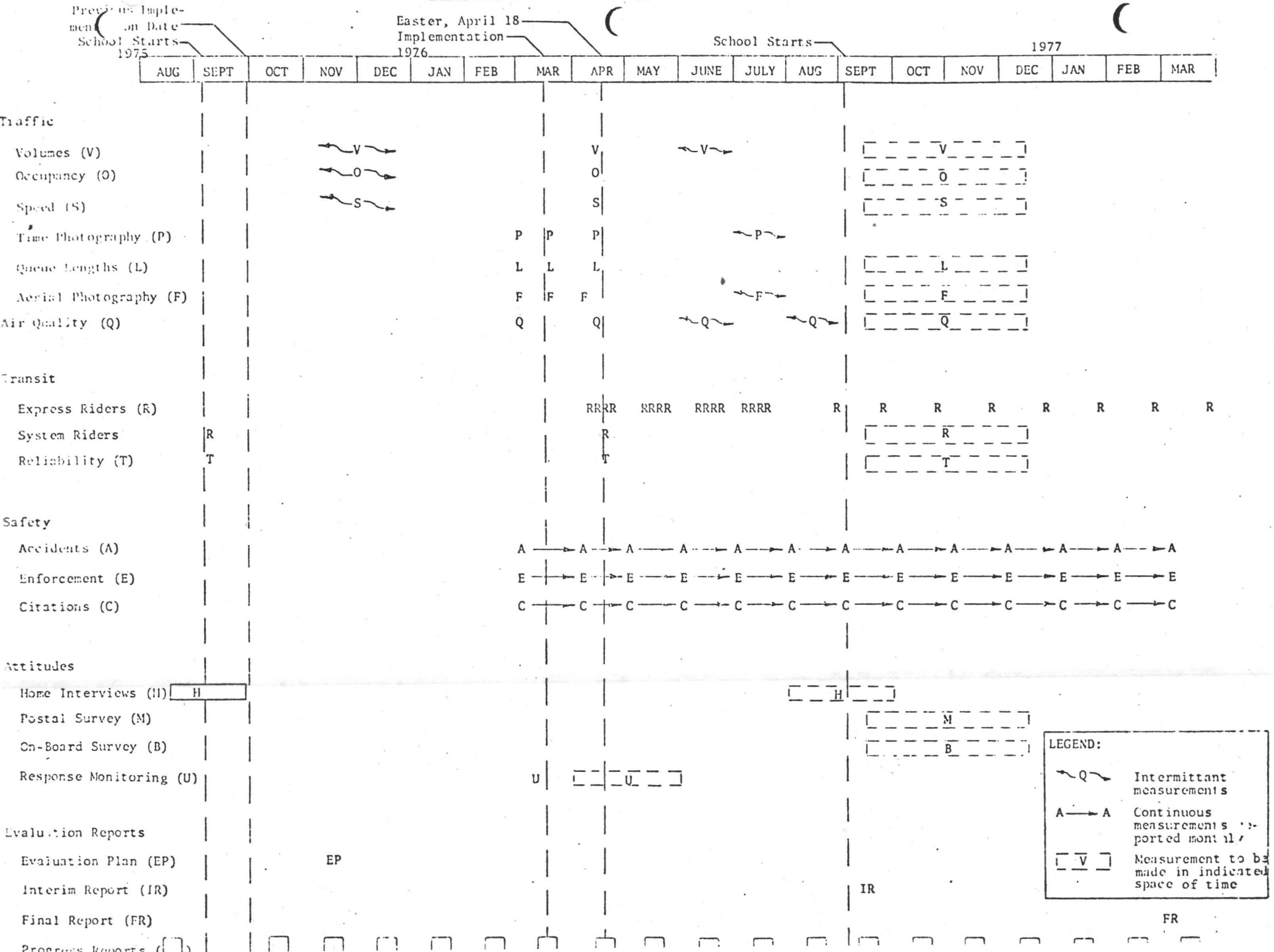
(ii) An attempt has been made to assess the likely differences in the results of the three preferential treatment projects, so that the experimental design plan for the Santa Monica Project may focus on these differences.

2.0 TASK SCHEDULE

Exhibit 2.1 contains a schedule of data collection activities and evaluation report due dates. Safety and enforcement data will be collected continuously throughout the demonstration, and vehicle flow and transit ridership on the Santa Monica Freeway will be monitored at frequenct intervals (never less than monthly) following project implementation. The bulk of the remaining data collection efforts will be focused in three time periods: the month preceding project implementation, one month following project implementation, and six to nine months following project implementation. The latter time period is somewhat flexible, and shall be scheduled when the on-going monitoring of vehicle congestion and transit ridership on the Santa Monica Freeway indicates that a steady state has been reached. It is not likely that this state will be achieved before the opening of Los Angeles schools for the 1976-77 session six months following project implementation. In the event that a steady state has not been achieved within nine months of the project implementation date, the UMTA and TSC project monitors will be consulted in joint session with the local agencies regarding the desirability of assembling an interim set of data before a steady state is reached.

The data collection schedule shows both the previous implementation date of September 29, 1975 and the current target date of March 15, 1976. The previous date is shown because the last-minute decision to postpone project implementation until the 1976 date occurred after certain preliminary data collection activities had already been initiated. The FHWA home interview survey was initiated in mid-August, 1975 and has already been completed. SCRTD point checks on existing lines were taken between September 10 and September 29, 1975 to

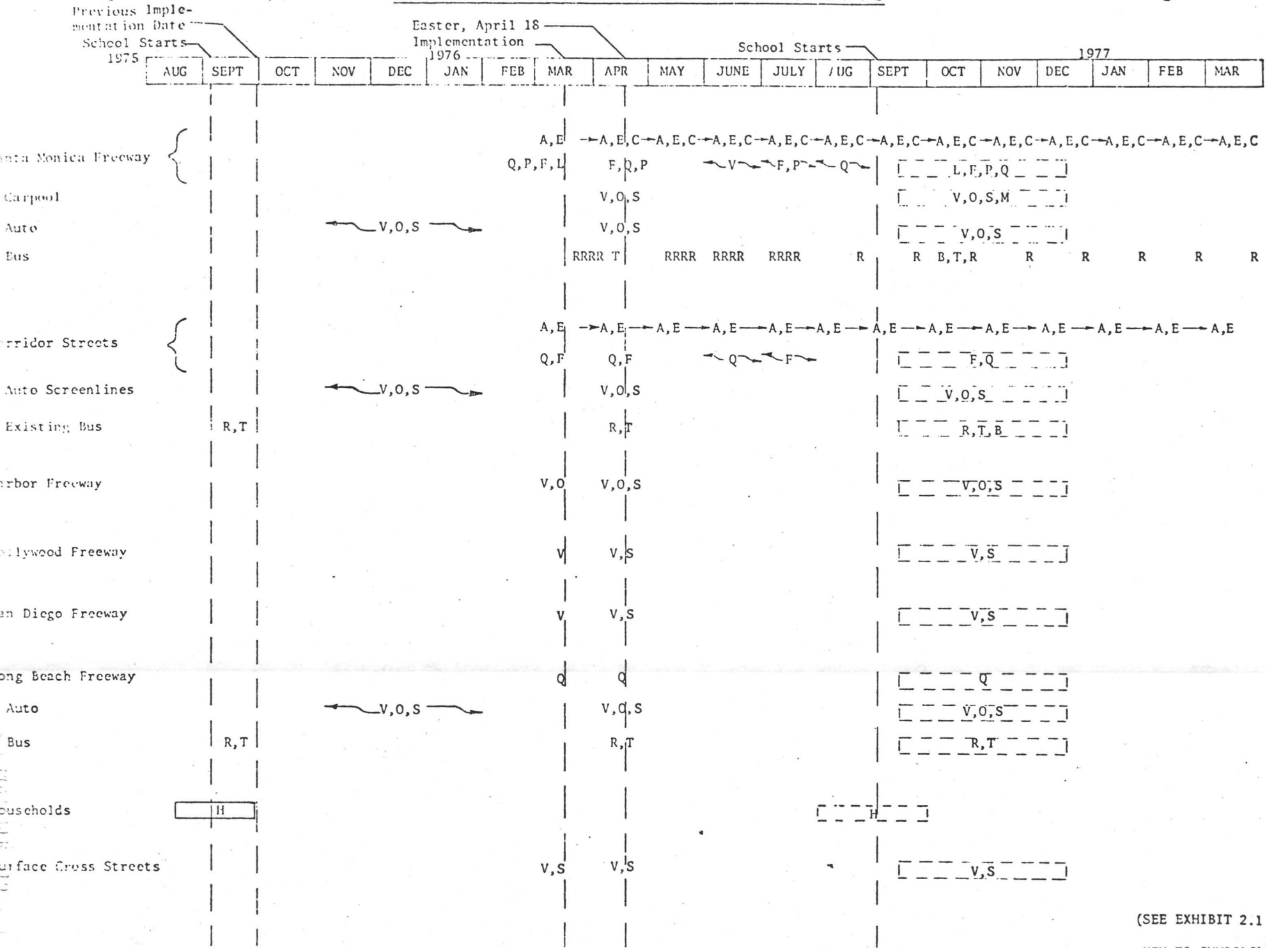
EXHIBIT 2.1: DATA COLLECTION



avoid massive changes in prescheduled union work assignments. Although it is not anticipated that the ridership data contained in these point checks will be affected by the current project delay, a limited series of validation checks will be made prior to the actual implementation date to test the validity of the September data.

Exhibit 2.2 relates the proposed measurement schedule to the various sample populations.

EXHIBIT 2.2: POPULATION MEASUREMENTS



(SEE EXHIBIT 2.1 FOR

3.0 TECHNICAL MANAGEMENT OF THE DEMONSTRATION EVALUATION

This section focuses on the role of the evaluation contractor, SYSTAN, Inc., before and after project implementation and contains an estimate of the total resources required for the evaluation process.

3.1 The Role of the Evaluation Contractor

The evaluation contractor will be expected to assume many responsibilities before and after project implementation. These responsibilities are summarized below.

3.1.1 Contractor Responsibilities

3.1.1.1 Pre-Implementation Responsibilities.

1. Monitor all deliberations and activities having an impact on project implementation and evaluation. This task shall include attendance at meetings of the joint project board and monitoring the collection of media reports on the proposed project.

2. Coordinate efforts of the various Federal, state, and local agencies participating in the project.

3. Monitor collection of data during the month preceding project implementation, in accordance with the published experimental design plan.

4. Collect any specialized data describing the demonstration setting that may prove perishable.

5. Assist in the preparation of such survey materials and monitoring procedures as can profitably be prepared prior to project implementation.
6. Prepare a final copy of the Experimental Design Report and submit monthly progress reports to the TSC technical monitor.

3.1.1.2 Post-Implementation Responsibilities. During the period following project implementation on March 15, 1976, the evaluation contractor shall undertake the following tasks:

1. Program Monitoring. The responsibility for monitoring the implementation of the evaluation plan includes the following duties:
   - Assure that the project operations are properly time-sequenced and data collection is performed according to the evaluation plan.
   - Coordinate the objectives and data collection activities of the various Federal, state and local entities participating in the project.
   - Respond to technical questions concerning operations or data collection to assure the integrity of the evaluation plan.
   - Revise the data collection plan or schedule to respond to unforeseen occurrences which are endemic to demonstrations and counter threats to validity as they occur.
   - Undertake preliminary data analysis that may lead to desirable alterations of the plan. (For example, early analysis may show that days of the week are homogeneous and hence sample sizes planned assuming lack of homogeneity may be reduced, resulting in demonstration cost savings.)

- Coordinate the experimental design, data collection, and analysis activities of the Santa Monica Freeway demonstration with corresponding activities for preferential lane demonstrations on the Golden State and San Diego Freeways.

2. Specialized Data Collection. The evaluation contractor will undertake the specialized data collection tasks designed to describe the general urban setting of the demonstration and its immediate surroundings in a manner which will promote the interpretation and use of demonstration results by other urban areas. The contractor will identify, assess, and report on those special features of the demonstration and its setting that are likely to affect the transferability of these results. Several such features (lack of a CBD orientation, existence of car-pooling incentives, geographic sprawl, computerized surveillance, high income, auto dependence, and climate) are identified in Section 1.5.1.1.

3. Survey Design and Implementation. The contractor will assist in the design of the materials used in the proposed license plate and on-board survey, and implement the on-board survey. Coordination of the license and on-board surveys with the FHWA home interview survey shall be accomplished as part of the program monitoring task.

4. Data Reduction and Analysis. The contractor will assemble the data collected by the diverse study participants, undertake the statistical tests and comparisons specified in the experimental design plan, analyze the results in the light of project objectives, and present these results in a form that is meaningful to local demonstration participants, public officials in Los Angeles, and representatives of other urbanized areas.

5. Report Preparation. The contractor shall prepare and submit to TSC five copies of monthly progress reports. These reports will summarize the progress of the demonstration as compared with the master schedule in the evaluation plan, discuss technical accomplishments to date, and outline the anticipated work to be covered during the succeeding report period. Cost schedules and fiscal reports shall also be prepared on a monthly basis. An interim technical report shall be prepared within six months of project implementation, describing project findings up to that point. Within one year of project implementation, the contractor shall prepare and submit a Final Technical Report which synthesizes the findings of each phase of the analysis relative to the expressed project objectives.

All of the above duties require that the consultant schedule regular visits to the demonstration site and be readily available on-call for specific requests from any of the parties having a role in the demonstration. The frequency of the regular visits is important, and experience suggests that it is more cost-effective to err on the side of too great a frequency than to low. This is because the cost of making visits, which may be marginal in terms of actual accomplishment, is more than compensated by the ability of the visiting contractor to interact with local participants and to be available to prevent the cavalier or casual decision which may unintentionally upset the entire evaluation plan.

With this guideline in mind, the evaluation consultants will plan monthly trips to the demonstration site during periods of no data collection activity. At this time, adherence to schedule will be checked and ad hoc questions discussed. It is intended that these trips will include a meeting of the

principals from the city agencies with the consultants to report on progress. The evaluation contractor will attend all meetings of the Joint Project Board established by the local agencies to oversee project implementation.

The contractor's evaluation manager will be on site at the time of project implementation and throughout the periods of intensive data collection, during which observations of data collection techniques will be made. Other members of the consultant's staff will perform initial analysis of data, especially when exogenous variables are suspected of having an impact.

TSC will provide the methodological guidelines and program structures for all UMTA demonstrations and will serve as the official interpreter of UMTA's objectives for each specific demonstration. Whereas UMTA's objectives focus both on the local interpretation of project findings and the transferability of those findings to other areas, local agencies naturally tend to be more interested in what they can learn from the demonstration than in generalizations for other localities. In past demonstration work, the evaluation consultant has often assumed the role of mediator in negotiations reconciling local and national objectives. This may require considerable "representation" effort at all levels, including the mayor and county board of supervisors. The task is a necessary one whether done by the consultant or some other party. As the on-site judge of what makes sense from the standpoint of the experimental design, the role of mediator is a natural one for the consultant. Success in this role requires that the consultant develop good communications with all local parties, as well as UMTA and TSC, and pay close attention to keeping these communication channels open and active.

3.1.2 Contractor Manpower and Material Estimates

The estimated level of manpower to be expended by the evaluation contractor prior to project implementation is 4-1/2 person-months, or 730 person-hours. This covers the period from July 1, 1975 to the revised implementation date of March 15, 1976. The estimated level for the first year following project implementation is twenty-six person-months, or 4,160 person-hours. Computer time is estimated at eight hours on a latest generation machine. Material costs are minimal, consisting of printed survey forms and report preparation. Travel and subsistence costs from Los Altos, California to the project site comprise an estimated five percent of project contractor expense.

The estimated total cost of contractor activities is $153,744. Pre-implementation activities account for $28,015 of this total, while evaluation costs for the first year following evaluation amount to $125,729. An itemized breakdown of these cost estimates has been submitted to TSC.* Exhibit 3.1 contains a task-by-task allocation of the estimated costs through the first year of the demonstration evaluation.

3.2 Total Demonstration Costs

Exhibit 3.2 summarizes the estimated costs of the first year of the proposed Santa Monica Freeway Preferential Lane Demonstration Project. The costs are divided into five categories:

1. Project Evaluation
2. Data Collection and Review

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*Memorandum from John Billheimer of SYSTAN to Howard Simkowitz and Carla Heaton of TSC submitting this Evaluation Plan for TSC approval, November 21, 1975.

EXHIBIT 3.1

EVALUATION CONTRACTOR

BREAKDOWN OF MANPOWER, COMPUTER TIME, AND DIRECT COSTS

FOR THE

FIRST YEAR OF THE PREFERENTIAL LANE DEMONSTRATION

Task	Person-Hours					Computer Costs ($)	Other Direct Costs ($)	Total Cost ($)	Percent of Total Cost
	Principal	Senior Associate	Associate and Research Associate	Research Assistant	Total				
Pre-Implementation Activities: Evaluation Plan Preparation, Updating, and Program Monitoring	160	240	200	120	730		3052	28015	18%
Post-Implementation Activities:									
1. Program Monitoring	80	240	160		480		2200	19833	13
2. Specialized Data Collection		40	240	40	320		450	8333	5
3. Survey Design and Implementation		120	200	320	640	900	550	15245	10
4. Data Reduction & Analysis	120	320	840	720	2000	3900	2883	55931	37
5. Report Preparation	120	240	240	120	720		3120	26387	17
Post-Implementation Subtotal	320	960	1680	1200	4160	4800	9203	125729	82%
TOTAL	480	1200	1880	1320	4890	4800	17055	153744	100%

EXHIBIT 3.2

SUMMARY OF ESTIMATED COSTS FOR THE FIRST YEAR OF THE

SANTA MONICA FREEWAY PREFERENTIAL LANE DEMONSTRATION

Item	Responsible Agency	ESTIMATED COST (Thousands of Dollars)	FEDERAL SOURCE		
			UMTA		FHWA
			Via TSC	Direct	
1. PROJECT EVALUATION					
Pre-Implementation Activities	Evaluation Contractor	28	28		
Post-Implementation Activities					
Program Monitoring	Evaluation Contractor	20	20		
Special Data Collection	Evaluation Contractor	8	8		
Survey Design & Implementation	Evaluation Contractor	15	15		
Data Reduction and Analysis	Evaluation Contractor	56	56		
Report Preparation	Evaluation Contractor	27	27		
SUBTOTAL		154	154		
2. DATA COLLECTION AND REVIEW					
Traffic Data	Caltrans	112		112	
Air Quality Data	Caltrans	72		72	
Transit Patronage					
SCRTD	SCRTD	27		27	
SMMBL	SMMBL	14		14	
Safety and Enforcement	CHP	10		10	
Home Interview	FHWA/Survey Contractor	227		100	127
SUBTOTAL		462		335	127
3. MARKETING AND PUBLIC INFORMATION					
Auto User Information	Caltrans	100		100	
Transit User Information	SCRTD, SMMBL	268		268	
SUBTOTAL		368		368	
4. LOCAL AGENCY ADMINISTRATION					
Caltrans	Caltrans	34		34	
SCRTD	SCRTD	46		46	
SMMBL	SMMBL	49		49	
CHP	CHP	2		2	
		131		131	
LOCAL AGENCY CONTINGENCY FUND	Joint Project Board	74		74	
TOTAL COSTS		1,189	154	908	127

3. Marketing and Public Information

4. Local Agency Administration

5. Contingency Fund

A task-by-task breakdown of the project evaluation cost estimates has been presented in Section 3.1 of the evaluation plan. Details of the data collection and review costs incurred by local agencies may be found in the Budget Supplement of the Project Grant Application submitted by SCRTD. Although this evaluation plan redirects certain of the data collection activities proposed in the grant application, the adjustments are not anticipated to increase the total data collection costs significantly. Details of the cost estimates for Marketing and Public Information and Local Agency Administration may also be found in the Project Grant Application. The contingency fund is administered by the Joint Project Board and amounts to 10% of the project grant to local agencies.

A P P E N D I X A

SAMPLE SIZE DETERMINATION

APPENDIX A

SAMPLE SIZE DETERMINATION

The sampling procedure for each measurement instrument used in the demonstration (as summarized in Exhibit 5.9) is described in this Appendix. The following guidelines are adhered to whenever possible in determining sample sizes:

1. The accuracy of estimates of variable levels should be within plus or minus 5 percent with 95 percent confidence (the plus or minus 5 percent range around the estimated value will include the true value 95 percent of the time that this estimation procedure is used).
2. If the true value of a variable (such as vehicle occupancy) shifts by 10 percent, the sample size should be sufficiently large so that the analyst fails to recognize that shift only 20 percent of the time (Type II error of .20) and might erroneously assume that the shift has occurred (when it has not) only 5 percent of the time (Type I error of .05).
3. Two-sided statistical procedures are used throughout (a conservative procedure).

Alterations to these guidelines will be made in the following instances:

1. Where the guidelines dictate prohibitively large and expensive samples given the limited budget allocated to data collection in the demonstration;
2. Where stratification is anticipated in the analysis, sample sizes are increased to allow this analysis according to the guidelines;
3. A 10% to 20% safety factor will be added to sample sizes as suggested in the TSC guidelines to allow for unusuable data

on surveys and to account for deviations from the assumptions used (for example, when the assumed variance of two statistics to be compared are unequal when equality was assumed).

Estimation of Variables

The t statistic is used to calculate the sample size for estimating variables. The formula used for these calculations is:

$$n = \frac{(t_{1-\alpha/2})^2 S^2}{\delta^2}$$

where: $t_{1-\alpha/2}$ is the t statistic (at 95% confidence according to the guidelines, making $\alpha = .05$)

S^2 is the sample variance

δ is the allowable error ($\pm$ 5% by the guidelines)

To meet the specified conditions of confidence and assuming a sample variance of 50% of the mean, a sample size of 385 is required:

$$n = \frac{(t_{.975})^2 (.5m)^2}{(.05m)^2} = 385$$

To indicate the great dependence on variance, a sample variance of 20% of the mean lowers the required sample size to 62:

$$n = \frac{(t_{.975})^2 (.2m)^2}{(.05m)^2} = 62$$

This formula can also be applied to derive a sample size for estimating the proportion of a population displaying a certain characteristic. Assuming a binomial distribution, the mean is the proportion "p," and the variance equals "pq." Using the worst case condition where p = q = .50 and the error to be detected equals .05 (10% of the mean):

$$n = \frac{(t_{.975})^2 (pq)}{(.1p)^2} = 385$$

Recognizing Shifts in Variable Values

The t statistic is used to calculate sample sizes necessary to recognize a 10% shift in a variable. The formula for these calculations and a partial tabulation is shown in Exhibit A.1.

In comparing two variables with the confidence conditions which are specific for use in this evaluation plan, $\alpha = .05$, $\beta = .20$ and $m - m_o = .1m_o$. Assuming that the variance of the variable equals 50% of the mean, a required sample size of 393 is obtained:

$$d = \frac{.1m_o}{\sqrt{(.5m_o)^2 + (.5m_o)^2}} = .1\sqrt{2}$$

$$n = \frac{(Z_{.975} + Z_{.80})^2}{.02} + 1 = 393$$

Again, the required sample size greatly reduces as the variance of the variable changes. For a 20% coefficient of variation (standard deviation/mean), the required sample size drops to 65.

TABLE A-8. SAMPLE SIZES REQUIRED TO DETECT PRESCRIBED DIFFERENCES BETWEEN AVERAGES WHEN THE SIGN OF THE DIFFERENCE IS NOT IMPORTANT

The table entry is the sample size (n) required to detect, with probability $1-\beta$, that the average m of a new product differs from the standard m_0 (or that two product averages m_A and m_B differ). The standardized difference is d, where

$d = \frac{|m - m_0|}{\sigma}$ (or $d = \frac{|m_A - m_B|}{\sqrt{\sigma_A^2 + \sigma_B^2}}$ if we are comparing two products).

The standard deviations are assumed to be known, and n is determined by the formula:

$$n = \frac{(z_{1-\alpha/2} + z_{1-\beta})^2}{d^2}$$

$\alpha = .05$

d \ $1-\beta$	.50	.60	.70	.80	.90	.95	.99
.1	385	490	618	785	1051	1300	1838
.2	97	123	155	197	263	325	460
.4	25	31	39	50	66	82	115
.6	11	14	18	22	30	37	52
.8	7	8	10	13	17	21	29
1.0	4	5	7	8	11	13	19
1.2	3	4	5	6	8	10	13
1.4	2	3	4	5	6	7	10
1.6	2	2	3	4	5	6	8
1.8	2	2	2	3	4	5	6
2.0	1	2	2	2	3	4	5
3.0	1	1	1	1	2	2	3

If we must estimate σ from our sample and use Student's t, then we should add 2 to the tabulated values to obtain the approximate required sample size. (If we are comparing two product averages, add 1 to the tabulated values to obtain the required size of each sample. For this case, we must have $\sigma_A = \sigma_B$.).

(Reproduced from Experimental Statistics, Handbook 91, U.S. Department of Commerce, NBS, 1963, page T-16.)

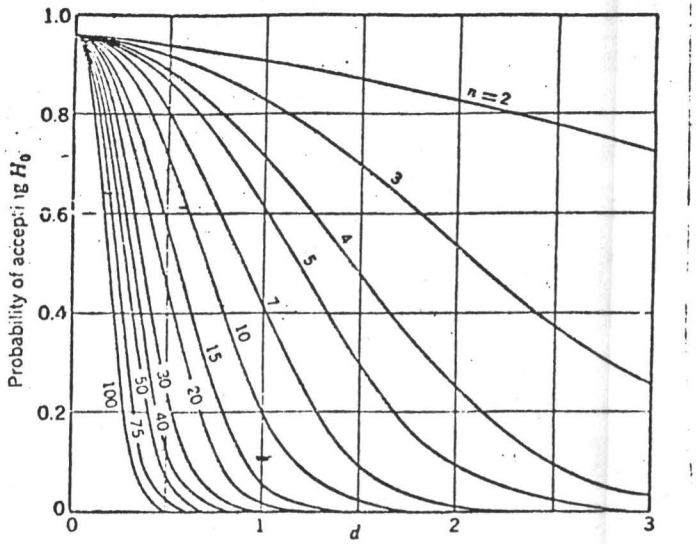


Fig. 6.10. OC curves for different values of n for the two-sided t test for a level of significance $\alpha=0.05$.

Reproduced by permission from "Operating Characteristics for the Common Statistical Tests of Significance" by Charles L. Ferris, Frank E. Grubbs, Chalmers L. Weaver, Annals of Mathematical Statistics, June, 1946

(Reproduced from Bowker & Lieberman, Engineering Statistics, Prentice-Hall, 1959, page 129.)

Recognizing Shifts in Variable Values of Finite Populations

When the populations of interest are smaller than 2,000, the TSC guidelines can be met with considerably smaller samples since the variance is a function of the population size. The derivation of the formulas used to find the sample size is shown in Exhibit A.4, and the result is displayed in Exhibit A.2 for the significance guidelines being followed in this study.

Recognizing Shifts in Variances

The chi-square statistic is used for determining shifts in variances. The curves for finding sample sizes are shown in Exhibit A.3.

In most cases where variance shifts are to be identified, mean shifts must also be identified. The sample size for variance shifts are usually equal to or larger than the corresponding ones for mean shifts. Therefore, variance shift is not a critical factor in determining sample size.

Data Collection Procedures

Utilizing the aforementioned relationships, the sample sizes for the following data collection tasks are determined in this Appendix:

Vehicle volume counts;

Vehicle occupancy counts;

Speed runs;

Patronage counts; and

Attitude surveys.

EXHIBIT A.2

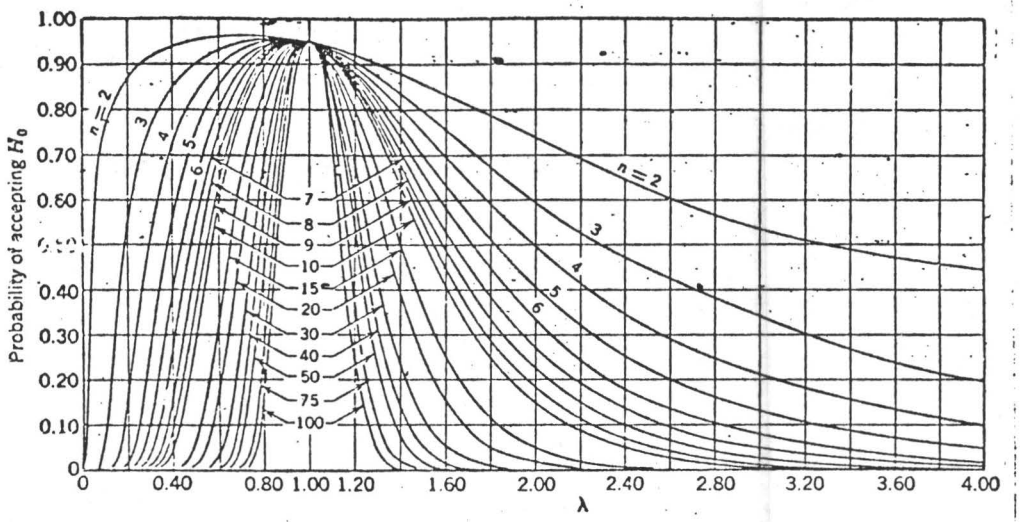


Fig. 6.15. OC curves for different values of n for the two-sided chi-square test for a level of significance $\alpha=0.05$

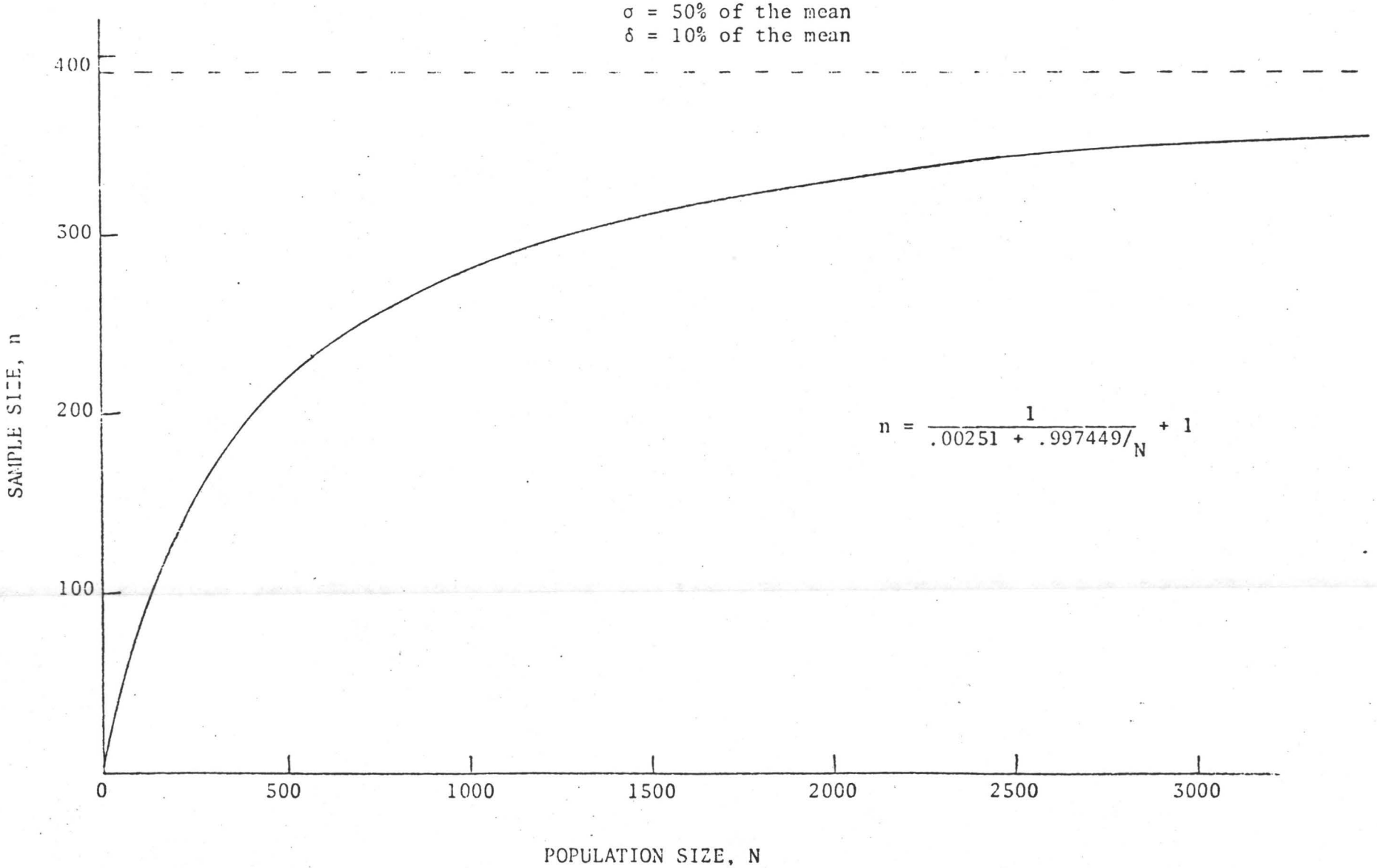
where $\lambda = \sigma/\sigma_o$

(Reproduced from Bowker & Lieberman, op cit., page 139.)

EXHIBIT A.3

SAMPLE SIZE REQUIRED FOR RECOGNIZING VARIABLE SHIFTS IN FINITE POPULATIONS

Assumptions: $\alpha = .05$
$\beta = .80$
$\sigma = 50\%$ of the mean
$\delta = 10\%$ of the mean



Time lapse photography is not discussed here, as this data represents a case study not subjected to statistical analysis. Since all accident and enforcement data will be collected around the clock for the duration of the demonstration, no discussion of sampling procedures is required in regard to the collection of these statistics (a 100% sample is used). If this data base is to be sampled for use in the analysis, sample sizes can be calculated in the future.

Air quality data is also being collected at an extensive number of locations around the freeway and on control routes. The populations involved in air quality measurements are not well defined and, due to the nature of meteorological conditions, perhaps cannot be. Therefore, no theory of statistics can be applied to determine sample sizes. Although the data resulting from these measurements is expected to be informative, no attempt will be made to attach measures of statistical significance to these statements.

A.1 Vehicle Volume Counts

One-day vehicle volume counts are to be taken on screenlines at 17 points at three times: before the opening of the preferential lane, shortly after, and from six to nine months after. Tube counts will be taken over 24 hours, and hand counts during the three-hour peak. Hand counts will be accumulated at fifteen-minute intervals. For the Santa Monica and Harbor Freeways a 100% sample exists, since all flows are recorded by the computerized monitoring system. Samples for analysis can be drawn from this data at little expense.

For arterial streets, this plan yields a sample size of one for the population of daily averages. A sample size of one is not sufficient for statistical

analysis. Moreover, increases to three or four days would be very expensive and still would not yield the desired standards of statistical validity. Therefore, it is necessary to use the population of flows in fifteen-minute intervals and all conclusions concerning changes in arterial flows as a result of the demonstration innovations would be based on the fifteen-minute flow population. This is a reasonable population for these purposes if there are a sufficient number of fifteen-minute interval flows.

Tests of hypotheses will be made to determine shifts in mean traffic flows and, in addition, shifts in the variability (variance) of flows.

From past demonstration experience, it is estimated that standard deviations for the population of fifteen-minute intervals may range from 3% to 30% of the mean. A minimally acceptable assumed value for sample planning would be 10% during the peak when flow is capacity constrained. The detection of a 10% shift in flow would require a sample size of 17 (sixteen from the table in Exhibit A.1 plus one according to the footnote). If the fifteen-minute intervals during the three-hour peak all obeyed the same probability distribution, a one-day sample would yield 12 samples. A two-day count by fifteen-minute intervals is thus required. This slightly exceeds the required sample size, offering a safety factor in case the assumption of a 10% standard deviation proves to be low. In addition, the sample is not limited to one day, which is advisable since traffic conditions do vary somewhat on different days.

Detecting a shift in variance of 50% would require a sample size of about 25 (Exhibit A.3). A two-day count would yield 24 samples, but detecting such

a shift is not deemed sufficiently important to warrant an increase in the number of days of observation above two.

A.2 Vehicle Occupancy Counts

Vehicle counts of the number of persons in automobiles will be made on the Santa Monica, Harbor, and Long Beach Freeways and on the corridor arterials before, shortly after, and six to nine months after implementation.

The major statistical test will be comparison of average vehicle occupancy before and after by a t-test. The current average occupancy is reported by Caltrans as 1.18 persons per automobile. Assuming a standard deviation of .5 persons per car, and a desire to detect change in the average of .05 persons per car, the sample size would be 1,569 (Exhibit A.1).

It should be possible to count 1,600 occupancies or more on each freeway and on the total set of corridor arterials during the one-day sample during the peak and off-peak periods. The sample size may be increased if the actual standard deviation from past data is higher than assumed above. A one-day sample is deemed acceptable in this case, since occupancy is not likely to be affected by unusual traffic conditions on a single day. Extremely bad weather might tend to alter the average occupancy rate, however, so this count should be taken on a day when the weather is unexceptional.

A.3 Speed Runs

Speed runs will be made at peak periods on the freeways and arterial streets before implementation, shortly after implementation, and after steady state has been reached.

Changes in both the mean travel times and the variability of travel times are of interest; therefore, sample sizes are determined for both experiments.

The variability of travel time is a function of the length of the run. For purposes of sample size calculation, assume a variance of 20% of the mean for freeway travel and 24% for arterial routes consisting of four signalized intersections. Because of the large variability, a shift of 15% of travel times will be the target. The sample size for this test is 42 runs for the arterials and 29 for the freeways (Exhibit A.1). A safety factor of two additional runs each to allow for unforeseen loss of data is desirable.

A change in the standard deviation of 50% should be detected. The sample size for this goal would be approximately 25 runs on each sample street (Exhibit A.3), which is below that required to estimate changes in the mean variable levels.

A.4 Patronage Counts

Old Routes Subject to Diversion

The plan for measuring ridership on existing lines called for point checks at points past where diversion to new service is expected to occur. These checks will be taken during the four days before and immediately after implementation, and after ridership has reached steady state. This plan provides a sample size of four.

Tests of hypotheses with a sample size of four days would provide, at a .05 significance level, a Type II error of approximately .60 of accepting the hypothesis of no change in ridership when a change of 15% had occurred, assuming a sample variance of 10% of the mean (Exhibit A.1). This plan does not meet the usual standards of detecting a 10% shift 80% of the time and may even be more deficient, since a larger variance is likely. Nevertheless, sampling is relatively costly. If the results are unsatisfactory, the "after" sample sizes may still be doubled to partially compensate for the smaller "before" sample.

New Freeway Routes

On new SCRTD and SMMBL freeway routes, all-day patronage counts have been planned at the rate of two per week for the first month, one per week for the next three months, and one per month for the remaining eight months.

Since patronage would hopefully be growing during the first four months, the sample rate may be too small in these months to meet the standards of validity proposed since each sample may actually come from a different and expanded population. It is preferable to reallocate sampling so that there are two samples per week every other week during the first five months and two samples a month during the same week in the 7th, 9th, 11th and 12th month.

For purposes of estimating ridership and assuming steady state after five months, the plan provides a sample size of eight. A sample size of seven is sufficient* to estimate ridership with an accuracy of plus or minus 10% at

*From $n = \frac{(t_{1-\alpha/2})^2 S^2}{\delta^2}$

95% confidence if the sample standard deviation is less than 10% of the mean.

Feeder and Cross-Town Routes -- SMMBL

The sampling rate for the park and ride lots and the cross-town route is proposed as once a month for twelve months. For the reasons discussed under freeway routes, this sample is too small for hypothesis testing on the time rate of growth, but is probably sufficient for estimating steady state ridership.

A.5 Attitude Surveys

Three surveys will provide information on attitudes: the home survey, the postcard survey of carpoolers, and the on-board survey of expressway bus users.

Home Surveys

Sample sizes for the home survey have been described in the main body of this report. The sample sizes for carpoolers and bus riders will be too small to meet the desired standards. However, these riders will also be surveyed by on-board questionnaires.

Carpool Postcard Surveys

A postcard survey of carpoolers on the Santa Monica Freeway, based on observed license plates, will be conducted after use of the lane has achieved a steady state. The intent of the survey is to estimate certain attributes of the population of carpool users; that is, to estimate the population proportion having certain characteristics.

The population of interest is all carpool users of the freeway. The target results are 1,100 carpools per hour during the peak and 200 per hour during the off-peak. Since the size of this population is not known with certainty, sample size calculations are based on an assumed infinite population. When the population is known from traffic volume counts, this sample may be adjusted for the finite population. However, if the desired carpooling goals are achieved, it is estimated that the samples given below would not be significantly reduced to account for the finite population.

The sample size is based on a Type I error of .05 (.95 confidence interval) for an estimation error of plus or minus .05. It is also assumed that the minimum population proportion of interest is .50, a worst-case assumption for selecting sample size. The estimation error is thus 10% of the mean $\left(\frac{.05}{.50}\right)$.

The sample size for this case based on a normal approximation to the binomial is 385.* It is suggested that this size sample be drawn for both the peak and off-peak hours and that it consist of observations at all four designated locations, after eliminating the double counts due to observations of cars at more than one location.

In order to account for the fact that there may be some variation among the different days of the week, it is suggested that the license plates be recorded on at least two days.

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*From $$n = \frac{(t_{1-\alpha/2})^2 S^2}{\varepsilon^2}$$

where $\pm \varepsilon$ is the allowable range on the estimate and z is the normal statistic.

If any inferences on carpoolers are to be made as a function of the location of recording, the sample sizes should be increased by considering each location to be the population of interest. This is not presently included in the design, but could be after the fact since license plates would be recorded and the survey sample could be increased after analysis of the first round of responses.

From one point of view, this is a generous sample size. It is based on the worst-case assumption concerning population proportions being estimated ($p = .5$) and the assumption of infinite population.

On the other hand, there are several arguments for increasing the sample size:

a) The number of non-respondents reducing the sample and perhaps biasing the results;

b) The desirability of performing hypotheses testing within sub-sets of carpoolers, which may require larger samples; these hypotheses would be suggested by initial analysis of the data; and

c) Non-responses will reduce the usable sample.

Weighing both sets of arguments, it seems desirable to sample at least 500 carpools for both peak and off-peak hours. If the incremental cost of increasing the sample is small -- which seems to be the case -- the sample might be increased to 800.

In any event, non-respondents should be considered a sub-population and sampled for follow-up interviews to ascertain if they have significantly different attributes from the voluntary respondents.

On-Board Surveys

On-board surveys will be conducted on freeway buses six to nine months after implementation of the demonstration. This population of freeway users is of interest for the same reasons that carpoolers are of interest. Sample size considerations are essentially the same.

The plan to place a surveyor on each bus on each route for one-half day should provide an adequate sample (of at least 500 riders). It is recommended that the questionnaire be given to each rider and that it be self-administered.

EXHIBIT A.4

DERIVATION OF FINITE POPULATION SAMPLE SIZE FORMULA

Z_p = STANDARD NORMAL DISTRIBUTION VARIABLE

α, β = SIGNIFICANCE LEVELS

d = DIFFERENCE TO BE DETECTED

σ = STANDARD DEVIATION OF POPULATION

N = POPULATION SIZE

n = REQUIRED SAMPLE SIZE

$$n = \frac{(Z_{1-\alpha/2} + Z_{1-\beta})^2}{d^2 \left(\sigma\sqrt{\frac{N-n}{N-1}}\right)^2 + \left(\sigma\sqrt{\frac{N-n}{N-1}}\right)^2}$$

LET $Z = (Z_{1-\alpha/2} + Z_{1-\beta})$

$$n = \frac{Z^2}{d^2/2\sigma^2 \left(\frac{N-n}{N-1}\right)}$$

$$n = \frac{(N-1)(2\sigma^2)(Z^2)}{d^2(N-1)}$$

$$n\left(1 + \frac{2\sigma^2 Z^2}{d^2(N-1)}\right) = \frac{2\sigma^2 Z^2 N}{d^2(N-1)}$$

$$n = \frac{2\sigma^2 Z^2 N / d^2(N-1)}{1 + 2\sigma^2 Z^2 / d^2(N-1)}$$

$$n = \frac{2\sigma^2 Z^2 N}{d^2(N-1) + 2\sigma^2 Z^2}$$

$$n = \frac{N}{\frac{d^2(N-1)}{2\sigma^2 Z^2} + 1} = \frac{N}{\frac{d^2(N-1)}{2\sigma^2 (Z_{1-\alpha/2} - Z_{1-\beta})^2} + 1}$$

ASSUMPTIONS: $d = 10\%$ OF MEAN $= .1np$

$\sigma = 50\%$ OF MEAN $= .5np$

$\alpha = .05$; $\beta = .20$

$$n = \frac{N}{\frac{(.1np)^2(N-1)}{2(.5np)^2(1.96+0.84)^2} + 1}$$

$$n = \frac{N}{.002551N - .002551 + 1}$$

$$n = \frac{1}{.002551 + .997449/N}$$

"1" SHOULD THEN BE ADDED TO THE RESULT OBTAINED

THE ABOVE FUNCTION IS PLOTTED IN EXHIBIT B.3

APPENDIX B

MEASUREMENT MATRICES

APPENDIX B

MEASUREMENT MATRICES

This appendix contains matrices designed to relate the data elements required for demonstration evaluation to the measurement instruments used to obtain the data. An efficient data collection plan requires that each measurement instrument be used to obtain as many of the data elements as is possible in the appropriate form for evaluation. The objective is to minimize the data collection effort while retaining the prescribed validity. Measurement instrument design is greatly aided by rearranging the measurement instrument data contained in the tableaus of Exhibits 1.5 through 1.9 in a matrix format relating evaluation measurements and measurement instruments. Such a restructuring is shown in the tables which comprise Exhibits B.1 to B.5. These tables are also useful for identifying duplications and omissions in the data collection plans.

The columns on the right-hand side of the matrices denote the measurement instruments, while the left-hand columns contain a listing of the required data elements. The circles in the appropriate right-hand columns define the innovations to which the data element pertains and the measurement instrument used to obtain the data.

To aid reference, data elements have been classified into the following groups:

TRANSPORTATION SYSTEM MEASURES

- Highway System Performance:
  - Productivity
  - Travel Time
  - Congestion
- Transit System Performance:
  - Reliability
  - Travel Time
  - Coverage
  - Productivity

TRAVEL BEHAVIOR MEASURES

- Residential Information
- Trip Information
- Mode Choice Attitudes

SAFETY AND ENFORCEMENT MEASURES

- Accidents
- Enforcement

PUBLIC ATTITUDE MEASURES

ENVIRONMENT MEASURES

- Air Pollution
- Energy Use

EXHIBIT B.1

IMPACT AREA	MEASURING INSTRUMENTS																													
	TRAFFIC DATA					AIR QUALITY DATA				TRAN-SIT DATA		SAFETY & ENFORCEMENT DATA			ATTITUDE & BEHAVIOR DATA															
PREFERENTIAL LANE TRANSPORTATION SYSTEM MEASURES	VEHICLE VOLUME COUNTS	VEHICLE OCCUPANCY COUNTS	SPEED RUNS	TIME LAPSE PHOTOGRAPHY	COMPUTERIZED TRAFFIC FLOW RECORDS	PERMANENT BAG SAMPLERS	PORTABLE BAG SAMPLERS	RESEARCH VAN SAMPLERS	MOBILE VAN SAMPLERS	POINT CHECKS	RIDING CHECKS	ACCIDENT RECORDS	WARNINGS AND CITATIONS	ENFORCEMENT LEVEL RECORDS	ENFORCEMENT PROBLEM RECORDS	HOME INTERVIEW SURVEY	TELEPHONE SCREEN SURVEY	LICENSE PLATE POSTCARD SURVEY	ON-BOARD SURVEY	PUBLIC RESPONSE MONITORING	MEDIA INFORMATION MONITORING	CALCULATIONS	DEMOGRAPHIC/LOCAL DATA CENSUS/TRANSIT RECORDS	TRANSIT & FREIGHT RECORDS					
HIGHWAY SYSTEM PERFORMANCE:																														
PRODUCTIVITY:																														
VEHICLE VOLUME	○	○																												
VEHICLE OCCUPANCY		○																												
VEHICLE LANE CHANGES					○																									
VMT BY FLEET COMPOSITION	○																○	○					○							
PASSENGER MILES BY MODE	○	○																	○	○										
TOTAL TRAVELLERS BY ROUTE	○	○									○																			
TOTAL VEHICLES BY ROUTE	○																													
PASSENGER THROUGHPUT PER HOUR		○									○																			
TRAVEL TIME:																														
AVERAGE VEHICLE SPEED				○		○																								
VEHICLE TRAVEL TIMES				○													○	○	○											

EXHIBIT B.1

PREFERENTIAL LANE

TRANSPORTATION SYSTEM MEASURES

(CONTINUED)

IMPACT AREA	MEASURING INSTRUMENTS: TRAFFIC DATA: VEHICLE VOLUME COUNTS	TRAFFIC DATA: VEHICLE OCCUPANCY COUNTS	TRAFFIC DATA: SPEED RUNS	TRAFFIC DATA: TIME LAPSE PHOTOGRAPHY	TRAFFIC DATA: COMPUTERIZED FLOW RECORDS	AIR QUALITY DATA: PERMANENT BAG SAMPLERS	AIR QUALITY DATA: PORTABLE BAG SAMPLERS	AIR QUALITY DATA: RESEARCH VAN SAMPLERS	AIR QUALITY DATA: MOBILE VAN SAMPLERS	TRANSIT DATA: POINT CHECKS	SAFETY & ENFORCEMENT DATA: RIDING CHECKS	SAFETY & ENFORCEMENT DATA: ACCIDENT RECORDS	SAFETY & ENFORCEMENT DATA: WARNINGS AND CITATIONS RECORDS	SAFETY & ENFORCEMENT DATA: ENFORCEMENT LEVEL RECORDS	ATTITUDE & BEHAVIOR DATA: HOME INTERVIEW SURVEY	ATTITUDE & BEHAVIOR DATA: TELEPHONE SCREEN SURVEY	ATTITUDE & BEHAVIOR DATA: LICENSE PLATE POSTCARD SURVEY	ATTITUDE & BEHAVIOR DATA: ON-BOARD SURVEY	ATTITUDE & BEHAVIOR DATA: PUBLIC RESPONSE MONITORING	ATTITUDE & BEHAVIOR DATA: MEDIA INFORMATION MONITORING	CALCULATIONS	TRANSIT & FREEWAY GRANT RECORDS/CASSIS/LOCAL DATA
HIGHWAY SYSTEM PERFORMANCE (CONTINUED):																							
CONGESTION:																							
OFF-RAMP QUEUE LENGTHS	○																						
VEHICLE COUNT IN 5-MINUTE INTERVALS						○																	
VEHICLE MINUTES OF DELAY UNDER 35 M.P.H.						○																	
TIME TO ACHIEVE PREFERENTIAL LANE - BUS - CARPOOL					○	○																	
PEAK TRAFFIC CONGESTION						○																	○
SHAPE OF PEAK LANE CONGESTION						○																	○
TRANSIT SYSTEM PERFORMANCE:																							
TRANSIT RELIABILITY:																							
ON-TIME PERFORMANCE											○	○											
DIFFERENCE BETWEEN SCHEDULED AND ACTUAL TRAVEL TIMES																							○

EXHIBIT B.1

PREFERENTIAL LANE

TRANSPORTATION SYSTEM MEASURES

(CONTINUED)

IMPACT AREA	MEASURING INSTRUMENTS: TRAFFIC DATA: VEHICLE VOLUME COUNTS	TRAFFIC DATA: VEHICLE OCCUPANCY COUNTS	TRAFFIC DATA: SPEED RUNS	TRAFFIC DATA: TIME LAPSE PHOTOGRAPHY	TRAFFIC DATA: COMPUTERIZED TRAFFIC FLOW RECORDS	AIR QUALITY DATA: PERMANENT BAG SAMPLERS	AIR QUALITY DATA: PORTABLE BAG SAMPLERS	AIR QUALITY DATA: RESEARCH VAN SAMPLERS	AIR QUALITY DATA: MOBILE VAN SAMPLERS	TRANSIT DATA: POINT CHECKS	TRANSIT DATA: RIDING CHECKS	SAFETY & ENFORCEMENT DATA: ACCIDENT RECORDS	SAFETY & ENFORCEMENT DATA: WARNINGS AND CITATIONS RECORDS	SAFETY & ENFORCEMENT DATA: ENFORCEMENT LEVEL RECORDS	ATTITUDE & BEHAVIOR DATA: HOME INTERVIEW PROBLEM ENFORCEMENT	ATTITUDE & BEHAVIOR DATA: TELEPHONE SCREEN SURVEY	ATTITUDE & BEHAVIOR DATA: LICENSE PLATE POSTCARD SURVEY	ATTITUDE & BEHAVIOR DATA: ON-BOARD SURVEY	ATTITUDE & BEHAVIOR DATA: PUBLIC RESPONSE MONITORING	ATTITUDE & BEHAVIOR DATA: MEDIA INFORMATION MONITORING	CALCULATIONS	DEMOGRAPHIC DATA	TRANSPORTATION NETWORK CHARACTERISTICS
RIDERSHIP PER DAY AND PER PEAK HOUR											○	◎													
TRAVEL TIME																									
TRANSIT TRIP TIME																				○				◎	○
DIFFERENCE BETWEEN PREVIOUS AND NEW TRANSIT HEADWAY																				○				◎	○
RATIO OF TRANSIT TRIP TIME TO AUTO TRIP TIME																				○				◎	○
DIFFERENCE BETWEEN PREVIOUS AND NEW TRANSIT TRIP TIME																								◎	○
ACTUAL TRANSIT VEHICLE IN-SERVICE TRAVEL TIME											○	◎	○												
SCHEDULED TRANSIT VEHICLE IN-SERVICE TRAVEL TIME																								◎	○
TRANSIT COVERAGE (NEW AND EXISTING LINES)																									
ROUTE MILES																								◎	○
TYPE OF SERVICE OPERATION THROUGHOUT THE YEAR																								◎	○
DAYS OF SERVICE OPERATION THROUGHOUT THE YEAR																								◎	○
SERVICE FREQUENCY											○	◎	○									○	○	◎	○
NUMBER OF PERSONS WHO USE SERVICE											○	◎	○									○	○	◎	○
SERVICE MARKET SHARE	◎																							◎	○

EXHIBIT B.1

IMPACT AREA PREFERENTIAL LANE TRANSPORTATION SYSTEM MEASURES (CONTINUED)	MEASURING INSTRUMENTS																										
	TRAFFIC DATA					AIR QUALITY DATA				TRANSIT DATA		SAFETY & ENFORCEMENT DATA			ATTITUDE & BEHAVIOR DATA												
	VEHICLE VOLUME COUNTS	VEHICLE OCCUPANCY COUNTS	SPEED RUNS	TIME LAPSE PHOTOGRAPHY	COMPUTERIZED TRAFFIC FLOW RECORDS	PERMANENT BAG SAMPLERS	PORTABLE BAG SAMPLERS	RESEARCH VAN SAMPLERS	MOBILE VAN SAMPLERS	POINT CHECKS	RIDING CHECKS	ACCIDENT RECORDS	WARNINGS AND CITATIONS	ENFORCEMENT LEVEL RECORDS	ENFORCEMENT PROBLEM RECORDS	HOME INTERVIEW SURVEY	TELEPHONE SCREEN SURVEY	LICENSE PLATE POSTCARD SURVEY	ON-BOARD SURVEY	PUBLIC RESPONSE MONITORING	MEDIA INFORMATION MONITORING	CALCULATIONS	TRANSIT & GRANT RECORDS	DEMO GRANT RECORDS	CENSUS/LOCAL DATA	
TRANSIT SYSTEM PERFORMANCE (CONTINUED):																											
TRANSIT PRODUCTIVITY (EXISTING AND NEW LINES SERVICING PREFERENTIAL LANE):																											
NUMBER OF VEHICLES BY TYPE																											
SEATED VEHICLE CAPACITY																											
STANDING VEHICLE CAPACITY																											
NUMBER VEHICLE TRIPS PER DAY																											
NUMBER VEHICLE MILES PER DAY																											
NUMBER SEAT MILES PER DAY -																											
NUMBER VEHICLE HOURS PER DAY																											
NUMBER OTHER OPERATING AND MAINTENANCE LABOR HOURS PER DAY																											
DEMONSTRATION COSTS IN DOLLARS (FEDERAL, STATE, LOCAL)																											
DEMONSTRATION OPERATING COSTS PER DAY																											
PEAK VEHICLE UTILIZATION																											
EXTENT OF MODAL SHIFT																				○			○				
UNIT REDUCTION																				○			○				
PARK AND RIDE LOT USAGE											○																

EXHIBIT B.2

PREFERENTIAL LANE

TRAVEL BEHAVIOR MEASURES

IMPACT AREA	MEASURING INSTRUMENTS																													
	TRAFFIC DATA					AIR QUALITY DATA				TRAN-SIT DATA		SAFETY & ENFORCEMENT DATA			ATTITUDE & BEHAVIOR DATA																
	VEHICLE VOLUME COUNTS	VEHICLE OCCUPANCY COUNTS	SPEED RUNS	TIME LAPSE PHOTOGRAPHY	TRAFFIC RECORDS	PERMANENT BAG SAMPLERS	PORTABLE BAG SAMPLERS	RESEARCH VAN SAMPLERS	MOBILE VAN SAMPLERS	POINT CHECKS	RIDING CHECKS	ACCIDENT RECORDS	WARNINGS AND CITATIONS	ENFORCEMENT LEVEL RECORDS	ENFORCEMENT PROBLEM RECORDS	HOME INTERVIEW SURVEY	TELEPHONE SCREEN SURVEY	POSTCARD SURVEY	LICENSE PLATE SURVEY	ON-BOARD SURVEY	PUBLIC RESPONSE MONITORING	MEDIA INFORMATION MONITORING	CALCULATIONS	TRANSIT & DMRB GRANT RECORDS	GEOLOGICAL DATA					
RESIDENTIAL INFORMATION:																														
PLACE OF RESIDENCE (ADDRESS)																	○			○	○									
SEX																	○			○	○									
MARITAL STATUS																	○			○	○									
AGE																	○			○	○									
NUMBER IN HOUSEHOLD																	○			○	○									
WORKING HOURS																	○			○	○									
OCCUPATION																	○			○	○									
DRIVER'S LICENSE																	○			○	○									
NUMBER OF VEHICLES OWNED																	○			○	○									
TYPE OF HOUSING																	○			○	○									
INCOME																	○			○	○									
RACE																	○			○	○									
TRIP INFORMATION:																														
ORIGIN-DESTINATION																	○			○	○									
TRIP FREQUENCIES																	○			○	○									

EXHIBIT B.2

IMPACT AREA PREFERENTIAL LANE TRAVEL BEHAVIOR MEASURES (CONTINUED)	MEASURING INSTRUMENTS																							
	TRAFFIC DATA				AIR QUALITY DATA				TRANSIT DATA		SAFETY & ENFORCEMENT DATA			ATTITUDE & BEHAVIOR DATA										
	VEHICLE VOLUME COUNTS	VEHICLE OCCUPANCY COUNTS	SPEED RUNS	TIME LAPSE PHOTOGRAPHY	ELECTRONIC RECORDS	PERMANENT BAG SAMPLERS	PORTABLE BAG SAMPLERS	RESEARCH VAN SAMPLERS	MOBILE VAN SAMPLERS	POINT CHECKS	RIDING CHECKS	ACCIDENT RECORDS	WARNINGS AND CITATIONS	ENFORCEMENT LEVEL RECORDS	ENFORCEMENT RECORDS	HOME INTERVIEW SURVEY	TELEPHONE SCREEN SURVEY	LICENSE PLATE BACKGROUND SURVEY	ON-BOARD SURVEY	PUBLIC RESPONSE MONITORING	MEDIA INFORMATION	CALCULATIONS	CENSUS/LOCAL DATA	TRANSIT & DEMO GRANT RECORDS
TRIP HISTORY	○	○									○						○		○					
TRANSIT HISTORY																	○							
TRIPS BY MODE BY ROUTE																							○	
DIVERSION TO NEW TRANSIT ROUTE FROM EXISTING AUTO & TRANSIT BY O/D											○						○		○					
PARKING COSTS																	○		○					
NUMBER OF CARPOOLERS																	○		○					
RELATIONSHIP OF CARPOOLERS																	○		○					
CARPOOL HISTORY																	○		○					
NUMBER OF VEHICLES REDUCED																	○		○					
ATTITUDES ON MODE CHOICE:																								
SITUATIONAL ATTITUDES BY MODE																	○							
CARPOOLING																	○		○					
TRANSIT RIDERSHIP																	○		○					
AUTO USE																	○		○					
PREFERENTIAL LANES																	○		○					
PREFERENTIAL LANE VIOLATIONS																								

EXHIBIT B.3

PREFERENTIAL LANE

SAFETY AND ENFORCEMENT MEASURES

IMPACT AREA	MEASURING INSTRUMENTS: TRAFFIC DATA: VEHICLE VOLUME COUNTS	TRAFFIC DATA: VEHICLE OCCUPANCY COUNTS	TRAFFIC DATA: SPEED RUNS	TRAFFIC DATA: TIME LAPSE PHOTOGRAPHY	TRAFFIC DATA: COMPUTERIZED TRAFFIC SIGNAL RECORDS	AIR QUALITY DATA: PERMANENT BAG SAMPLERS	AIR QUALITY DATA: PORTABLE BAG SAMPLERS	AIR QUALITY DATA: RESEARCH VAN SAMPLERS	AIR QUALITY DATA: MOBILE VAN SAMPLERS	TRANSIT DATA: POINT CHECKS	TRANSIT DATA: RIDING CHECKS	SAFETY & ENFORCEMENT DATA: ACCIDENT RECORDS	SAFETY & ENFORCEMENT DATA: WARNINGS AND CITATIONS RECORDS	SAFETY & ENFORCEMENT DATA: ENFORCEMENT LEVEL RECORDS	ATTITUDE & BEHAVIOR DATA: HOME INTERVIEW SURVEY	ATTITUDE & BEHAVIOR DATA: TELEPHONE SCREEN SURVEY	ATTITUDE & BEHAVIOR DATA: LICENSE PLATE POSTCARD SURVEY	ATTITUDE & BEHAVIOR DATA: ON-BOARD SURVEY	ATTITUDE & BEHAVIOR DATA: PUBLIC RESPONSE MONITORING	MEDIA INFORMATION MONITORING	CALCULATIONS	TRANSIT & GRANT RECORDS DEMO GRANT LOCAL DATA	CENSUS/LOCAL DATA
ACCIDENTS:																								
NUMBER OF ACCIDENTS																								
SEVERITY (PROPERTY DAMAGE, INJURY, OR FATALITY)																								
PRIMARY CAUSE																								
DIRECTION OF TRAVEL																								
TIME OF DAY																								
ENTERING OR LEAVING PREFERENTIAL LANE																								
NEAREST INTERSECTION																								
HISTORY OF ACCIDENTS BY INTERSECTION																								
ENFORCEMENT:																								
CITED VIOLATIONS OF PREFERENTIAL LANE AND ACCESS RAMPS																								
OBSERVED VIOLATIONS OF PREFERENTIAL LANE AND ACCESS RAMPS																								
PROBABLE CAUSE OF VIOLATION (IGNORANCE, CONFUSION, NON-COMPLIANCE)																								
PERCENT OF ACCIDENTS BY PROBABLE CAUSE																								
ENFORCEMENT PROBLEMS OF PREFERENTIAL LANE																								
POLICE UNIT ASSIGNMENTS																								

EXHIBIT B.4

IMPACT AREA	MEASURING INSTRUMENTS																										
	TRAFFIC DATA				AIR QUALITY DATA				TRANSIT DATA		SAFETY & ENFORCEMENT DATA			ATTITUDE & BEHAVIOR DATA													
	VEHICLE VOLUME COUNTS	VEHICLE OCCUPANCY COUNTS	SPEED RUNS	TIME LAPSE PHOTOGRAPHY	COMPUTERIZED TRAFFIC FLOW RECORDS	PERMANENT BAG SAMPLERS	PORTABLE BAG SAMPLERS	RESEARCH VAN SAMPLERS	MOBILE VAN SAMPLERS	POINT CHECKS	RIDING CHECKS	ACCIDENT RECORDS	WARNINGS AND CITATIONS	ENFORCEMENT LEVEL RECORDS	ENFORCEMENT PROBLEM RECORDS	HOME INTERVIEW SURVEY	TELEPHONE SCREEN SURVEY	LICENSE PLATE POSTCARD SURVEY	ON-BOARD SURVEY	PUBLIC RESPONSE MONITORING	MEDIA INFORMATION MONITORING	CALCULATIONS	TRANSIT & GRANT RECORDS	DEMO/LOCAL DATA	CENSUS/LOCAL DATA	
PREFERENTIAL LANE																											
PUBLIC ATTITUDE MEASURES																											
PUBLIC RESPONSE:																											
NUMBER OF FAVORABLE AND UNFAVORABLE MEDIA RESPONSES																											
NUMBER OF TELEPHONE COMPLAINTS																											
NUMBER OF COMMUTER COMPUTER INQUIRIES																											
NUMBER OF QUESTIONNAIRE RESPONSES																											

EXHIBIT B.5

IMPACT AREA	MEASURING INSTRUMENTS: TRAFFIC DATA					AIR QUALITY DATA				TRANSIT DATA		SAFETY & ENFORCEMENT DATA				ATTITUDE & BEHAVIOR DATA							
PREFERENTIAL LANE ENVIRONMENT MEASURES	VEHICLE VOLUME COUNTS	VEHICLE OCCUPANCY COUNTS	SPEED RUNS	TIME LAPSE PHOTOGRAPHY	COMPUTERIZED TRAFFIC FLOW RECORDS	PERMANENT BAG SAMPLERS	PORTABLE BAG SAMPLERS	RESEARCH VAN SAMPLERS	MOBILE VAN SAMPLERS	POINT CHECKS	RIDING CHECKS	ACCIDENT RECORDS	WARNINGS AND CITATIONS	ENFORCEMENT LEVEL RECORDS	ENFORCEMENT PROBLEM RECORDS	HOME INTERVIEW SURVEY	TELEPHONE SCREEN SURVEY	LICENSE PLATE POSTCARD SURVEY	ON-BOARD SURVEY	PUBLIC RESPONSE MONITORING	MEDIA INFORMATION MONITORING	CALCULATIONS	TRANSIT & DEMO GRANT RECORDS CENSUS/LOCAL DATA
AIR POLLUTION:																							
CO LEVELS	O					O	O	O	O														O
HC LEVELS								O	O														O
NOx LEVELS								O	O														O
ENERGY USE																							O

APPENDIX C

MEASUREMENT CHECKLISTS

APPENDIX C

MEASUREMENT CHECKLISTS

To assist the local agencies in their data collection tasks, checklists have been prepared summarizing the pre-implementation data to be collected by each participant in the demonstration. These checklists reflect the data collection process specified in Section 1.3 of the evaluation plan. Local agencies participating in the demonstration (Caltrans, LADT, SCRTD, SMMBL, CHP and LAPD) will receive only those checklists related to their individual tasks. Master copies of all checklists are maintained by SYSTAN and the Federal agencies participating in the demonstration.

Responsible Agency: LADT

D148-3
Time Frame:
Prior to Project
Implementation

CHECKLIST
FOR
PRE-IMPLEMENTATION MEASUREMENTS

SANTA MONICA PREFERENTIAL LANE EVALUATION

Measurement: Historical Accident Data

Location: Corridor Streets

Wilshire Boulevard
Olympic Boulevard
Pico Boulevard
Venice Boulevard
Washington Boulevard
Adams Boulevard
Jefferson Boulevard
Rodeo Road/Exposition Boulevard
Santa Barbara Avenue

Sampling Method:

The LADT will assist SYSTAN in assembling a profile of accident data on those surface streets in the project corridor within the LADT jurisdiction for the six years prior to project implementation. Accident data will be recorded by severity (serious injury, slight injury, complaint of injury, property damage and/or fatality) and by primary cause, time of day and nearest intersection. It is anticipated that the accident location analysis report currently produced by the LADT, giving a six-year history of accidents by intersection and route, will be adequate for the purposes of the evaluation.

Responsible Agency: CALTRANS

D148-3
Time Fra. :
Immediately
Preceding Pro,
Implementation

CHECKLIST
FOR
PRE-IMPLEMENTATION MEASUREMENTS

SANTA MONICA PREFERENTIAL LANE EVALUATION

Measurement: Time-Lapse Photography

Location: Santa Monica Freeway

Cloverfield Street	[]
Overland Avenue	[]
Crenshaw Boulevard	[]
Western Avenue	[]

Sampling Method:

Freeway operations will be filmed at peak hours by time-lapse photography at each location.

Responsible Agency: CALTRANS

D148-3
Time Frame:
Prior to Project Implementation

CHECKLIST
FOR
PRE-IMPLEMENTATION MEASUREMENTS

SANTA MONICA PREFERENTIAL LANE EVALUATION

Measurement: On-Ramp Queue Lengths

Location:	Santa Monica Freeway Eastbound (A.M. Peak)	Santa Monica Freeway Westbound (P.M. Peak)
Lincoln Boulevard	[]	
Cloverfield Boulevard	[]	
Bundy Drive	[]	
La Cienega Boulevard (southbound (ramp)	[]	[]
Washington Boulevard	[]	
Crenshaw Boulevard		[]
20th Street (Hoover Street)		[]
Vermont Avenue		[]
Arlington Avenue		[]
Fairfax Avenue		[]
Robertson Avenue		[]
Western Avenue		[]

Sampling Method: Queue lengths will be measured on at least two different days during peak hours at 15-minute intervals at the above minimum locations. The queue lengths will be measured in both the reserved and unreserved access lanes and combined with the metering rate to compute mean delays at each on-ramp. All vehicles in the queue shall be counted during each observation period.

Responsible Agency: CALTRANS

D148-3
Time Frame:
Prior to Projec
Implementation

CHECKLIST
FOR
PRE-IMPLEMENTATION MEASUREMENTS

SANTA MONICA PREFERENTIAL LANE EVALUATION

Measurement: Speed Runs

Location:	Eastbound (A.M. Peak)	Westbound (P.M. Peak)
Olympic Boulevard	[]	[]
Pico Boulevard	[]	[]
National Boulevard	[]	[]
Venice Boulevard	[]	[]
Washington Boulevard	[]	[]
Rodeo Road/Exposition Boulevard	[]	[]
Sixth Street		[]
Santa Monica Boulevard		[]
Adams Boulevard		[]

Santa Monica Freeway (median lane)	[]	[]
(remaining lanes)	[]	[]
San Diego Freeway	[]	[]
Ventura-Hollywood Freeway	[]	[]
Long Beach Freeway (median lane)	[]	[]
(remaining lanes)	[]	[]

Sampling Methods: Speed runs will be conducted for the full length of each designated freeway and corridor arterial. During these runs, speed checks will be made at appropriate intervals to supplement the data obtained from the full-length runs. At least 24 speed runs will be conducted using a free floating car at 15-minute intervals during two three-hour peak periods. Speed data on the Harbor Freeway will be obtained from the 42-mile loop computer.

Location	Site	Permanent Bag	Portable Bag	Research Van	Mobile Van
Westside Neighborhood Park Fairfax and Adams	S24		[]		
Hobart Boulevard School Olympic Boulevard and Hobart Boulevard	S31		[]		
Catholic Girls' High School Kingsley Drive and Pico Boulevard	S32		[]		
Normandie Playground Venice Boulevard and Normandie Avenue	S33		[]		
Catholic School Adams Boulevard and Vermont Avenue	S34		[]		

Sampling Method: Permanent Bag Samplers are automatic, collecting 24 one-hour continuous CO bag samples which will then be reduced at the District Lab by Non-Dispersive Infra-red (NDIR) analysis on a weekday monitoring schedule.

Portable Bag Samplers will collect one-hour CO bag samples from 6:00 a.m. to 6:00 p.m. intermittently at each of four sites, operating simultaneously on one screenline. The screenlines will be sampled in succession (line one, then line two, then line three, return to line one and repeat) following the same schedule as the permanent bag samplers. Samples will then be taken to the District Lab for DNIR analysis.

The Research Van will collect several pollutants, including CO, from multi-level probes in the Santa Monica Freeway median. During the operational periods, the research van will remain at a permanent site.

Several air pollutants will also be monitored by a mobile van alternating between the permanent bag sampling sites every other sampling day.

The intermittant bag sampling will be modified during traffic count days so that air sampling will always occur on days when traffic is being counted.

Responsible Agency: CALTRANS

D148-3

Time Frame:
Prior to Project
Implementation

CHECKLIST
FOR
PRE-IMPLEMENTATION MEASUREMENTS

SANTA MONICA PREFERENTIAL LANE EVALUATION

Measurement: Air Quality Data

Location	Site	Permanent Bag	Portable Bag	Research Van	Mobile Van
Palms Recreation Center 2950 Overland Avenue	PW	[]		[]	[]
Terrace Park Pico Boulevard and Bonnie Brae Street	PE	[]		[]	[]
Long Beach Freeway		[]			
Santa Monica Freeway				[]	
Northeast Corner, Olympic and Selby at pedestrian undercrossing	S11		[]		
Rancho Park Golf Course Parkway in front of Clubhouse	S12		[]		
Venice Boulevard, Median 300' West of Motor Avenue	S13		[]		
La Ballona Elementary School 10915 Washington Boulevard	S14		[]		
Carthay Center School Olympic Boulevard @ Carrillo	S21		[]		
Pico Rents Northeast Corner Crescent Heights @ Pico	S22		[]		
Venice Boulevard, Median South of Route 10	S23		[]		

Responsible Agency: CALTRANS

D148-3
Time Frame:
Prior to Project
Implementation

CHECKLIST
FOR
PRE-IMPLEMENTATION MEASUREMENTS

SANTA MONICA PREFERENTIAL LANE EVALUATION

Measurement: Vehicle Occupancy Counts

Location:	Sepulveda Boulevard Screenline	La Cienega Boulevard Screenline	Western Avenue Screenline
Rodeo Road/Exposition Boulevard	[]	[]	[]
Jefferson Boulevard	[]	[]	[]
Culver Boulevard	[]	[]	[]
Adams Boulevard	[]	[]	[]
Washington Boulevard	[]	[]	[]
Pico Boulevard	[]	[]	[]
Olympic Boulevard	[]	[]	[]
Santa Monica Boulevard	[]	[]	[]
Wilshire Boulevard	[]	[]	[]

Santa Monica Freeway at Cloverfield Street	[]
Overland Avenue	[]
Crenshaw Boulevard	[]
Western Avenue	[]
Harbor Freeway at Adams Boulevard	[]
Long Beach Freeway at Gage Avenue	[]

Sampling Method: One-day vehicle occupancy counts will be hand-counted during the peak and off-peak periods until a sample size of 800 occupancies or more is obtained at each location.

CHECKLIST
FOR
PRE-IMPLEMENTATION MEASUREMENTS

SANTA MONICA PREFERENTIAL LANE EVALUATION

Measurement: Vehicle Volume Counts

Location:	Sepulveda Boulevard Screenline	La Cienega Boulevard Screenline	Western Avenue Screenline
Rodeo Road/Exposition Boulevard	[]	[]	[]
Jefferson Boulevard	[]	[]	[]
Culver Boulevard	[]	[]	[]
Adams Boulevard	[]	[]	[]
Washington Boulevard	[]	[]	[]
Pico Boulevard	[]	[]	[]
Olympic Boulevard	[]	[]	[]
Santa Monica Boulevard	[]	[]	[]
Wilshire Boulevard	[]	[]	[]

Santa Monica Freeway at Cloverfield Street	[]
Overland Avenue	[]
Crenshaw Boulevard	[]
Western Avenue	[]
Harbor Freeway at Adams Boulevard	[]
Ventura-Hollywood Freeway at Edgewater Street	[]
San Diego Freeway at Sunset Boulevard	[]
Long Beach Freeway at Gage Avenue	[]

Sampling Methods:

Two-day volume counts will be taken at each location and broken down into 15-minute intervals for evaluation. Surface streets will be hand-counted and tube-counted. Hand counts will cover two three-hour peak periods, while tube counts will be taken over a 48-hour period.

Freeway traffic will be hand-counted for 23 minutes out of each 30-minute period and adjusted to provide total volume and occupancy. Vehicle volumes on the Santa Monica and Harbor Freeways, in addition, will be extracted from the 42-mile loop computer at 5-minute intervals. Computer counts on the Santa Monica Freeway will be adjusted to separate median lane counts from counts in the remaining lanes.

Responsible Agency: CALTRANS

D148-3
Time Frame:

Prior to Project Implementation

CHECKLIST
FOR
PRE-IMPLEMENTATION MEASUREMENTS

SANTA MONICA PREFERENTIAL LANE EVALUATION

Measurement: Media Monitoring

Sampling Methods:

CALTRANS' Public Relations Department will read all daily newspapers in the Los Angeles area and will maintain up-to-date separate newspaper clipping files of those articles pertaining to the Santa Monica Freeway Demonstration Program. CALTRANS will also make arrangements with a Los Angeles media monitoring firm to monitor all local radio and television broadcasts and to provide them with selected transcripts of all references to the freeway project.

Responsible Agency: CALTRANS

D148-3

Time Frame:
Immediately Prec edi.
Project Implementati

CHECKLIST
FOR
PRE-IMPLEMENTATION MEASUREMENTS

SANTA MONICA PREFERENTIAL LANE EVALUATION

Measurement: Aerial Photography

Location:

Olympic Boulevard
Pico Boulevard
National Boulevard
Venice Boulevard
Washington Boulevard
Rodeo Road/Exposition Boulevard
Sixth Street
Santa Monica Boulevard
Adams Boulevard

Sampling Method: Aerial photographs will be taken of each location at peak hours from a CHP helicopter using a 35-millimeter camera. The photographs will focus on congestion and ramp queueing activities in the vicinity of these locations.

Responsible Agency: LAPD

D148-3
Time Frame:
Prior to Project
Implementation

CHECKLIST
FOR
PRE-IMPLEMENTATION MEASUREMENTS

SANTA MONICA PREFERENTIAL LANE EVALUATION

Measurement: Historical Enforcement Data

Location: Surface Streets in the Project Corridor

Sampling Method:

The LAPD will assist SYSTAN in assembling a profile of typical manpower assignments on the surface streets in the project corridor for the year prior to project implementation. This information can best be obtained from the captains of each of the eight LAPD divisions affected by the project.

Responsible Agency: SMMBL

D148-3
Time Frame:
Prior to Project
Implementation

CHECKLIST
FOR
PRE-IMPLEMENTATION MEASUREMENTS

SANTA MONICA PREFERENTIAL LANE EVALUATION

Measurement: Riding Checks

Point Check Location	Lines Checked	Duration of Check	Checkers Required	
Bundy and Centinela	14	7 A.M. - 6 P.M.	1	[]

Sampling Method:

Transit ridership on the #14 crosstown line will be continuously monitored once each month throughout the one-year length of the project, for a total of twelve checks. The number of passengers boarding or alighting will be recorded at each stop or during each trip.

Responsible Agency: SMMBL

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Time Frame:
Prior to Project
Implementation

CHECKLIST
FOR
PRE-IMPLEMENTATION MEASUREMENTS

SANTA MONICA PREFERENTIAL LANE EVALUATION

Measurement: Point Checks (Existing Lines)

Point Check Location	Lines Checked	Duration of Check	Checkers Required	
Pico and Rimpau	7-12-13	6 A.M. - 7 P.M.	1-1/2	[]
Pico and La Cienega	7-12	6-8:30 A.M.; 5-7 P.M.	1	[]
Pico and Beverly Glen	7	6-8:30 A.M.; 5-7 P.M.	1	[]
Pico and Bundy	7	6 A.M. - 7 P.M.	1-1/2	[]
Lincoln and Montana	3	6:30-8:30 A.M.; 5-7 P.M.	1	[]
Sunset and Chautauqua	9	6:30-8:30 A.M.; 5-7 P.M.	1	[]
Crosstown	11	6:30-8:30 A.M.; 5-7 P.M.	1	[]
			8	

Sampling Method:

Transit ridership counts on the existing lines will be taken at each location. The point checks will be taken on four separate weekdays and then averaged to improve accuracy. Existing routes on which patronage diversion is expected during mid-day hours will be checked all day, while those lines affected by the new peak-hour freeway-express service will be checked only during morning and evening peak hours. Transit ridership counts will also be taken on the #11 crosstown line as part of a continuous monitoring of the line's performance. The line will be checked once each month throughout the one-year length of the project, for a total of twelve checks.

Responsible Agency: SCRTD

D148-3
Time Frame:
Prior to Project Implementation

CHECKLIST
FOR
PRE-IMPLEMENTATION MEASUREMENTS

SANTA MONICA PREFERENTIAL LANE EVALUATION

Measurement: Point Checks (Existing Lines)

Point Check Location	Lines Checked	Duration of Check	Checkers Required	
Wilshire and Fairfax	83	6-9 A.M.; 4-7 P.M.	1	[]
Wilshire and Federal	83	6 A.M. - 7 P.M.	1-1/2	[]
Olympic and Fairfax	4	6-9 A.M.; 4-7 P.M.	1	[]
Bundy and Santa Monica	4	6 A.M. - 7 P.M.	1-1/2	[]
Wilshire and Robertson	21	6-9 A.M.; 4-7 P.M.	1	[]
Venice and National	21	6-9 A.M.; 4-7 P.M.	1	[]
Burton and La Cienega	27	6 A.M. - 7 P.M.	1-1/2	[]
Rodeo and La Cienega	27	6-9 A.M.; 4-7 P.M.	1	[]
Pico and La Cienega	27	6-9 A.M.; 4-7 P.M.	1	[]
Sepulveda and Century	51	6 A.M. - 7 P.M.	1-1/2	[]
La Cienega and La Tiejera	51	6 A.M. - 7 P.M.	1-1/2	[]
Sunset and Church	601	6-9 A.M.; 4-7 P.M.	1	[]
Venice and La Cienega	606-604	6-9 A.M.; 4-7 P.M.	1	[]
Sepulveda and Culver	606	6-9 A.M.; 4-7 P.M.	1	[]
Sepulveda and Venice	604	6-9 A.M.; 4-7 P.M.	1	[]
Venice and Grand	601-604-605-606	6-9 A.M.; 4-7 P.M.	1	[]
Pico and Rimpau	26	6 A.M. - 7 P.M.	1-1/2	[]
Washington and La Brea	12	6-9 A.M.; 4-7 P.M.	1	[]
Jefferson and La Brea	9	6-9 A.M.; 4-7 P.M.	1	[]
Downtown stop nearest freeway entrances/exits	34-36	6-9 A.M.; 4-7 P.M.	1	[]
			23	

Sampling Method:

Transit patronage on existing lines will be counted at each location on four separate weekdays. Point checks will be taken during peak hours on only those lines that would be affected by the new freeway-express service operating during peak hours. All-day checks will be conducted on those existing lines where patronage diversion to the new service during mid-day hours is expected. Transit ridership will also be monitored at the downtown stop nearest the freeway entrances and exits for control lines #34 and #36. Corresponding data from the ongoing monitoring of the San Bernardino Busway will also be obtained. Checkers counting ridership will also record the on-time performance of the lines monitored.

Responsible Agency: LADT

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Time Frame:
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CHECKLIST
FOR
PRE-IMPLEMENTATION MEASUREMENTS

SANTA MONICA PREFERENTIAL LANE EVALUATION

Measurement: Speed Runs

Location:	Eastbound (A.M. Peak)	Westbound (P.M. Peak)
Lincoln Boulevard	[]	
Cloverfield Boulevard	[]	
Bundy Drive	[]	
La Cienega Boulevard	[]	[]
Washington Boulevard (southbound ramp)	[]	
Crenshaw Boulevard	[]	[]
20th Street (Hoover Street)		[]
Vermont Avenue		[]
Arlington Avenue		[]
Fairfax Avenue		[]
Robertson Boulevard		[]
Western Avenue		[]

Sampling Method:

Speed runs on cross streets will be conducted, using a free-floating car, for distances of at least 1/2 mile in the vicinity of the Santa Monica Freeway metered on-ramps. At least 24 speed runs should be made on each segment of access road. This corresponds to runs at 15-minute intervals during two three-hour peak periods.

Responsible Agency: LADT

D148-3
Time Frame:
Prior to Project Implementation

CHECKLIST
FOR
PRE-IMPLEMENTATION MEASUREMENTS

SANTA MONICA PREFERENTIAL LANE EVALUATION

Measurement: Vehicle Volume Counts

Location:	Eastbound (A.M. Peak)	Westbound (P.M. Peak)
Lincoln Boulevard	[]	
Cloverfield Boulevard	[]	
Bundy Drive	[]	
La Cienega Boulevard	[]	[]
Washington Boulevard (southbound ramp)	[]	
Crenshaw Boulevard	[]	[]
20th Street (Hoover Street)		[]
Vermont Avenue		[]
Arlington Avenue		[]
Fairfax Avenue		[]
Robertson Boulevard		[]
Western Avenue		[]

Sampling Methods:

Two-day volume counts will be taken at each location and broken down into 15-minute intervals for evaluation. Surface streets will be hand-counted and tube-counted. Hand counts will cover two three-hour peak periods, while tube counts will be taken over a 48-hour period.

Responsible Agency: CHP

D148-3
Time Frame:
Prior to Project
Implementation

CHECKLIST
FOR
PRE-IMPLEMENTATION MEASUREMENTS

SANTA MONICA PREFERENTIAL LANE EVALUATION

Measurement: Historical Accident and Enforcement Data

Location: Santa Monica Freeway

Sampling Method:

The CHP will assist SYSTAN in assembling a month-by-month profile of accident data on the Santa Monica Freeway for the six years preceding project implementation. Accident data on the seven CHP beats and in the two command areas (Central Los Angeles and Western Los Angeles) covered by the preferential lane project will be recorded by number, severity (property damage, injury or fatality), and primary cause. To the extent possible, the month-by-month summaries will classify accidents by direction of travel and time of day. Enforcement levels containing the number of units assigned to each of the seven freeway beats will be acquired from the daily schedules of manpower assignments for the year prior to project implementation.

SYSTAN, INC. 343 SECOND STREET P.O. BOX U LOS ALTOS, CALIFORNIA 94022 (415) 941-3311

November 24, 1975 REF: D148-3

Mr. Pat Conway
Project Coordinator
Santa Monica Freeway Preferential Lane Project
Southern California Rapid Transit District
1060 South Broadway
Los Angeles, CA 90015

Dear Pat:

Enclosed for your review is a final copy of the evaluation plan for the Santa Monica Freeway Preferential Lane Project.

The original draft reviewed by your office has been updated to reflect the current implementation date of March 15, 1976. In addition to these schedule revisions, changes in the plan's content include provisions for measuring traffic changes on north-south streets, additional attention to on-ramp queue lengths, plans for a telephone center to monitor public response, refinement of sampling plans, and the development of checklists for pre-implementation measurements. Checklists for the pre-implementation measurements to be made by SCRTD appear in Appendix C of the enclosed copy. With the exceptional of a few additional point checks, you have already accomplished most of these measurements.

The latest edition of the evaluation plan has been issued in loose-leaf form to facilitate future changes stemming from additional review, alterations in project implementation plans, lessons learned as the demonstration progresses, further project delays, acts of God, and other threats to the sanity of those involved in planning the project. SYSTAN will mail you supplementary pages as they are produced.

Let me know if you have any questions or comments regarding the enclosed evaluation plan, particularly those portions of Section 1.3.3.3 dealing with SCRTD data collection.

Thank you for your help in developing the enclosed plan.

Yours truly,

John W. Billheimer

JWB:cap
Enclosure