FIRST YEAR REPORT
SAN BERNARDINO FREEWAY EXPRESS BUSWAY EVALUATION

February 1974

Prepared for the

SOUTHERN CALIFORNIA
ASSOCIATION OF GOVERNMENTS

Crain & Associates

URBAN CONSULTANTS
MENLO PARK, CALIFORNIA

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ACKNOWLEDGEMENTS AND AUTHORS

This report is prepared under the auspices of and with assistance from the Busway Evaluation Committee. Principal members of this committee are William Dochnahl of SCAG; Daniel G. Miller of SCRTD; John E. Reeves, Edwin Anderson, I. K. Zipperman, and Cecil Broome of Caltrans; and L. L. Clearwater of the City of Los Angeles. Ronald Fisher of UMTA has periodically provided a valuable overview function. King Cushman, who preceded Bill Dochnahl, coordinated the total effort through most of the evaluation process.

The principal author of this report is John L. Crain, transportation consultant. Other members of the Crain & Associates staff and their contributions were: Fred C. Stoffel - preliminary draft of Sections III, IV, and V; Peter G. FitzGerald - survey field operations; Sherrill Swan - statistical analyses; Charles D. Bigelow - benefit and cost analyses; Susan A. Kemp - research assistance and report coordination; Sydwell D. Flynn - report editing.

SUMMARY

THE BUSWAY

The San Bernardino Freeway Express Busway is an 11-mile double lane exclusive roadway for buses. The busway lanes are physically separated by concrete and flexible barriers from those serving the automotive traffic, making it a bus rapid transit system. This $60 million bus rapid transit system is the first such facility in the U.S. that is complete with on-line stations and double (bi-directional) bus lanes.

The eastern half of the busway was opened on 29 January 1973. On 16 July, the first of its three rapid transit stations was opened at El Monte. This station, at the eastern terminus, is a modern facility complete with parking spaces to provide for automobile "park-ride" service. There are 700 completed spaces now, 700 to be built. The busway system is depicted in Figure 1.

THE EVAULATION

A comprehensive evaluation of the busway is being carried out as a joint effort of Southern California Association of Governments (SCAG), the Urban Mass Transportation Administration (UMTA), Federal Highway Administration (FHWA), California Department of Transportation, (Caltrans), Southern California Rapid Transit District (SCRTD), and the City of Los Angeles. This is a five year effort assessing the operational and economic feasibility and the traveler response to the new facility.

The evaluation methodology is such that findings can be related to the other major national busway experiment,

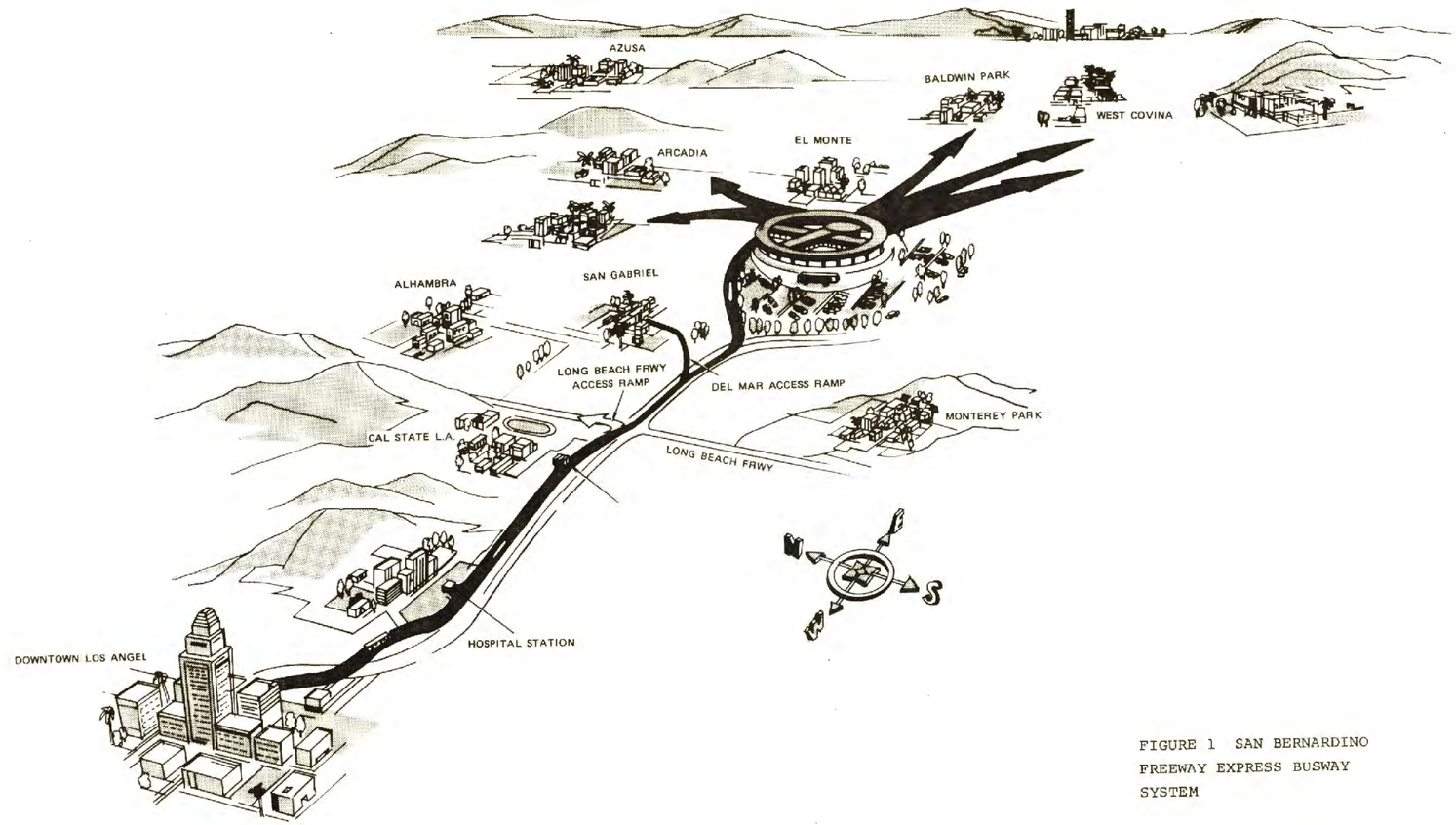


FIGURE 1 SAN BERNARDINO FREEWAY EXPRESS BUSWAY SYSTEM

the Shirley Highway Busway in Washington, D.C. Findings are also related to the SCAG Short Range Transportation plan which is the process by which the Los Angeles basin is to meet Federal requirements for transportation planning and environmental protection. Thus, the Busway project acts as a pilot demonstration for the busway elements of the Short Range Plan.

The evaluation has comprised a variety of tasks including a pre-busway on-board survey, ridership and traffic counts before and since the busway opening, household surveys in the spring and fall of 1973, and various analyses tasks. The initial findings of the evaluation, based on the partially completed busway, are reported on in this "first year report".

THE RESEARCH FINDINGS

Public Acceptance

After one year of operation, there appears to be a warm acceptance of the busway concept by users and non-users alike. The spring survey showed that residents of 82% of commuter households and 76% of non-commuter households were aware of the busway. By the fall survey, these numbers had changed to 86% and 73%, and were highest, 92% and 78%, in the corridor area east of El Monte where busway service is already available.

Of all commuters interviewed during the fall household survey, 75% offered general praise of the busway (suggesting it will reduce pollution, will improve total freeway efficiency, etc.). About 20% were negative (saying that busway lanes are wrong, unsafe, too costly, etc.).

Operational Feasibility

The operational feasibility of the busway system has been conclusively demonstrated. Buses have operated over the busway successfully and reliably. Automobiles have not invaded the exclusive bus lanes. To date, there have been no accidents attributable to the existence of the busway.

The SCRTD has mastered the problems of rerouting and rescheduling to incorporate the new busway into their total system. The innovative El Monte station and park-ride facility has functioned without major customer problems since its opening.

Ridership Growth

Commuters have responded very favorably to the busway. The ridership on the busway transit lines has risen dramatically.

Time	Riders	
	Peak*	Off-Peak
When busway opened	1200	800
April 1973	1250	750
September 1973	2500	1200
Year End 1973	4000	1600

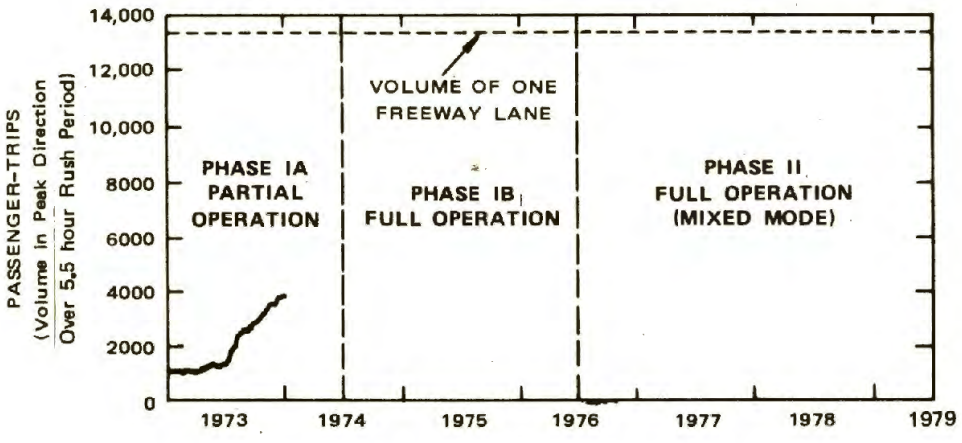
This growth has also been measured in terms of market share. The transit market is defined as the total of all commuters who live within the San Bernardino Freeway corridor in areas that are or will be served by the

*Data pertains to a 5.5 hour peak period of morning inbound and evening outbound riders. Off-peak data pertains to both directions, and all other hours between 6 AM and 8 PM. Peak period ridership continues to increase in the busway's second year, to 7800 by June 20.

busway and who regularly commute to the Los Angeles area. The transit share of this market during 1973 has risen from 12% to 16.5%. More important, the transit market share of the eastern portion of the corridor that was served by the busway in 1973 has risen from about 4% to 25%.

Highway, Busway Comparison

Because busway patronage is still growing, one cannot yet compare highway and busway volumes. The number of bus runs operating over the busway was quadrupled with the opening of the El Monte station. Although patronage has risen dramatically, it has not yet caught up with this greatly increased supply of service. Similarly, the busway lanes are not yet carrying as many persons as the parallel highway lanes. To relate busway rush period ridership to person-trip volumes on the parallel lanes, the following time series graph is offered.



The busway column of the table is based on a small sample of interviewees, but the differences between the numbers in this column and numbers in the Pre-Busway column are, in general, statistically significant.

Mode Split Implications

One purpose of the busway evaluation is to provide a check, based on market place conditions, of the mode split curves now being used in rapid transit planning in the Los Angeles area. This check now appears to be somewhat inconclusive; the mode split values obtained from over 600 commuter household interviews are about five percentage points higher than those currently being used for planning. The San Bernardino Freeway corridor seems to have a relatively high transit usage rate and thus is dissimilar to other sectors of the Los Angeles basin. However, it is encouraging that this first entry of rapid transit into the basin is producing much higher transit ridership than would have been predicted from the current mode split models.

Attitudes

The evaluation has proven conclusively that there is an attitudinal factor which affects the mode choice decision process and this factor is as important in terms of effect as travel time and travel cost savings. Thus there will be a continuing and critical need for public transportation marketing in the years to come. Attitudes were measured to be more automobile oriented in the Los Angeles corridor than in the Shirley Highway busway corridor in the Washington, D.C. area.

Busway Compared to Rail Rapid Transit

This comparison is of critical importance to Southern California because of the large investment costs in rapid transit that appear to be needed. It is suggested by some that this busway approach to rapid transit would be less costly than a rail rapid transit facility although this is argumentative in terms of a complete regional facility. Federal financing has been more easily obtainable since Federal Highway Trust Fund monies are usable for busway construction. However, this is changing also as new legislation continues to open the Highway Trust Fund to mass transit usage.

It is premature to draw this busway-rail comparison, but at this point, it is clear that this particular busway does not appear to be inferior to rail rapid transit in its ability to attract passengers. This statement cannot be generalized to other busways. The success in patronage growth of this busway must be noted relative to (a) the type of service provided (suburb-to-downtown), (b) the demand level, and (c) the comparatively high transit market share traditionally enjoyed by SCRTD in this corridor.

THE NEXT PHASES

We are currently conducting Phase I of the busway experiment, exclusive use by transit vehicles of the partial busway. Phase II will commence when the complete busway with all three stations becomes operational. This is expected in September, 1974. Buses will continue to be the sole user of the busway during the two year Phase II program. In the three year Phase III the present Caltrans-SCRTD agreement calls for experimentation with the metering of car pools for travel on the busway lanes.

The final plans for Phase III as well as decisions on the use of the busway concept in other Los Angeles corridors and in other corridors throughout the nation will depend on the next three years of results of the San Bernardino Freeway Busway evaluation.

I. INTRODUCTION

BACKGROUND

The San Bernardino Freeway Express Busway (SBFEB) is a federally funded mass transportation project developed jointly by the Federal Highway Administration (FHWA), California Department of Transportation (Caltrans), Urban Mass Transportation Administration (UMTA), Southern California Association of Governments (SCAG), Southern California Rapid Transit District (SCRTD), and the City of Los Angeles. Forerunner of this project is the highly successful Shirley Highway Busway operating in Washington, D.C. In the Shirley Highway corridor, the transit market share of trips rose from 29% to 36% during the 12-month period following the opening of the second section of the busway.[1]

Though similar in many respects to the Shirley Highway project, the SBFEB is the first comprehensive bus rapid transit system with on-line stations and, probably, ticket vending capability and turnstiles.

Current discussion of public transportation in Los Angeles centers not so much on the question of "Should we have public transportation?", but on "What kind of public transportation?" Several forces have helped create this kind of questioning. The Environmental Protection Agency has issued a mandate that automobile usage must decrease to enable metropolitan areas to meet the agency's clean air standards. The fuel crisis is currently placing severe restrictions on automobile usage.

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[1] Ronald J. Fisher, Shirley Highway Express Bus on Freeway Demonstration Project, Jan 1972, p. 8. (Presented at Highway Research Board 51st Annual Meeting.)

Principally, the SBFEB project was undertaken to demonstrate the feasibility of bus rapid transit and to provide an opportunity to develop operational experience with such a system. The San Bernardino Freeway corridor was selected as the demonstration site because (a) this major transit corridor has been identified in all previous rapid transit studies and (b) the right-of-way was already available, thereby alleviating the need for costly and disruptive right-of-way acquisition.

It is hoped that the busway will provide viable rapid transit service for Los Angeles area patrons without large capital investment, extensive land condemnation, or massive construction which characterize fixed rail systems. Rapid transit will be provided, instead, by maximizing the efficiency of an existing transportation corridor.

It is not yet known whether the busway form of rapid transit is less or more expensive than a rail system particularly in terms of a regional system that would satisfy a transit demand level significantly larger than that which now exists. However, it is clear that the busway approach can be implemented much faster and that federal financial assistance for busway development is presently more readily available. Federal and state highway trust fund monies can be used for busway construction under existing legislation. This inequity in financing between rapid transit bus and rapid transit rail systems may disappear soon, particularly if the Federal Administration's proposed Urban Transportation Assistance Program is implemented.

The weak link of bus rapid transit is the as yet unresolved problem of efficiently handling the buses in the downtown area. The costs of a CBD, grade-separated bus circulation system have not been determined. The practicality of solving the problem through reserved bus lanes will be evaluated within the SBFEB project.

Conceptually a busway has both positive and negative features in terms of customer attractiveness. It possesses flexibility not obtainable in fixed guideway systems in that the bus, utilizing the existing highway network, serves as both the mainline and feeder vehicle. On the other hand, outside of the exclusive right-of-way portion of any particular system a bus is subject to the same congestion problems as other surface traffic. A bus, being restricted in size for compatibility with street and highway design, generally is less roomy and comfortable than other fixed guideway vehicles. Finally, some people are simply adverse to bus riding, since the bus has never been a symbol of fast, comfortable public transportation.

Metropolitan Los Angeles is a vast automobile-oriented urban area, much of which is low density development. The bus system of the SCRTD, though one of the nation's most extensive, has never been able to offer sufficiently convenient and speedy service over such a large system of highways. Recently, a fixed rail rapid transit system was proposed for the Los Angeles Basin that would cost $6.7 billion and would take a decade to construct. Such a project, if undertaken would be the largest single public works project yet devised, surpassing even the construction of the St. Lawrence Seaway. The evaluation of the SBFEB, with its potential for faster and cheaper implementation, is then crucial to the major decisions that will be made on how to reduce automobile usage in the Los Angeles area.

OBJECTIVES

The demonstration objectives of the SBFED project are:[1]

- To determine the usage and operational charac-

[1] Environmental Statement of Proposed Express Busway on the San Bernardino Freeway (FAI-10), a Joint Project of the State Department of Public Works, Division of Highways, and the Southern California Rapid Transit District, 70-LA-10, March 1971.

teristics of a bus mass transit system on exclusive bus lanes in the median of the freeway in an auto-oriented, major metropolitan area

- To determine the feasibility and characteristics of mixed-mode operation of the busway
- To determine the feasibility of providing three modes of transportation (auto, bus, rail) in a single corridor
- To establish a rational basis for planning future freeways incorporating mass transit facilities
- To determine the performance of alternate types of rubber-tired vehicles and communication and control systems suitable for use under these conditions
- To determine the effectiveness of and demand for fringe parking facilities in connection with the busway project

The long-range objectives for the five-year evaluation[1] of the demonstration project (as opposed to the demonstration itself) are listed below. The short-range objectives for the first-year evaluation are cited at the end of Section II.

- To perform a benefit-cost evaluation of the busway under exclusive bus usage and under mixed mode usage

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[1] Evaluation Plan for the San Bernardino Freeway Express Busway, prepared for SCAG, SCRTD, State of California, and City of Los Angeles by Crain & Assoc., 15 December 1972.

- To perform a transit ridership market analysis under the above two usage conditions

- To perform this evaluation in a manner that will provide comparable data to that collected on the Shirley Highway Busway project

- To compare busway user behavior with usage predictions of the Los Angeles Regional Transportation Study (LARTS) mode split model, currently being used for rapid transit planning in Southern California

- To evaluate the performance of and user reaction to specific features of the physical design

- To evaluate the interactive effects between the bus transit system and automobiles in the Los Angeles Central Business District (CBD)

THE BUSWAY SYSTEM

The busway system, when completed, will consist of the busway itself (an eleven-mile, two-lane roadway) and three rapid transit stations (two on-line, one off-line). Figure 2 is a photograph of the actual busway in operation. The busway commences in the east at the off-line El Monte terminal, where a park-ride facility is located. As illustrated in Figure 1, the busway will occupy the median strip of the San Bernardino Freeway from El Monte to a point just east of the Long Beach Freeway interchange. At this point, the busway will cross both freeways on an overhead ramp and parallel the north side of the San Bernardino Freeway. At a point just west of the University station, the westbound busway lane crosses over

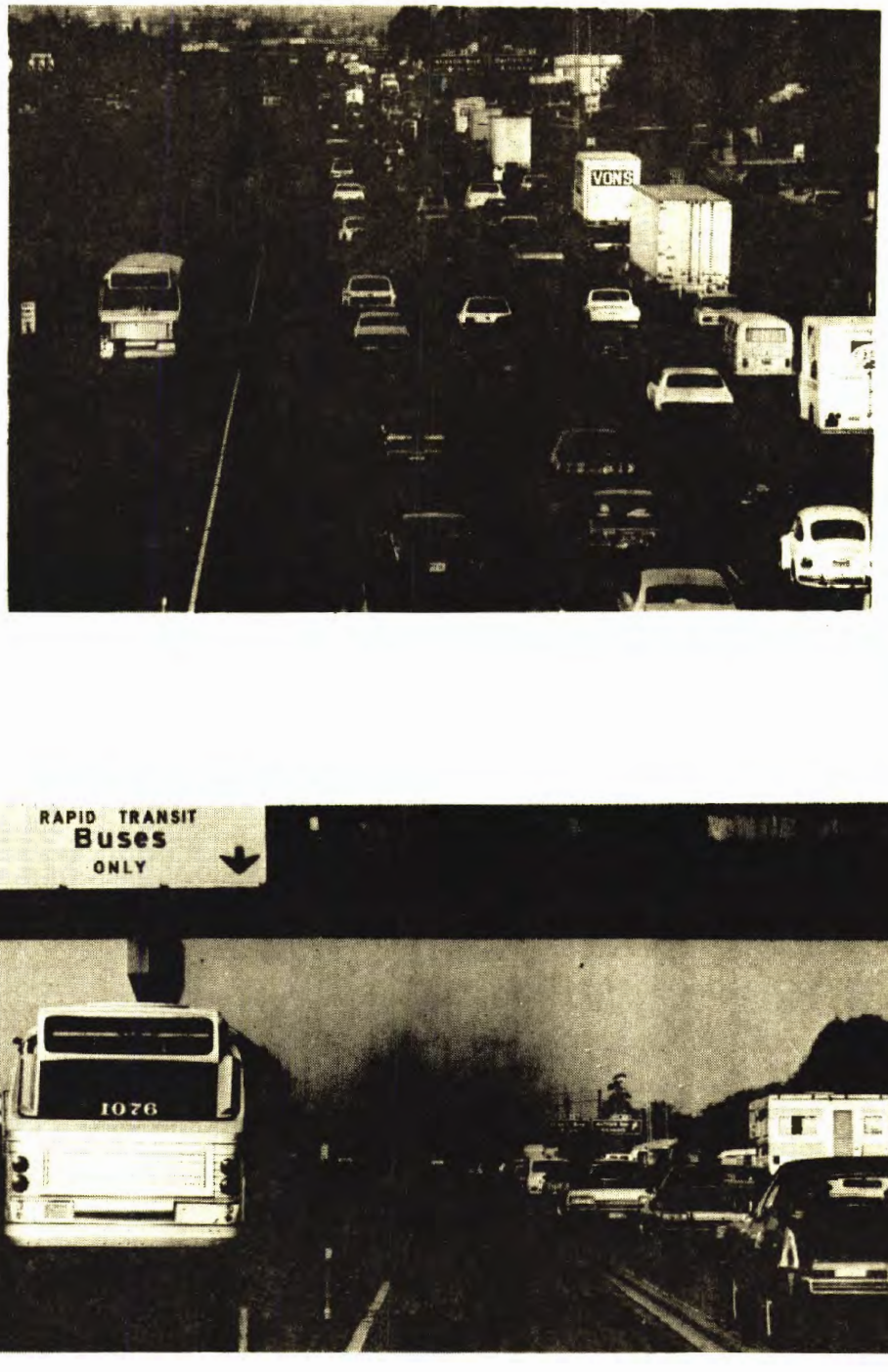

FIGURE 2 BUSWAY IN OPERATION
(Looking West at Garfield Avenue)

the eastbound lane by means of a ramp, thereby reversing the normal placement of the busway lanes. The lanes remain reversed to the termination of the busway at Mission Road. This configuration enables vehicular traffic other than buses to enter and exit the busway at a point just east of Mission Road. It will be needed if carpools are allowed to use the busway at a later date.

Upon exiting the busway at Mission Road, buses must share right-of-way with other vehicles. The remainder of the distance to the Civic Center (approximately 1.3 miles) must be made either on surface streets or on a combination of surface streets and non-exclusive lanes of the Santa Ana Freeway. Buses are now following tentative routings between the end of the busway and the CBD.

Improved downtown circulation plans for buses are being studied - possibly including bus-exclusive lanes. At present, no definitive circulation plans have been approved. Inbound buses may enter the busway only at the El Monte terminal, the Del Mar Avenue entrance ramp in San Gabriel, and at the Long Beach Freeway bus access ramp. In addition, there will be two on-line stations for passenger access at California State University at Los Angeles and at the County Hospital.

The El Monte terminal, pictured in Figure 3, is a circular building with control facilities and a small waiting area inside, and ten covered bus bays on the circumference. When the busway system is completed, within the El Monte terminal, space has been provided for several specialty stores and a coffee shop. The station is surrounded by a parking lot which will offer approximately 1500 parking stalls when completed. All buses entering the station pass through the entrance gate. Over a loudspeaker, they receive loading bay assignments. The

FIGURE 3 EL MONTE TERMINAL

attendant in the control booth identifies each bus by a television camera mounted at the entrance gate. In addition to voice announcements, an electrically controlled display board informs waiting passengers of the next arrivals and departures.

The University station, to be completed in 1974, appears as an artist's sketch in Figure 4. This on-line station will be located adjacent to the California State University at Los Angeles, immediately west of the Long Beach Freeway interchange. At this point, the busway parallels the north side of the San Bernardino Freeway. Access to the station will be provided by a covered walkway from the University connecting to the walkway over the busway itself. Ramps on either side of the busway will allow passengers access to the east and westbound buses. As Figure 4 shows, buses which are not required to stop at the station are provided with bypass lanes.

The last station before reaching the end of the busway will be an on-line station adjacent to the County Hospital and U.S.C. Medical Center complexes, also pictured as an artist's rendition in Figure 4. Access to all buses will be from the median separating the east and westbound lanes of the busway. Access to the station will be by a covered overhead walkway. As in the case of the University station, bypass lanes for through buses will be provided.

PROJECT CONSTRUCTION STAGING

The busway project and evaluation schedule is subdivided into three phases, as indicated in Figure 5. Phase I commenced with the opening of the partial busway.

At the time of this report, the busway has been completed only to the vicinity of the Long Beach Freeway interchange -

FIGURE 4

HOSPITAL AND
UNIVERSITY STATIONS
(Artist Sketches)

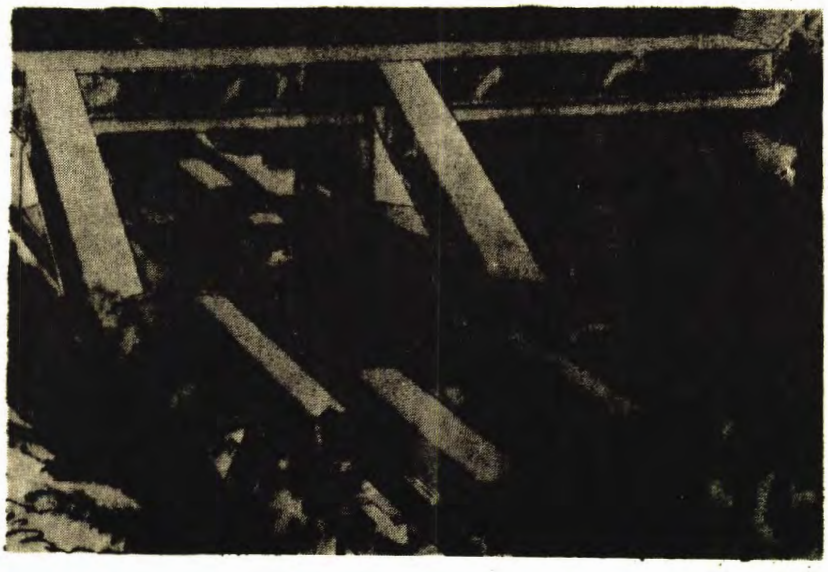

FIGURE 4

HOSPITAL AND
UNIVERSITY STATIONS
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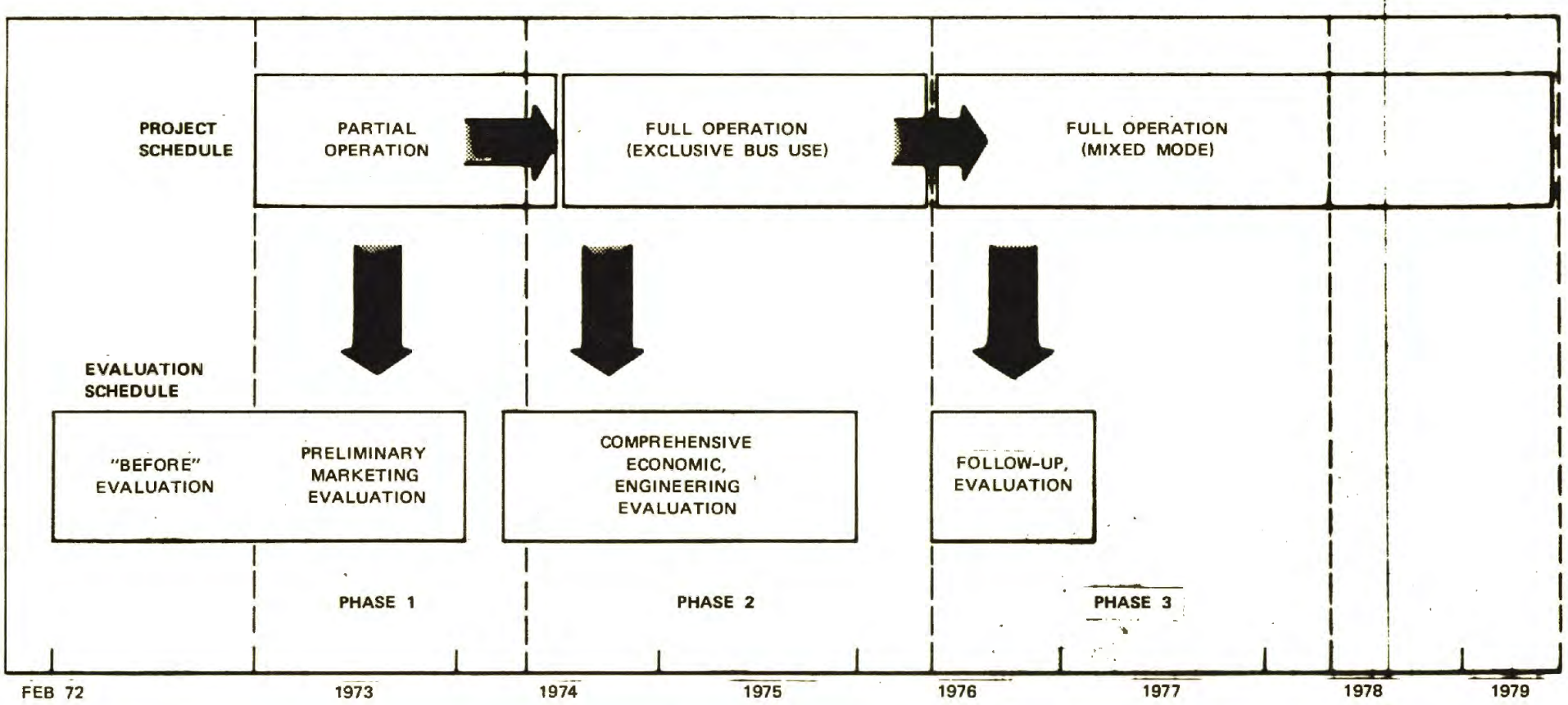

FIGURE 5 PROJECT AND EVALUATION SCHEDULE

a distance of seven miles from the completed El Monte terminal. Between this point and Mission Road, inbound buses are provided with an exclusive lane on the San Bernardino Freeway to the vicinity of the Herbert Avenue overcrossing. From this point to Mission Road, approximately 2.5 miles, buses are utilizing the automobile-carrying lanes of the freeway in normal fashion. Outbound buses presently must use normal freeway lanes up to the beginning of the busway at the Long Beach Freeway, a distance of nearly four miles from Mission Road.

A permit procedure has been established to permit non-RTD buses to use the busway. These non-RTD buses must meet minimum standards of vehicle cruising speed capability, maintenance, and driver training for bus breakdown procedures.

The next major milestone is the completion of the busway from the Long Beach Freeway to Mission Road scheduled for 1 May 1974 with revenue service expected to commence 1 June. The two on-line stations are scheduled to open 1 September. Phase II commences immediately thereafter with full utilization of the complete busway. During the two-year duration of Phase II, buses will have exclusive use of the busway. Depending upon the results of Phase II evaluation, the following two years (Phase III) will be devoted to some form of mixed mode utilization. During Phase III, RTD buses will thus share their lanes with certain other components of traffic, such as carpools and non-RTD buses.

CORRIDOR DEFINITION

As presently designed, the busway provides service to most of the San Bernardino Freeway Corridor, a residential commute traffic corridor east of downtown Los Angeles. This commute corridor is defined, for purposes of this project, as that area bounded by the Los Angeles River on the west, by Azusa Avenue on the east, Mission Road, Huntington Drive, and Interstate 210 on the north, and by the Pomona Freeway on the south. The principal transportation artery serving this corridor is the San Bernardino Freeway. This project study corridor, depicted in Figure 6, is approximately 20 miles in length and varies between 2.5 and eight miles in width. Included are portions of approximately 21 separate municipalities, plus part of Los Angeles itself. The busway actually serves an area considerably more vast than the project study corridor by virtue of busway lines 60 and 401-403, which begin to the east of the corridor (see Figure 7).

The project study corridor has been subdivided into sections entitled "served-now", "served-later", and "not served", denoting the service areas of the partially completed busway. The approximate boundaries of these areas are illustrated in Figure 6. The "served-later" and "served-now" portions of the corridor are termed the "served corridor". Included in the served corridor are about 190,000 households and 22,000 commuters who travel to the downtown area each morning. These commuters living in the served corridor will, upon busway completion, have the opportunity of utilizing the busway on their commute trips to the Los Angeles CBD. Persons living in the not served area do not have access to the busway other than through the Hospital station, where there is no park-ride facility. The area within walking distance of the Hospital station is indicated as a part of the served-later area.

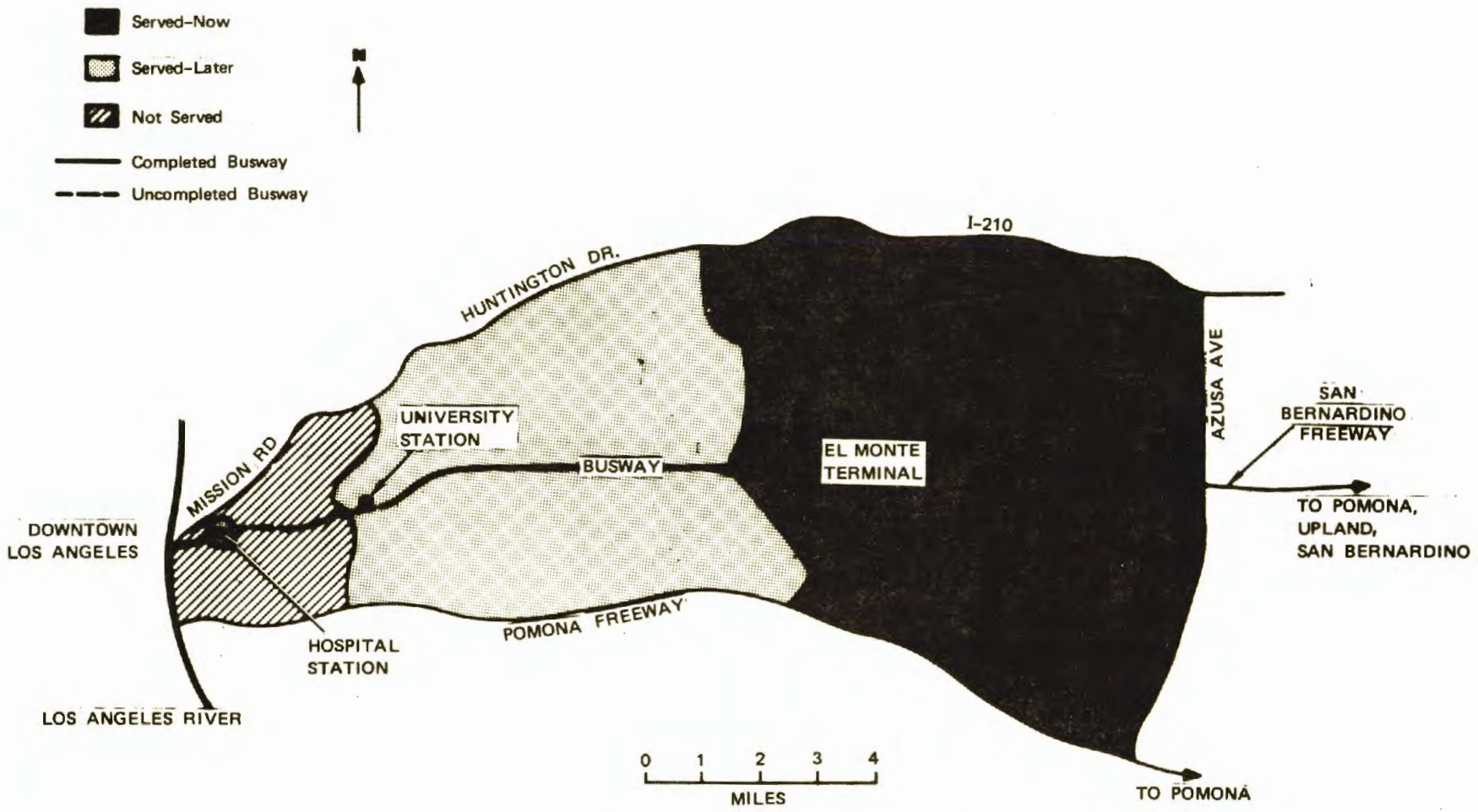

FIGURE 6 PROJECT STUDY CORRIDOR

It should be pointed out however, that service within the "served area" varies considerably. Due to the lack of access to the busway in the vicinity of Fremont and the busway, residents south of the busway and west of Del Mar Avenue will be poorly served. It is not clear at this time the extent to which the areas near the two on-line stations will be served by the busway.

SUMMARY OF PRESENT SCRTD OPERATIONS IN THE PROJECT STUDY CORRIDOR

Since the opening of the new El Monte terminal on 15 July 1973, SCRTD has revised applicable bus schedules and routes to better serve the Los Angeles CBD via the new busway. Figure 7 illustrates the current service areas of the busway trunk lines (i.e., through lines), east of the El Monte terminal. The routes of all other lines which operate in the study corridor and which serve the El Monte terminal are illustrated in Figure 8. As these feeder lines do not enter the busway,[1] a passenger on board a feeder bus and desiring to continue to the CBD must transfer to one of the trunk lines. In addition to these corridor routes which serve the El Monte terminal, the following two lines also provide east-west corridor coverage, but do not operate via the El Monte terminal: line 69 from the Rosemead Shopping Center to Los Angeles and line 52 between Arcadia and Los Angeles. Neither of these routes utilize the busway. A complete discussion of schedule speeds and service frequencies of these lines is provided in Section V.

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[1] Upon commencement of operations via the new Del Mar Avenue access ramp, peak period runs of lines 53 and 63 will utilize the busway.

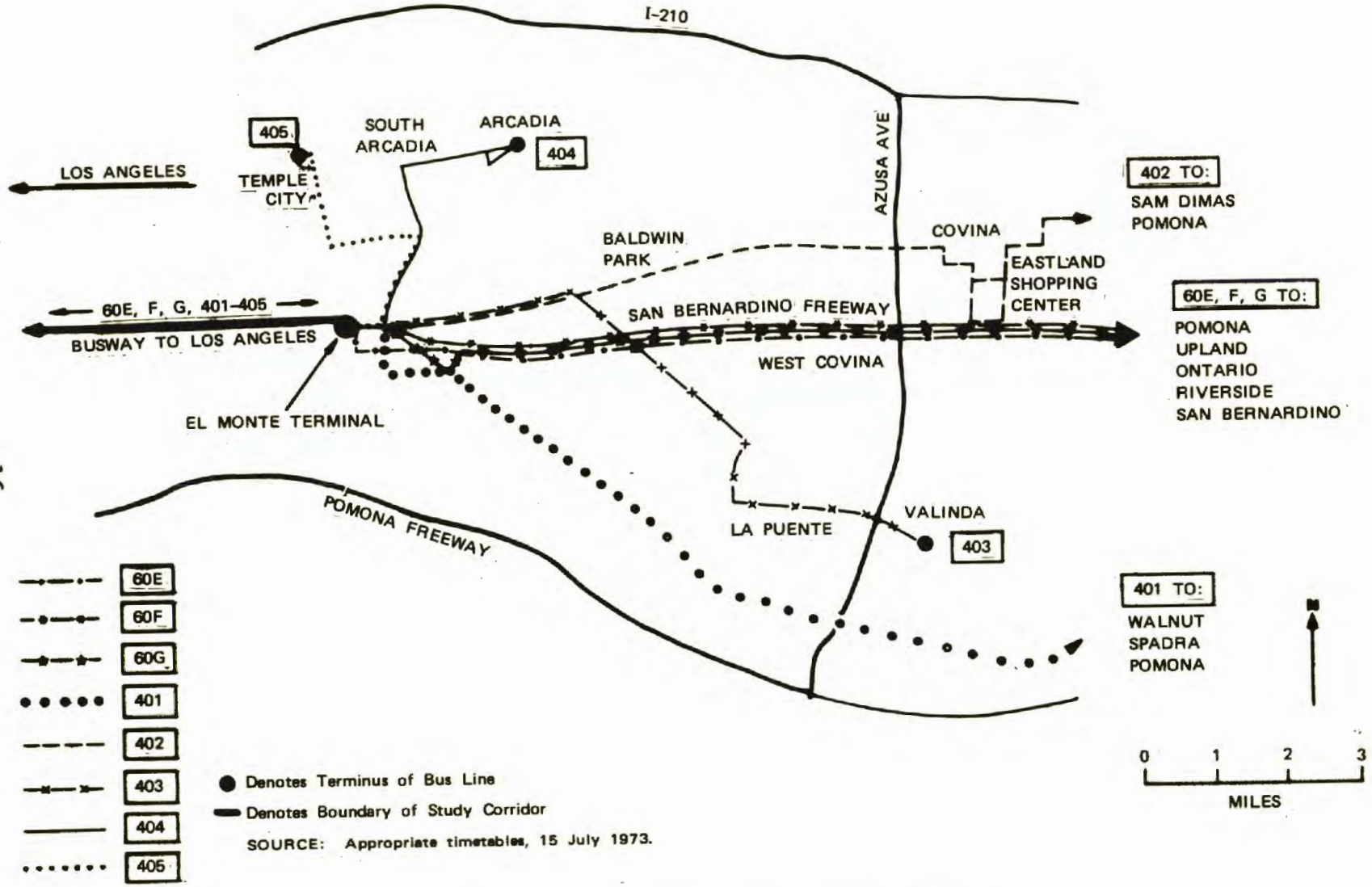
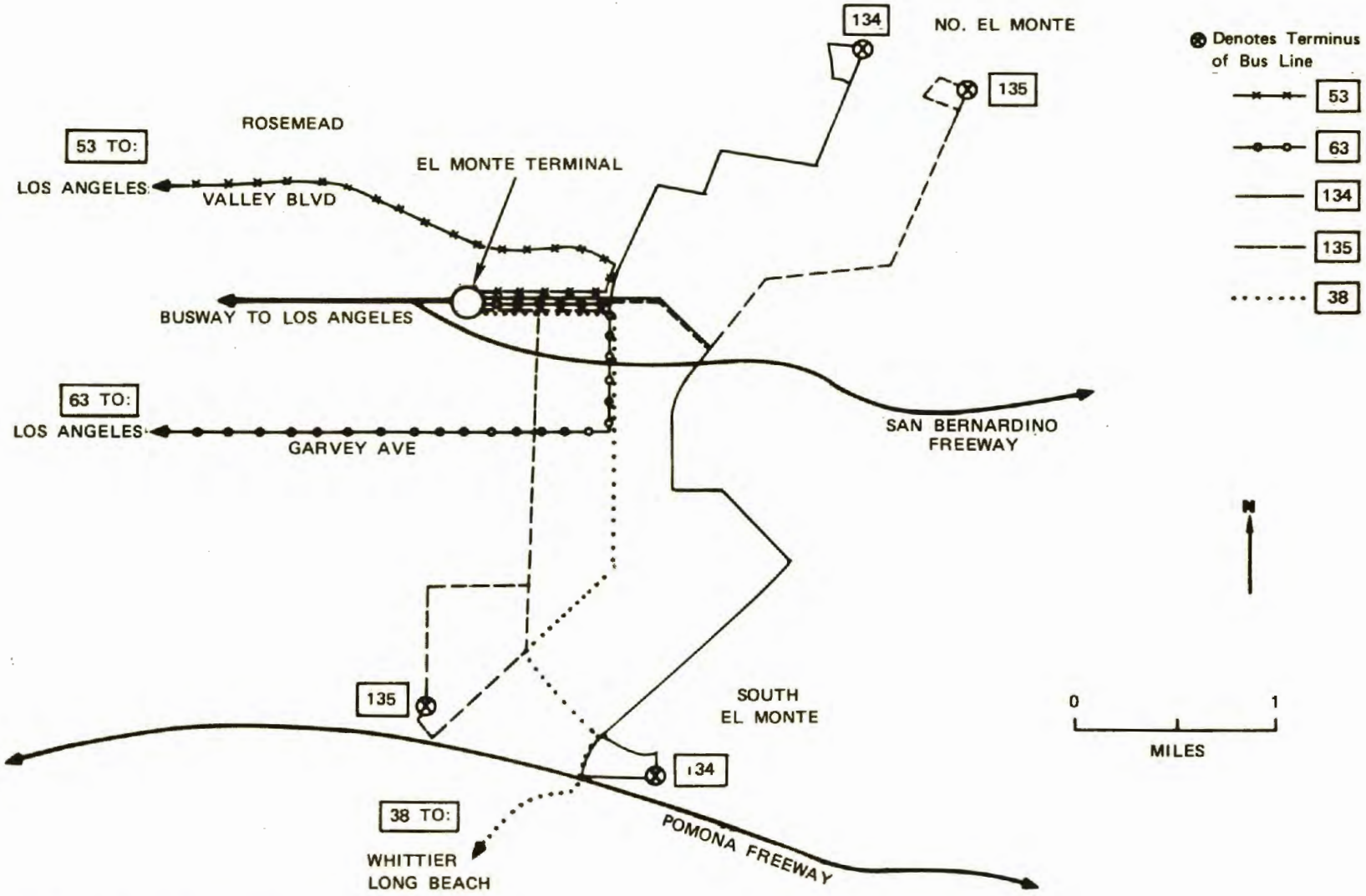


FIGURE 7 BUSWAY TRUNK LINES SERVICE AREAS



SOURCE: Appropriate Timetables, 15 July 1973.

FIGURE 8 FEEDER LINES TO EL MONTE TERMINAL

II. EVALUATION METHODOLOGY

BACKGROUND AND PHASING

Because of the national significance of this project, a comprehensive and scientifically valid evaluation was needed. The Urban Mass Transit Administration (UMTA) desired that the evaluation methodology be consistent with that used on the Shirley Highway Busway in Washington, D.C., so that results of these two major busway projects would be comparable. The evaluation also had to meet the needs of local interests. To assure this, an evaluation committee acting as a board of control over the evaluation and composed of representatives of SCAG, SCRTD, Cal Trans, and the City of Los Angeles was formed. Thus, the evaluation plan was designed to fit national needs, to be comparable to the Shirley Highway project, and to represent a consensus of local interests.

The evaluation plan consists of three sections, one for each of the three phases of the project: partial operation of the busway, full operation with exclusive bus usage, and full operation with non-exclusive bus usage. Design of the evaluation plan is flexible, subject to changes as time and events evolve. Figure 5, previously presented, illustrates the general evaluation schedule. Phase I evaluation, the subject of this report, provides a measurement of the "before" condition, plus a measurement of the initial effects of the project in terms of transit ridership, traveler benefits, and mode split. These measurements are related principally to rush period service. The system is considered as only partially complete with patronage not yet matured; therefore, market share, benefits, and mode split are still changing.

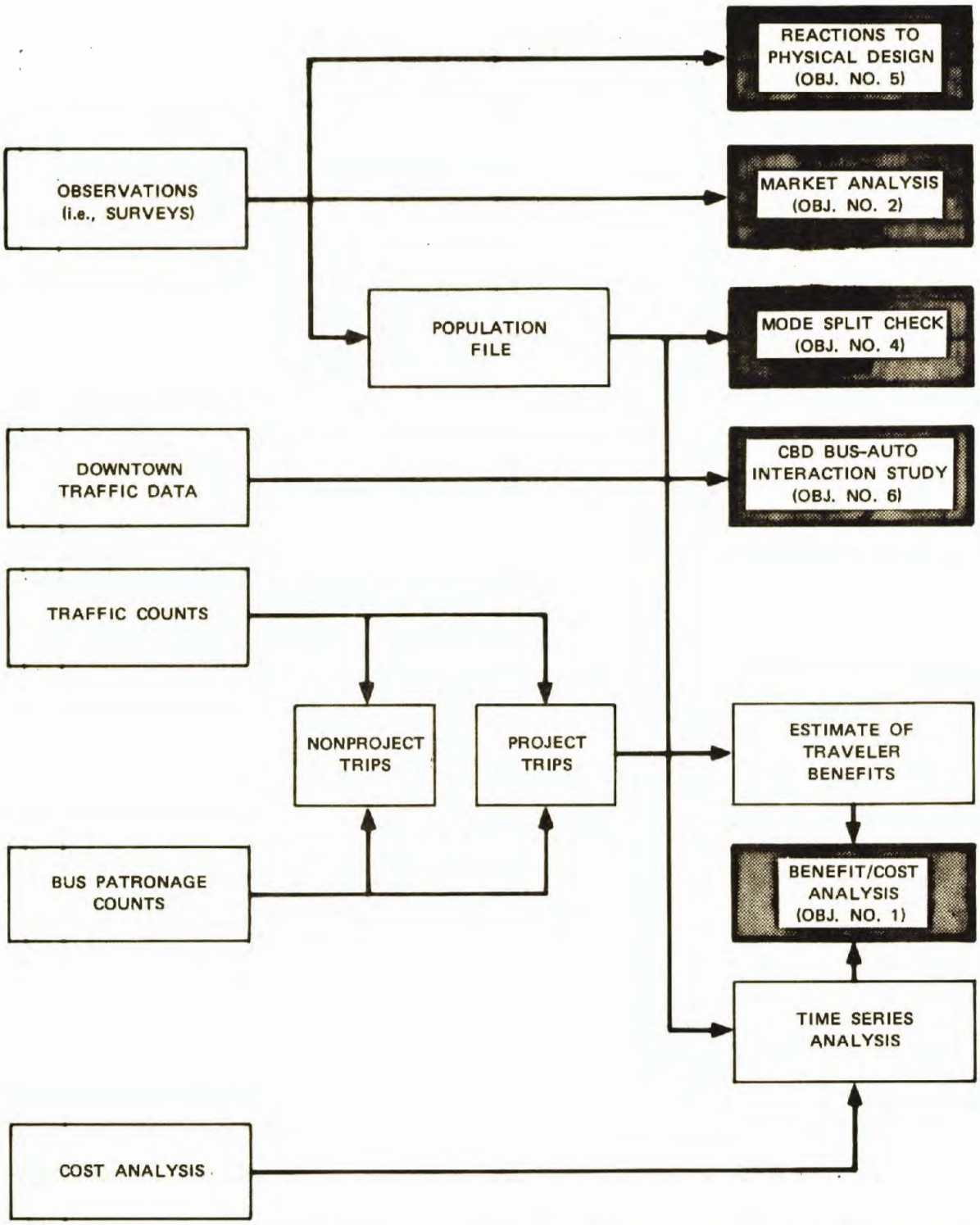
Phase II will be the most complete evaluation. It will continue the evaluation procedure, but with the busway operational throughout and with patronage grown to a mature state. This evaluation will encompass rush period, off-peak, and reverse flow usage. An evaluation will also be made of user perceptions of some of the physical elements of the system.

Phase III will be similar in scope to Phase I, limited to rush hour usage and more concerned with volume of usage and mixed mode interactive effects than with traveler benefits.

The flow diagram in Figure 9 illustrates the general methodology; i.e., how major evaluation tasks produce the desired evaluation objectives.

The main impact of the busway is on commute trips between homes in the corridor and work locations in the Los Angeles CBD. These are termed project trips in this evaluation. The central idea of the busway is to divert some project trips from auto to bus, obtaining high usage (efficiency) of the busway, thereby reducing congestion and saving commute time and cost for transit and automobile users alike.

The saving of commute time and cost is called a traveler benefit, and can be evaluated in dollar terms. There are other benefits from auto-to-bus diversion. These are usually termed community benefits, e.g., air pollution reduction, reduced auto accidents. In the benefit-cost analysis, however, a relationship is established between traveler benefits and busway construction and bus operating costs. Community benefits are handled qualitatively.



NOTE: Objective No. 3, comparibility to Shirley Highway Project, is obtained through similarity in procedures and data files. Objective No. 5 is pursued in Phase II only.

FIGURE 9 GENERAL EVALUATION METHODOLOGY

To undertake this evaluation, a reasonably simple methodology has been adopted. Two underlying assumptions simplify the methodology:

- The major factors behind transit-auto mode split are known and need not be isolated. These are those factors now being used in the disutility function of the LARTS mode split model: commute time, commute cost, and excess time, which is weighted by a psychological weighting multiplier

- The estimate of the traveler benefit from a specific transit trip can be represented from the same factors

TASKS

The tasks which comprise the methodology depicted in Figure 9 are described below.

Counts

Counts are periodically taken of the morning rush period flow across the screenline (Los Angeles River) and at other intermediate points within the corridor. This measures passenger trips by auto and transit, the occupancy factors of automobiles, the percentage of auto traffic that is non-passenger cars, etc. The automobile counts and counts on non-busway transit lines are taken about once a year. The busway counts are currently taken weekly.

Observations (Surveys)

At least once in each evaluation phase, a set of "observations" is made which is the basis for measuring the travelers' reactions to the busway. Two alternative approaches have been developed to perform these observations. The first is the Shirley Highway approach: an on-board survey of bus passengers and a mail-back questionnaire for auto drivers. The second is a shortcut approach using a small household survey. It is designed to produce a less comprehensive answer in less time and with less cost.

The on-board survey is taken on a representative sample of buses. The survey taker gives every rider a questionnaire to be filled out on the spot or, if that is not possible, to be mailed back later. The procedure produces an 85% to 95% response rate.

The auto survey starts with the screenline count of autos and a recording of the license plate numbers of a selected fraction. The names and addresses of the people in this fraction are obtained through use of a license plate number vs. address file, obtained through the Department of Motor Vehicles. (Out-of-corridor addresses are eliminated through a series of steps.) The questionnaires are mailed to these people. Because of changed addresses and disinterest, this procedure produces a 40% to 60% usable response. The shortcoming of this method is the lower response rate, which produces the possibility of a response bias that is difficult to evaluate or to correct.

The shortcut approach is used in Phase I. A small sample of 360 households is selected. Half of these are randomly drawn to statistically represent the universe of project

trips, while the other half is selected to represent a specific set of commuters: those who are geographically located where large commute time savings are possible if the busway is used. The first set is called the random sample, and the second is called the select sample. The random sample, representative of the whole, is used to estimate total benefits. The select sample is used to check the mode split curve and user reaction where the greatest diversion effect would occur. This double sample represents a compromise between statistical validity and survey efficiency.

Population File

The survey data are placed into a population file comparable to the population file in the Shirley Highway methodology. There is a separate file for each survey. Each file is a listing of each commute trip surveyed and the various data obtained on or estimated for this trip.

The total file is comprised of the following fields of data:

- Address information (trip serial number, origin and destination, expansion factor, etc.)
- Mode and submode
- Total and component trip costs
- The disutility value (difference in cost between mode used and mode not used)
- Traveler attributes (age, sex, etc.)

- Attitude data

- Marketing data (the feeder mode, the perceived reason for mode switching, etc.)

Once this file is completed, the calculation of market share, the estimate of total benefits, and the mode split check proceed quite readily.

Estimating the Project Trip Fractions

When the on-board bus plus auto mail-back survey process is used, the mechanisms for isolating project trips from non-project trips are inherent in the survey process. (Since a known percentage of screenline flow is randomly sampled, the percentage of project trips in the sample represents an unbiased estimate of the percentage present in the total population.) When the household survey is used, the market share from the resulting population file is used to estimate the project trip fraction for the screenline automobile person trip counts.

Marketing Analysis

The most direct outcome of the surveys and the population file is the marketing information. The key value obtained is the transit market share of trips - that fraction of project trips attained by the transit system. The market share is estimated for both the busway transit system and the total corridor transit system. Data is also obtained on user vs. non-user personal characteristics, their perceptions and preferences concerning the service, and their feeder modes. A geographical spread of users can be observed from the origin/destination data plus interpretation of the validated mode split curve.

Traveler Benefit Analysis

The benefits chosen for the Phase I design of the benefit-cost analysis are benefits to all travelers in the busway corridor and especially at peak commuting hours. They include both the quantitative benefits to driving commuters as well as those that will accrue to former bus riders and to former auto drivers who have switched to the busway.

Benefits to driving commuters result from the attraction of some commuters to the busway with a consequent reduction in traffic congestion and a savings in auto travel times and possibly accidents. Benefits to pre-busway bus commuters result from the sharply reduced bus travel times and from some reduced waiting times due to schedule improvements. Possible benefits to drivers who switch to the busway must be analyzed in terms of reduced travel times and costs, recognizing that there may be some additional waiting and walking times. In effect, the aggregation of all the traveler benefits will be a measure of the overall travel efficiency increase in the corridor due to the busway introduction.

In response to the recent fuel price increases and air pollution control measures, the format for presenting information on benefits is designed to accommodate additional changes during Phase II. It is expected that such changes will significantly affect the comparisons between automobile and bus commuting.

Finally, non-quantifiable community benefits are identified for possible inclusion in the Phase II effort.

Mode Split Check

The trips contained within the population file are grouped by disutility value. The mode split for each of these groups, representing a range of disutility values, is computered. These data are plotted in the usual mode split format. The

data can be subdivided in terms of any other variable in the file, e.g., income, attitude measures, to evaluate sensitivity of the mode split-disutility value relationship to various factors.

Cost Analysis

The busway costs are developed in terms of administrative costs (including those for planning, management, design and evaluation); construction cost of the busway; projected maintenance costs; costs for new buses and their operation; and the impact, if any, on SCRTD operating costs. The latter impact is measured by analyzing the difference in administrative and operating costs for the "before" and "after" conditions. An important effort in the cost analysis is the identification of the years during which costs were incurred. A second effort was devoted to determining whether any significant cost changes in SCRTD operations have occurred so the magnitude and timing of such changes can be reflected in the benefit-cost analysis.

Not all costs are available for the Phase I presentation and some important costs are estimated rather than taken from records. However, the objective of Phase I was to identify important data needs which could be met in Phase II so the estimates presented in this report will be confirmed as the data becomes available during the Phase II time period.

Benefit-Cost Evaluation

It was apparent during the design of the program for the overall busway evaluation that a complete data base would not be available during Phase I. However, it was also recognized that as much data as possible should be collected

during Phase I, and that the benefit-cost analysis format should be completely tested in terms of available data. Any new data requirements would then be met during the Phase II effort. Additionally, the presentation of the benefit-cost format prior to completing the analysis provides an opportunity for checking the responsiveness of the benefit-cost analysis to the needs of the decision makers.

The current rate of interest in private money lending is used, since this amount could have been obtained if the public's tax money had not been invested in the busway but had been, instead, loaned out on the open market.

Time Series Analysis

The most direct outcome of the counting processes is the monitoring of the flow of person trips over the busway and over the other San Bernardino Freeway lanes. This shows the growth in transit patronage and the reduced congestion, if any, on the adjacent highway. It shows directly whether the busway can be justified in terms of volume of person trips it is carrying. But furthermore, it is used as a continuing correction process to the benefit-cost evaluation and mode split estimates. As patronage increases, both the aggregate benefits and mode split estimate have to be increased accordingly.

THE PHASE I EVALUATION

The presentation of the Phase I evaluation is the subject of the remainder of this report. Specifically, the objectives of this evaluation are:

- To measure the market share, transit rider attributes, and the origin-destination pattern of bus patrons in the "before-busway" condition (III)[1]

[1] Indicates section is which evaluation is presented.

- To monitor trends of busway performance through the first year, including frequencies, passenger volumes, equipment and service changes, relative to volumes on the adjacent highway lanes (IV,V)

- To develop low-cost, small sample household survey techniques and test their substitution for the lengthier and costlier on-board bus and automobile mailback surveys (VI)

- To obtain a preliminary marketing analysis of the partial busway operation (VI)

- To conduct preliminary mode split comparisons and benefit-cost analyses to a degree that they will at least test the methodology to be used in later phases (VI,VII)

- To write a Phase I report documenting the configuration of the busway and the first-year results (i.e., this report)

III. PRE-BUSWAY CONDITIONS

The busway evaluation commenced with an assessment of all pre-busway conditions to allow changes produced by the busway to be described relative to a well-documented initial condition.

The pre-busway documentation included:

- Volume, speed, and flow characteristics of the freeway
- Operations and ridership in the project study corridor
- Transit rider attributes (socio-economic profiles and travel behavior patterns)

The freeway flow data was obtained through routine Cal Trans highway measurements taken about once a year. Route and service level data were routinely documented by SCRTD. Ridership volumes were available from periodic SCRTD ridership counts on the east-west corridor routes. The transit rider attribute data were obtained by an on-board survey performed in the spring of 1972, as an initial step in the busway evaluation program.

The complete results of the 1972 on-board survey are reported in Appendix A of this report. Summarizations and extracts from that survey are included within this section.

HIGHWAY FLOW CHARACTERISTICS

Figure 10 is an historical record of the actual traffic volume of the San Bernardino Freeway from the beginning of 1964 to the beginning of 1973. Volume counts were recorded at a point on the freeway where the busway is located. The levels of service and the speeds attainable at those levels are also indicated for the freeway (four lanes each direction), at the corresponding volume levels. Figure 10 thus shows that since 1968, traffic conditions during the peak period have been approaching an unstable state, with speeds near 35 mph. However, periodic speed checks made in 1972 and 1973 along the same stretch of freeway indicate that actual speeds during the peak hour were approximately 31 mph.[1]

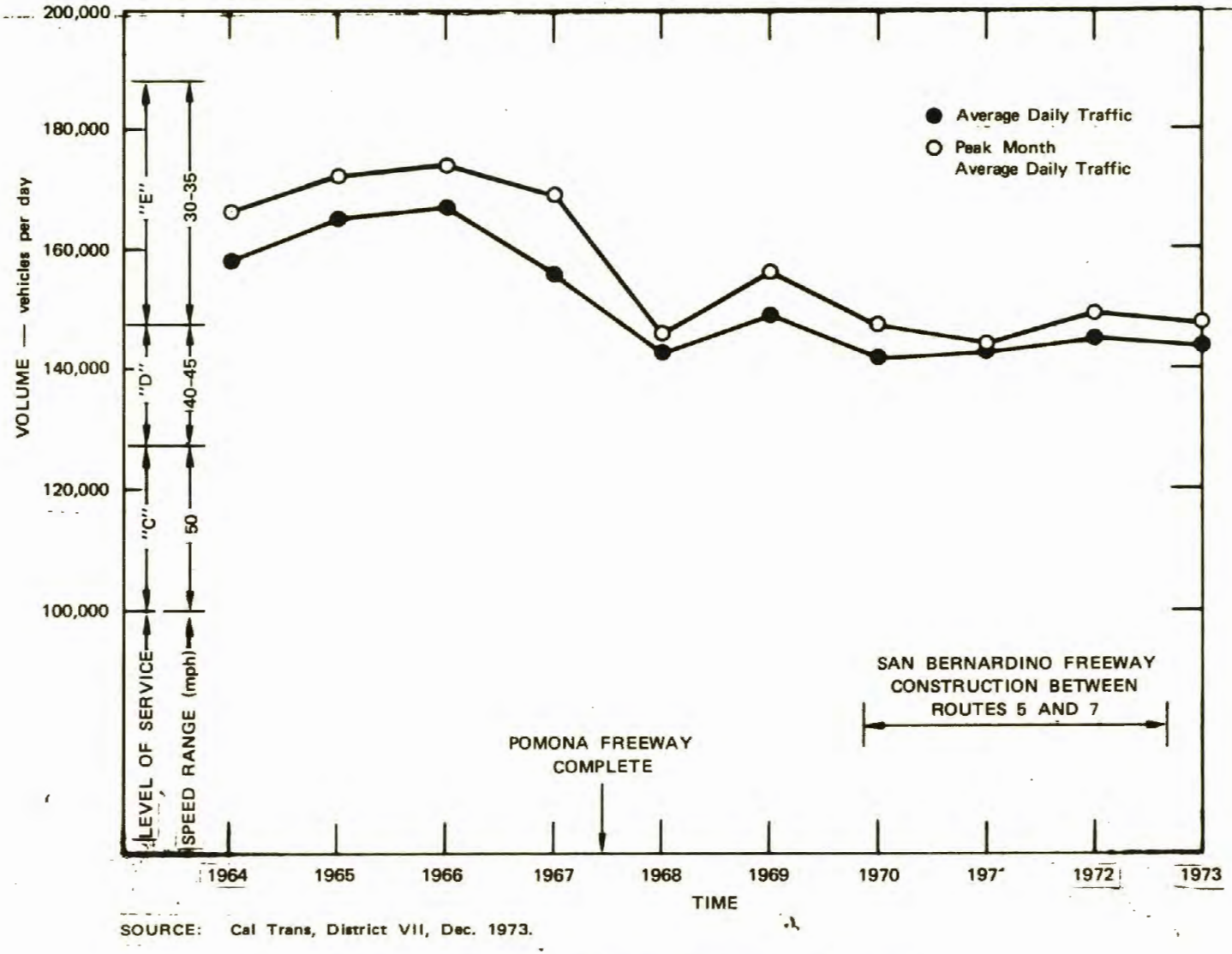
OPERATIONS AND RIDERSHIP IN THE PROJECT STUDY CORRIDOR

Prior to the opening of the new busway 29 January 1973, the only buses utilizing the San Bernardino Freeway (lines 53L and 60E, F, and G) operated via the old El Monte station and were mixed with normal vehicular traffic on the freeway. The old station, located at Ramona Boulevard and Tyler Avenue (a few blocks from the new terminal), had no extensive parking provisions and was never intended to be a high-volume commuter-oriented bus terminal.

Perusal of the pre-January 1973 timetables of lines 53L and 60E, F, and G shows that there were 13 inbound trips to the Los Angeles CBD which stopped at the old El Monte station between 6 AM and 9 AM weekday mornings.[2] These trips origi-

[1] Derived from speed measurements between Santa Anita Avenue and Alameda Street off-ramps (floating car method).

[2] Line 60 Timetable - 20 Sept 1970 and Line 53 Timetable - 17 Oct 1971. In addition to the 13 trips, three others passed through El Monte during the same time span but did not stop at the station.



SOURCE: Cal Trans, District VII, Dec. 1973.

FIGURE 10 SAN BERNARDINO FREEWAY VOLUMES

nated in Pomona, Redlands, Riverside, San Bernardino, Eastland Shopping Center, and El Monte. Morning inbound running time between El Monte station and First and Spring Streets was approximately 28 minutes.

A comparison with current busway trunk lines timetables shows that during the same interval, 71 inbound trips are being provided. In addition to serving the pre-busway origins listed above, trips now originate also at Upland, La Puente, Arcadia, and Temple City.[1] Thus, one may conclude that pre-busway express bus service to the CBD was designed to cater to a limited number of commuters. Generally speaking, however, once a commuter was on board one of these buses, service from distant points to the CBD was not unreasonable, as rush hour express buses took advantage of the San Bernardino Freeway.

Lines 52, 53, 63, and 69 were the four major "local" (i.e., surface street) east-west lines serving the corridor. Pre-busway service to local residents had generally been good, with rush hour headways of from six to 10 minutes for lines 52, 53, and 63, and from 30 to 40 minutes for line 69.[2] Routes and service frequencies of these lines have remained practically unchanged since the opening of the busway. Total average weekday patronage on the five major corridor lines considered in this study (52, 53, 60, 63, and 69) increased 16% between 1965 and 1968, but by 1970 had fallen back to just below the 1965 level. Compared to 1965 patronage levels, 1970 levels for lines 52, 60, and 69 had fallen, while those for lines 53 and 63 had risen.[3]

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[1] Lines 60, 401-405 Timetables - 15 July 1973. In April 1973 line 60B previously operating to Redlands was cut back to terminate at Redlands.

[2] Line 63-69 Timetable, 21 June 1970; Line 53 Timetable, 21 Oct 1971; Line 52 Timetable, 5 April 1970.

[3] Taken from written descriptions of corridor lines operating history, provided by SCRTD Planning Department.

The fact that bus service in this corridor had generally been considered good is reflected in results of the 1972 on-board survey of corridor transit riders. Riders were asked if the availability of SCRTD transit service influenced the selection of their residential location. Over half of all riders, both commuters and others, said their decision was influenced by the proximity of public transportation.[1]

TRANSIT RIDER ATTRIBUTES

The following is a summary of the on-board survey reported on in Appendix A.[2]

- The commuter represented over two-thirds of the San Bernardino Freeway corridor pre-busway transit patronage.

- The prime market for corridor transit service was trips to and from the Los Angeles CBD. Nearly two-thirds of all inbound bus trips were to the CBD. About one-fourth of all inbound passengers deboarded in the corridor before the bus reached the CBD; about one-tenth traveled through the CBD and to points beyond.

- The pre-busway transit users came from a higher socio-economic background than what might be expected of most bus commuters. Median family

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[1] Appendix A.

[2] An even more complete tabulation of the survey results is available in Interim Report, San Bernardino Freeway Busway Evaluation, Crain & Associates, 1 June 1973.

income was $10,000 per year and 20% had incomes in excess of $15,000.

- Over one-third were "choice" riders, having a car to use for commuting if they so chose. Another 15% could have used the family car, but this would have inconvenienced another family member.

- About 50% of the riders were transit dependent. These people were 75% female, 33% low income, and 60% youth.

- SCRTD service had been advertised in many ways, and all of these ways appeared to have had some effectiveness with some socio-economic segment. Nearly half of the riders obtained transit information from SCRTD phone service and hand-out materials.

- The availability of SCRTD service has been a factor in residential location. About 60% of SCRTD users said that the location of their home was selected with some regard for its proximity to bus routes.

IV. TIME SERIES ANALYSIS - BUSWAY DEVELOPMENT

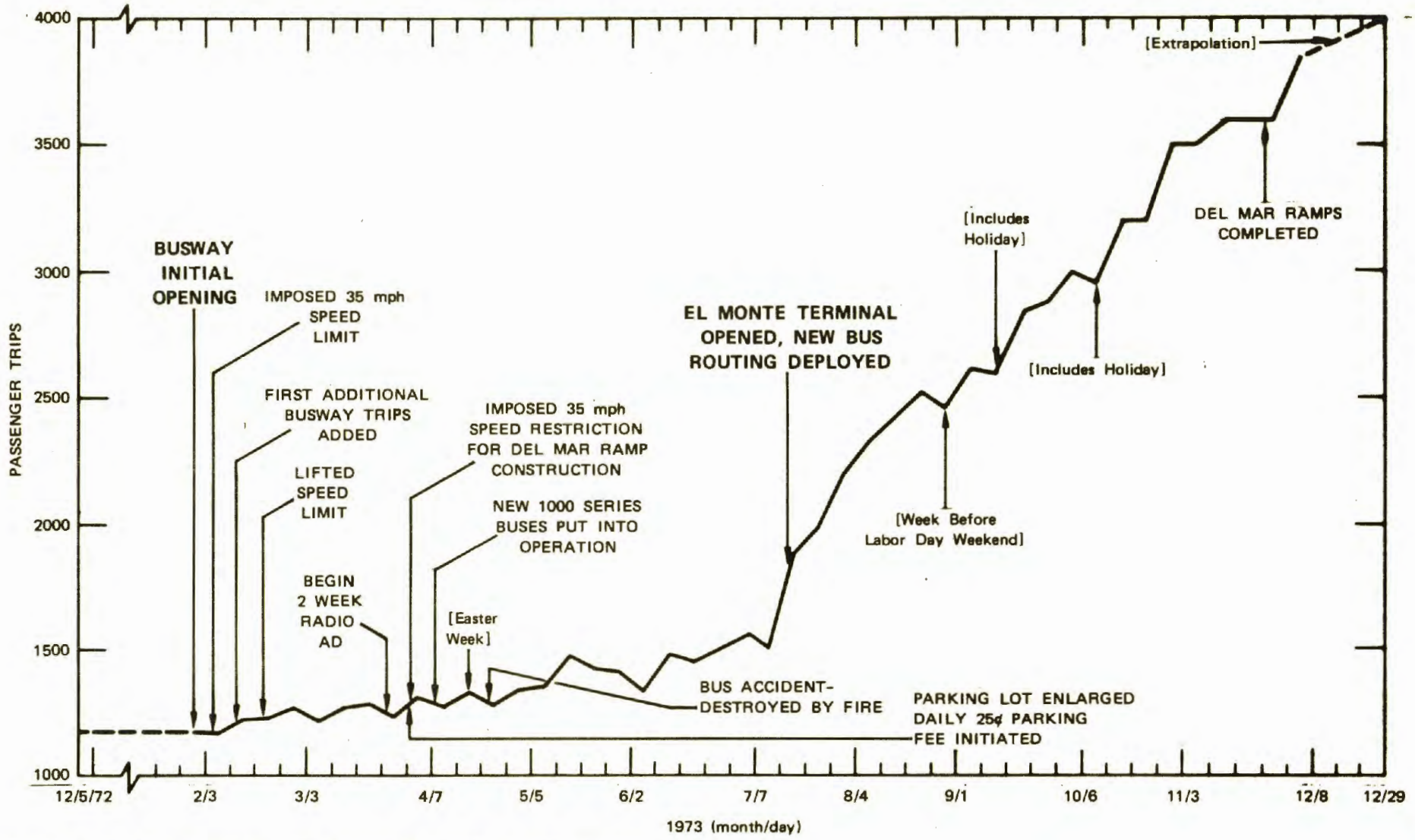
The purpose of the time series analysis is to describe the changing pattern of busway usage from its initial opening 29 January 1973, through the first year of operation. The most recent data is included in this analysis, consistent with the deadline of this report. Patronage versus time is presented in graphic form and serves as the key indicator of growth of busway usage. After the analysis of patronage trends, the following parameters are discussed in terms of their influence on patronage: facilities, parking, equipment, schedule speeds and service frequencies, and promotion and advertising.

PATRONAGE

Explanation of Data

Figure 11 is a graphical presentation of peak period busway patronage versus time. Indicated on the figure are major and minor events which are discussed in detail under appropriate headings below. Where necessary, daily patronage reports are averaged to give one report per week. Counts were performed by the SCRTD Schedule Division at a point on the screenline separating the corridor from the Los Angeles CBD. In all cases, peak period patronage is defined as the sum of inbound passengers between 6 AM and 9 AM, and outbound passengers between 4 PM and 6:30 PM, for all lines utilizing the busway.

Before the initial busway opening, patronage is that of lines 53L and 60, the only lines which then utilized the San Bernardino Freeway. After the initial opening until



*Lines 53L and 60 until 15 July 1973; lines 60 and 401-405 after 15 July 1973.
SOURCE: SCRTD Schedule Division Busway Passenger Checks.

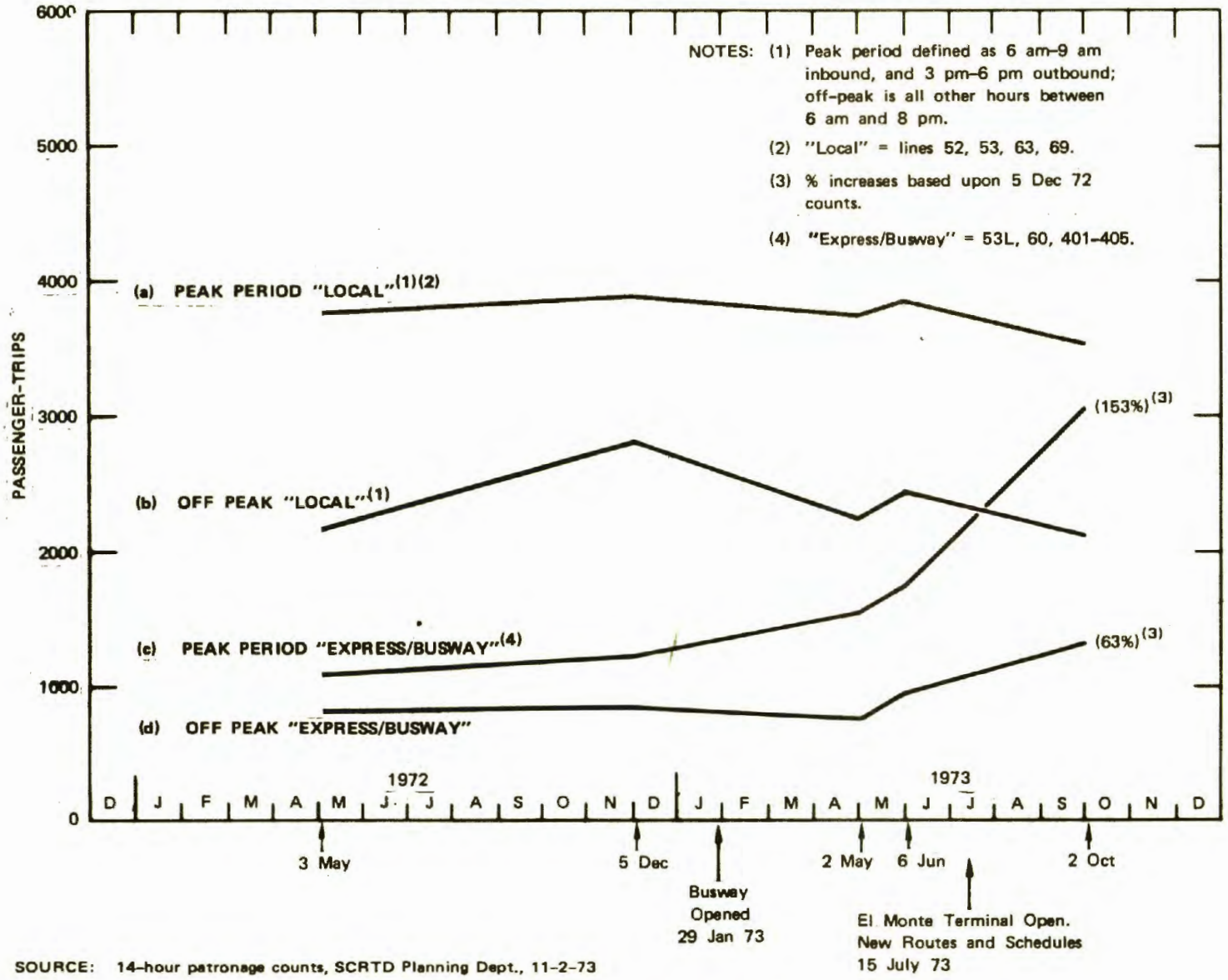
FIGURE 11 PEAK PERIOD BUSWAY PATRONAGE—ALL LINES*
(6 AM-9 AM, 4 PM-6:30 PM)

14 July 1973, patronage figures are once again those of lines 53L and 60, which had been rerouted to the new busway. After 15 July 1973, patronage levels indicated in Figure 11 represent the sum of patronage on lines 60 and 401 through 405. (On 15 July 1973, line 53L was replaced by lines 401 and 402, and lines 403, 404, and 405 were added to the route structure.) Thus, Figure 11 represents the rise of total busway patronage from the pre-busway condition (lines 53L and 60) to the present level of service (lines 60 and 401-405).

Figure 12 is a record of how increases in peak period patronage compare to off-peak increases for both "express" lines and "local" lines. The "express" patronage curves reflect patronage counts on lines 53L and 60 before 15 July 1973, and on lines 60 and 401-405 after that date. The "local" patronage curves reflect patronage counts on the non-busway lines, 52, 53, 63, and 69, both before and after 15 July 1973. These local lines are the four major east-west surface-street lines serving the corridor. The reader may note that peak period express patronage counts (curve C) are slightly higher than those recorded in Figure 11. This results from the fact that peak period data presented in Figure 11 cover 5.5 hours from 6 AM to 9 AM and 4 PM to 6:30 PM, whereas the peak period data in Figure 13 were recorded during a six hour period - from 6 AM to 9 AM and 3 PM to 6 PM.

Peak Period Trends

The time span of Figure 11 may be subdivided into two major intervals. The first interval, beginning with the partial opening of the busway on 29 January 1973 and ending with the El Monte terminal opening on 15 July 1973, is distinguished by a noticeable increase in ridership on lines 53L and 60.



SOURCE: 14-hour patronage counts, SCRTD Planning Dept., 11-2-73

FIGURE 12 TOTAL CORRIDOR PEAK VERSUS OFF-PEAK PATRONAGE

Opening day ridership on these lines was slightly more than pre-busway ridership. This gain continued to increase to an average of 26.5% during the last three weeks preceding opening of the new El Monte terminal. Events occurring within this period, identified in Figure 11, caused no noticeable fluctuations in ridership growth.

The second major interval of the patronage record is distinguished by the immediate rise in ridership following the opening of the El Monte terminal and deployment of a new route structure. No other major changes in operations had occurred for more than three months preceding this event. Ridership on all lines (Figure 11) increased from 1506 passenger-trips on the Tuesday preceding the terminal opening to 1730 on 16 July 1973--the first weekday following the opening. Second-day ridership increased to 1895 passenger-trips and third-day ridership to 1941. As of 31 December 1973, total extrapolated ridership showed an increase of 250% over the pre-busway level of 1046 passenger-trips.

Off-Peak Trends

The data presented in Figure 12 is not as extensive as that for peak period ridership presented in Figure 11; hence, it is not possible to analyze the off-peak patronage trend in as much detail. Generally, the form of the express off-peak patronage curve (curve D) is the same as that for peak period ridership in Figure 11. By 6 June 1973, express off-peak patronage had increased slightly, relative to pre-busway levels. After the opening of the new terminal, off-peak express patronage showed an increase of 63% over the pre-busway count of 5 December 1972 (versus 153% for peak period express patronage--curve C). The smaller patronage increase during the off-peak hours shows that the busway

system has been more attractive to CBD-bound peak period commuters who obtain greater time savings by avoiding the peak period automobile congestion. This observation is consistent with results of the household surveys of corridor residents reported in Section VI.

Bus-to-Bus Diversion

Of special interest in Figure 12 are curves A and B. Both peak period and off-peak ridership of local lines have declined somewhat since the 15 July 1973 terminal opening and initiation of the new route structure. A detailed study of the patronage counts of each line reveals that all lines have suffered minor declines in patronage since 5 December 1972, but seemingly significant losses were incurred by line 52 (18% peak period loss, 29% off-peak loss) and by line 53 (8% peak period loss, 39% off-peak loss). However, the loss in line 52 patronage may be understood when one analyzes the service areas of the new busway lines 404 and 405. Line 52 provides local service to the Los Angeles CBD from Temple City and South Arcadia (among other points), and its service frequencies and routing have remained essentially unchanged since 1972. New bus lines have since been added, giving both cities access to the busway. Temple City is being served by busway line 405 and South Arcadia by busway line 404. Hence, it appears that, for Los Angeles-bound patrons, bus-to-bus diversion from line 52 to lines 404 and 405 may have taken place.

The loss in patronage on line 53 may be explained by a similar analysis of coverage of new busway lines. Before 15 July 1973, line 53 provided local service from Los Angeles via El Monte to Pomona. Since the initiation of the new route structure, line 53 service beyond El Monte was truncated and replaced by busway lines 401 and 402. Thus, one

may conclude that, for the most part, patronage loss on line 53 is due to a forced diversion; line 53 patrons living east of El Monte are now obliged to take either line 401 or 402.

Shape of Patronage Response Functions

Of major interest is the shape of the rise in transit patronage following a major service improvement. The dramatic increases following the busway opening on 29 January and the inauguration of the new terminal and routes on 15 July provide two opportunities to analyze patronage response.

Immediately after the 29 January opening, excluding minor fluctuations, there was a slow linear growth (15 passenger-trips per week) over a prolonged period of time. Figure 11 implies that this growth is still continuing nearly a year after the event. After the 15 July changes, the growth increased dramatically, rising at an average rate of 233 passenger-trips per week through the first three weeks following the changes. However, the patronage increased at a steadily decreasing rate, and after the sixth week, the rate had dropped to 107 passenger-trips per week. Beyond this point, there are signs of the protracted linear growth that characterized the response to the initial busway opening.

FACILITIES

The major patronage increases to date coincide with the two major facility changes - the opening of the first seven miles of bus-exclusive lanes in January 1973 and the opening of the El Monte terminal in July. Other minor facility improvements have been completed since the busway opening, but have produced no discernable effect on busway patronage.

The complete chronology of facility and parking improvements is listed below:[1]

- 29 January - operation of RTD buses began on first seven miles of bus-exclusive lanes
- 1 April - 125 new parking spaces added to 50 existing spaces at old El Monte station. 25¢/day parking charge instituted
- 15 July - new El Monte terminal opened with 700 parking spaces
- 26 November - Santa Anita Boulevard widened between Ramona Boulevard and San Bernardino Freeway
- 26 November - Del Mar access ramps completed. Revenue service began 31 December.

Not until spring and summer, 1974, will further major facility changes take place: the addition of the remaining four miles of bus-exclusive lanes (including the Long Beach Freeway access ramps), the widening of Santa Anita Boulevard between Valley Mall and Ramona Boulevard, and the completion of the two on-line stations. The final completion of the busway facilities as now planned will be marked when the second stage of the parking lot, holding an additional 700 cars, comes into service in the fall of 1975.

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[1] Caltrans, District VII, Design Division.

Coincident with the two major facility improvements to date have come service improvements signifying decreased running times, higher service frequencies, and greater corridor coverage. Thus, one cannot conclude that facility changes alone have been responsible for the increased patronage. Please see the discussion under "Schedule Speeds and Service Frequencies" in this section for a detailed analysis.

This pattern of facility improvements accompanied by service changes will continue throughout the busway development. Thus, it is likely that patronage increases will come in dramatic upsurges following each of the combinatory changes. It also appears that each upsurge will diminish and die out only after several months have passed, after all affected commuters have made their new decisions.

PARKING

No changes in parking facilities at the old El Monte station were made until 1 April 1973, at which time 125 new spaces were added and a 25¢/day parking charge was established. Previously, only about 50 parking spaces existed exclusively for the station. Parking checks indicated, however, that even before 1 April, nearly 200 cars were parked in the station parking lot and other nearby parking facilities.[1] When the new El Monte terminal opened on 15 July 1973, 700 new parking spaces were provided adjacent to the new terminal and a 25¢/day parking fee was levied. 700 additional spaces will be added in late 1975. Special parking lots at the termini of the trunk or feeder lines have not been pro-

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[1]Letter from C.E. Hayden to K.W. Webster, SCRTD, 19 March 1973.

vided. An aerial photo of the El Monte terminal and its parking facilities is presented in Figure 13.

EQUIPMENT

Only one change in rolling stock has been recorded since the opening of the busway. Effective the week beginning 9 April 1973, 100 new 1973 Series 1000 General Motors buses were put into operation on all busway lines except for line 60. The new buses have the same engine and transmission as the 7000 Series Flxible buses purchased in 1971, differing primarily in interior furnishings, as evidenced in Figure 14. Seats are three-quarter, high-back, semi-buckets sitting on "T" pedestals which permit easier cleaning and more package storage. As there are 47 seats instead of the usual 51, more leg room is provided. Better lighting and improved wall panels complete the new interior design. The new buses are air-conditioned, as were the older Flxible models.

Visual scrutiny of Figure 11 shows that no sharp increase in the patronage growth rate coincides with the introduction of these new buses. It may well be, however, that this new equipment was in part responsible for the continued increase in patronage during the period preceding the opening of the new El Monte terminal. Project clinic studies within the Shirley Highway Evaluation indicated that new buses with high aesthetics and high comfort were clearly attractive to passengers. However, the importance that passengers attached to the quality of the vehicle was measured and shown to be far overshadowed by the importance attached to commute time, cost, and seat availability.[1]

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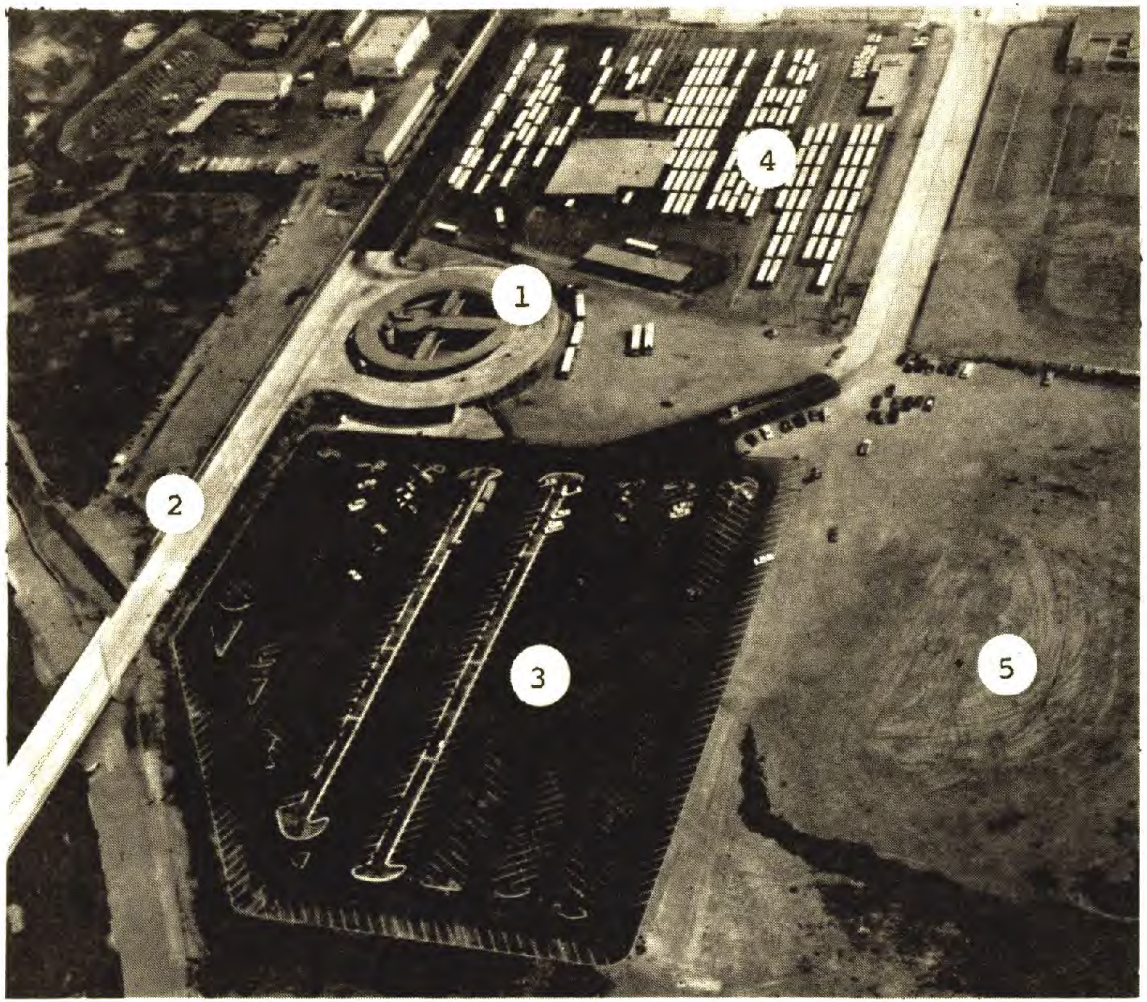
[1] Product Evaluation of New Look Buses, Crain & Associates, November 1971.



1. Terminal Building
2. Busway to Los Angeles
3. Phase I Parking
4. Proposed Phase II Parking
5. Planned Bus Maintenance Yard

FIGURE 13 AERIAL VIEW OF EL MONTE TERMINAL
(Photo taken on Saturday; note lack of patronage)

FIGURE 14 SERIES 1000 BUS, INTERIOR VIEW

SCHEDULE SPEEDS AND SERVICE FREQUENCIES

The 29 January 1973 opening of the first seven miles of bus-exclusive lanes meant an immediate reduction in travel time for those lines utilizing the busway. In the first running time check on 31 January 1973, SCRTD Schedule Division recorded a round-trip (inbound in morning and outbound in evening) running time of 39.6 minutes. The "before busway" running time of 61.3 minutes (measured 5 December 1972) was thus reduced by 35.4%. A 35 mph speed restriction was imposed for two weeks beginning 5 February 1973. A two-block 35 mph speed restriction was imposed beginning 1 April 1973 for Del Mar Avenue bus ramp construction. These two speed restrictions, combined with traffic variabilities on CBD surface streets and on the San Bernardino Freeway west of the Long Beach Freeway interchange, have caused variations in travel time savings. Current schedules for busway trunk lines (as of 15 July 1973) show a scheduled round trip running time of 40 minutes between El Monte terminal and First and Spring Streets. Currently, peak period automobile traffic is heavily congested on the San Bernardino Freeway and in the CBD. Due to this congestion, no further reductions in travel time are anticipated until the opening of the full busway system in 1974.

Since 12 February 1973, service frequencies (frequency of departures and arrivals) have been increased as warranted by increasing patronage. Between 5 December 1972 and 6 June 1973, 16 new one-way trips were added to the daily schedule of lines 53L and 60.[1]

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[1] 14-Hour Counts, Planning Division, SCRTD, 2 November 1973. It is important to note that these extra trips were added in response to growing passenger demand, and thus cannot be construed as a cause for this increased demand.

Concurrent with the new terminal opening on 15 July, line 53L was replaced by lines 401 and 402. At this time, service frequencies on lines 401, 402, and 60 were increased by 137 daily one-way trips to a total of 225.[1] In addition to the line redesignation, lines 403, 404, and 405 were added to the busway route structure. Taken together, these three lines provide an additional 75 new one-way trips between the lines' origins and the CBD. The six busway lines provide a total of 300 one-way trips directed to the CBD from the lines' origins. This total figure excludes the 54 one-way shuttle trips operated by lines 403 and 405 during the off-peak hours between these lines' origins and El Monte.[2]

It is apparent that improvements in schedule speeds and service frequencies have been realized as a result of major facility improvements. To which factor, then does one attribute the resultant increases in patronage? For a definitive answer, one would have to personally question the new patrons. However, referring again to the Shirley Highway Busway Evaluation, studies indicate that time savings and reliability are given top priority by commuters, whereas factors such as convenience, comfort, and image rank relatively low on their scale of desirable attributes for a transit system.[3] Thus, without direct polling of the new patrons, one can infer that the initial patronage increases after 29 January 1973 were due primarily to savings in commute time allowed by the new busway rather than to the facility itself. Similarly, even though the new terminal has lent bus commuting a more modern image and provided added conveniences, one must conclude that the increased

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[1] 14-Hour Counts.

[2] 403, 404, 405 Timetables, 15 July 1973.

[3] Product Evaluation of New Look Buses.

Table 2

CHRONOLOGY OF SERVICE CHANGES

DATE	EVENT
29 Jan 73	Bus lanes opened between El Monte and Long Beach Freeway, allowing rerouting of lines 53L and 60 onto the busway.
31 Jan 73	First running time check: 35.4% running time reduction over pre-busway times.
5 Feb 73	Speed restriction of 35 mph for additional busway construction. Lifted 13 February.
12 Feb 73	First addition of extra trips to schedule of lines 53L and 60. Additions continued as warranted through 15 July 1973.
18 Feb 73	New timetables issued for lines 53L and 60 reflecting reduced running time.
1 Apr 73	Imposition of 35 mph 2-block speed restriction for Del Mar Avenue ramp construction.
9 Apr 73	New timetables issued for lines 53L and 60, reflecting further running time reductions.
15 Jul 73	Route restructuring and amplification concurrent with opening of El Monte terminal. Line 53L redesignated lines 401 and 402. Addition of lines 403, 404, and 405. Schedules and routes of lines 38, 53, 60, 63, 134, and 135 modified. New schedules issued for all these lines.

growth rates after 15 July 1973 were probably caused by increased access to the busway afforded by the terminal and by expanded route coverage, rather than by the terminal facility itself.

PROMOTION AND ADVERTISING

Early in the busway development SCRTD was not in a position to respond to massive increases in passenger demand. Thus, promotion of the new busway was deliberately minimized and service level increases were delayed until the opening of the El Monte terminal. Occasional news releases preceded the 1973 opening by about one year. The 29 January initial opening was accompanied only by routine news reporting. During the period 26 March - 6 April, a SCRTD radio advertisement referred indirectly to the busway as an example of new SCRTD services.

With the opening of the new El Monte terminal, promotion was stepped up. A festive ceremonial occasion was planned for opening day, and news services were alerted. Figure 15 is a photograph of the opening day celebration. Brochures describing the new system were distributed and are illustrated in Figure 16.

The impact of these promotional activities on patronage is not discernible due to the concurrence of the terminal opening and the route restructuring and amplification.

FIGURE 15 OPENING DAY AT EL MONTE TERMINAL

FIGURE 16 BROCHURES

V. OPERATIONAL PERFORMANCE

RELATIVE CAPACITIES OF BUSWAY AND FREEWAY

Busway

By year's end, the total busway patronage for inbound morning trips (leaving El Monte for Los Angeles 6 AM - 9 AM) and outbound afternoon trips (arriving El Monte from Los Angeles 4 PM - 6:30 PM) was approximately 4000 persons (see Figure 11). Since 15 July 1973 there has been a daily total of 71 morning inbound busway trips and 62 afternoon outbound trips during the above peak periods.[1] Assuming maximums of 51 seated passengers per bus for line 60 buses and 47 seated passengers per bus for all other buses, the current busway capacity during the 5.5 hour peak period is thus 6391 passenters.

The future capacity of the busway can only be determined theoretically at this time. There are two limiting features - the minimum headways on the busway with buses running at top speed and the maximum output of the El Monte terminal. Assuming exclusive use of the 47-seat 1000 Series buses, one would theorize as follows.

The minimum headway on the busway should be quite low. General Motors experiments in the early sixties proved that buses running at 65 mph could be spaced as close as six seconds.[2] This indicates 600 buses, or over 14,000 seats per hour.

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[1] Timetables for lines 60, 401-405, 15 July 1973.

[2] General Motors Corporation, New Systems Implementation Study, Volume III, February 1968.

The output or number of departures per hour of the El Monte terminal is limited by the dwell time of the bus at the loading bay and by the number of bays. The dwell time is the length of time between the departure of one bus from the bay and the entrance, loading, and departure of the following bus. This time has not been measured but is currently believed by SCRTD to be about two minutes. There are 10 loading bays, meaning that the terminal output should be 10 buses per two minutes, 300 buses per hour, or approximately 14,000 seats per hour. This computation does not assume any standees or additional buses that enter the busway at the Del Mar ramps.

Actual operation might prove that there are problems in reaching this theoretical capacity; obtaining such measurements is one of the tasks anticipated in Phase II of the evaluation. Meanwhile, theoretical capacity of the busway is cited as "in excess of 14,000 seated passengers per hour." The capacity during the 5.5 hour rush period would then be in excess of 77,000 passengers.

Freeway

In 1969 the freeway was operating at level of service "E" (see previous Figure 10). In this condition a peak hour flow of 7500 vehicles per hour was recorded between the Long Beach Freeway and Santa Anita Avenue.[1] Since a freeway is considered to be accommodating its maximum volume when operating at level of service "E", a peak hour flow of 7500 vehicles per hour (or 1875 vehicles per hour per lane)

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[1] Environmental Statement on Proposed Express Busway on the San Bernardino Freeway, State Department of Public Works, Division of Highways, and SCRTD, March 1971, p. 3.

will be considered to be the capacity of this freeway.[1]

Assuming a capacity of 7500 vehicles per hour and 1.3 persons per automobile during the peak period,[2] the present 5.5 hour peak period capacity (morning, inbound, afternoon outbound) of the San Bernardino Freeway is 53,625 persons, or 13,406 persons per lane. It should be noted that traffic on the parallel lanes of the San Bernardino Freeway is currently running at the borderline between levels of service "D" and "E" with resultant speed near 35 mph and the likelihood of momentary stoppages. Thus the freeway may be currently running at slightly less than capacity. However, since we do not have a current measurement, we assume in this report that the freeway is still running at capacity, i.e. 1875 vehicles per lane per hour.

Thus, the busway appears to have a theoretical capacity of over ten times that of a single highway lane and about three times the capacity of the eight-lane freeway. Of course, increased carpooling efforts spurred by the fuel crisis may raise the current average of 1.3 persons per vehicle, thus increasing freeway capacity.

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[1] Highway Capacity Manual, HRB Special Report 87, 1965, p. 253. The theoretical capacity of 8000 vehicles per hour at level of service "E" is rarely reached, even on the most heavily traveled freeways (see Highway Capacity Manual, p. 27).

[2] LARTS data indicates an average occupancy factor of 1.15 throughout the region, while the fall household survey indicated a factor of 1.6 for corridor auto commuters. The factor of 1.6 does not account for work absenteeism or for other reasons for an occupant not to travel with his carpool on a given day. Thus, the occupancy factor of 1.6 should be reduced by approximately 20% to account for absenteeism and other factors. The resultant factor of 1.3 will be checked on subsequent Cal Trans traffic counts.

RELATIVE VOLUMES OF BUSWAY AND FREEWAY

Figure 17 compares the trend of passenger volume on the busway during the 5.5 hour peak period to the existing volume of one lane of the San Bernardino Freeway during the same period. As discussed in Section IV, two major events have occurred - the initial busway opening and the El Monte terminal opening - and have produced the growth rate increases noted in Figure 17. The next two major events will be the opening of the fully completed busway system by summer 1974, and the inauguration of mixed mode usage in 1976. Given the present rate of patronage growth and the two major forthcoming events, it is reasonable to forecase that busway volume will reach that of an adjacent freeway lane before the end of the project.

The point at which the volume of a busway lane equals that of a freeway lane does not, of course, represent the break-even point of the busway. The yearly amortized cost of a busway lane is more than that of a freeway lane, indicating that the break-even point lies somewhere above the point of equal volumes. Conversely, at equal volumes, freeway traffic moves at approximately 30 miles per hour while busway traffic moves at 65 miles per hour. Also at equal volumes, the busway offers the additional benefits of more efficient energy consumption, less air pollution, less driver fatigue and frustration, less demand for expensive downtown parking facilities. These busway benefits indicate that the break-even point lies somewhere below the point of equal volumes. The location of the break-even point will be more accurately determined in the Phase II and III evaluations.

SCHEDULE SPEEDS, SERVICE FREQUENCIES, AND FARES

Figure 18 indicates presently existing service frequencies of busway trunk lines departing the El Monte terminal for the Los Angeles CDB. The line entitled "composite" shows bus departure frequency for passengers boarding at the El Monte

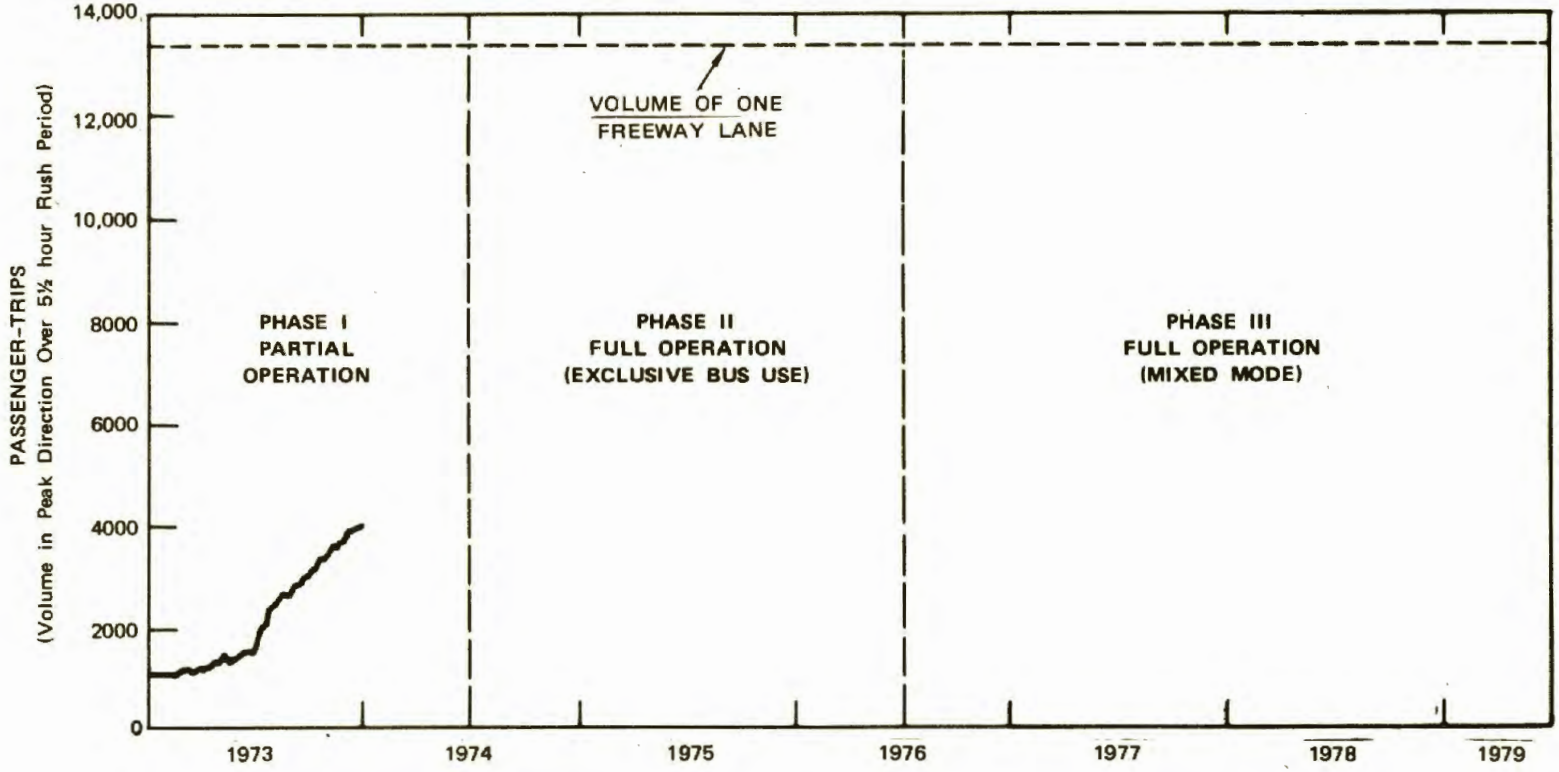
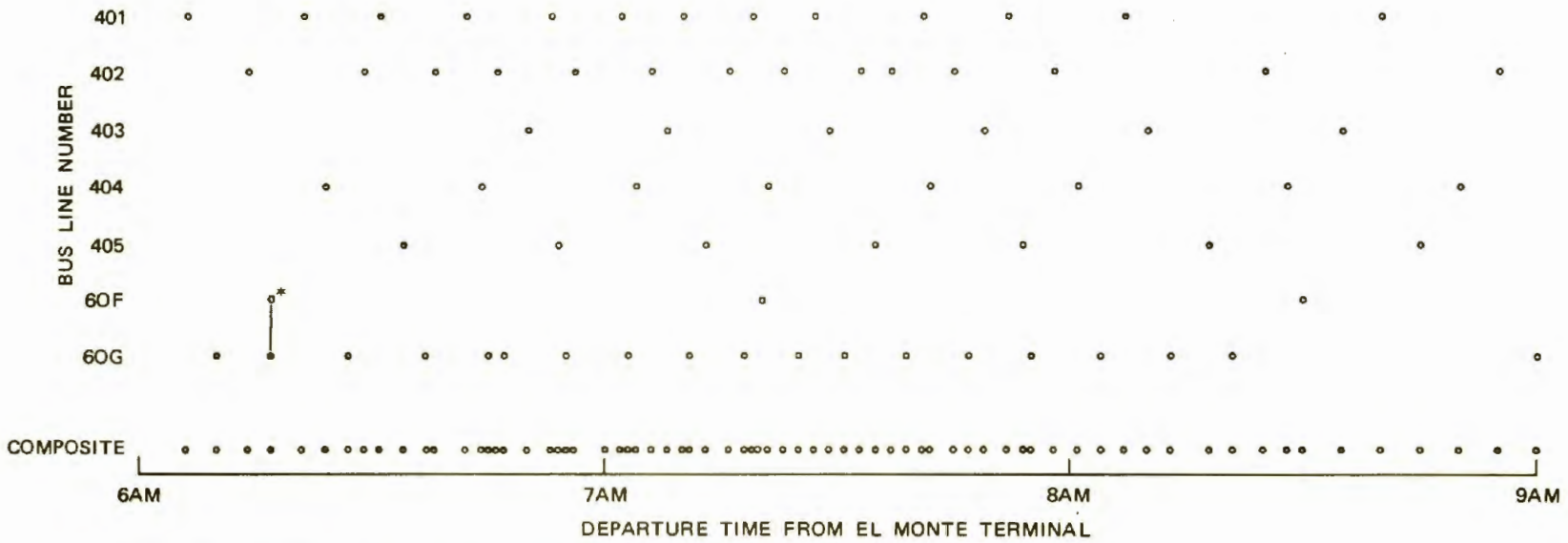


FIGURE 17 COMPARATIVE BUSWAY AND FREEWAY VOLUMES



SOURCE: Appropriate Timetables, 15 July 1973.

*Single Bus Trip for 60F and 60G

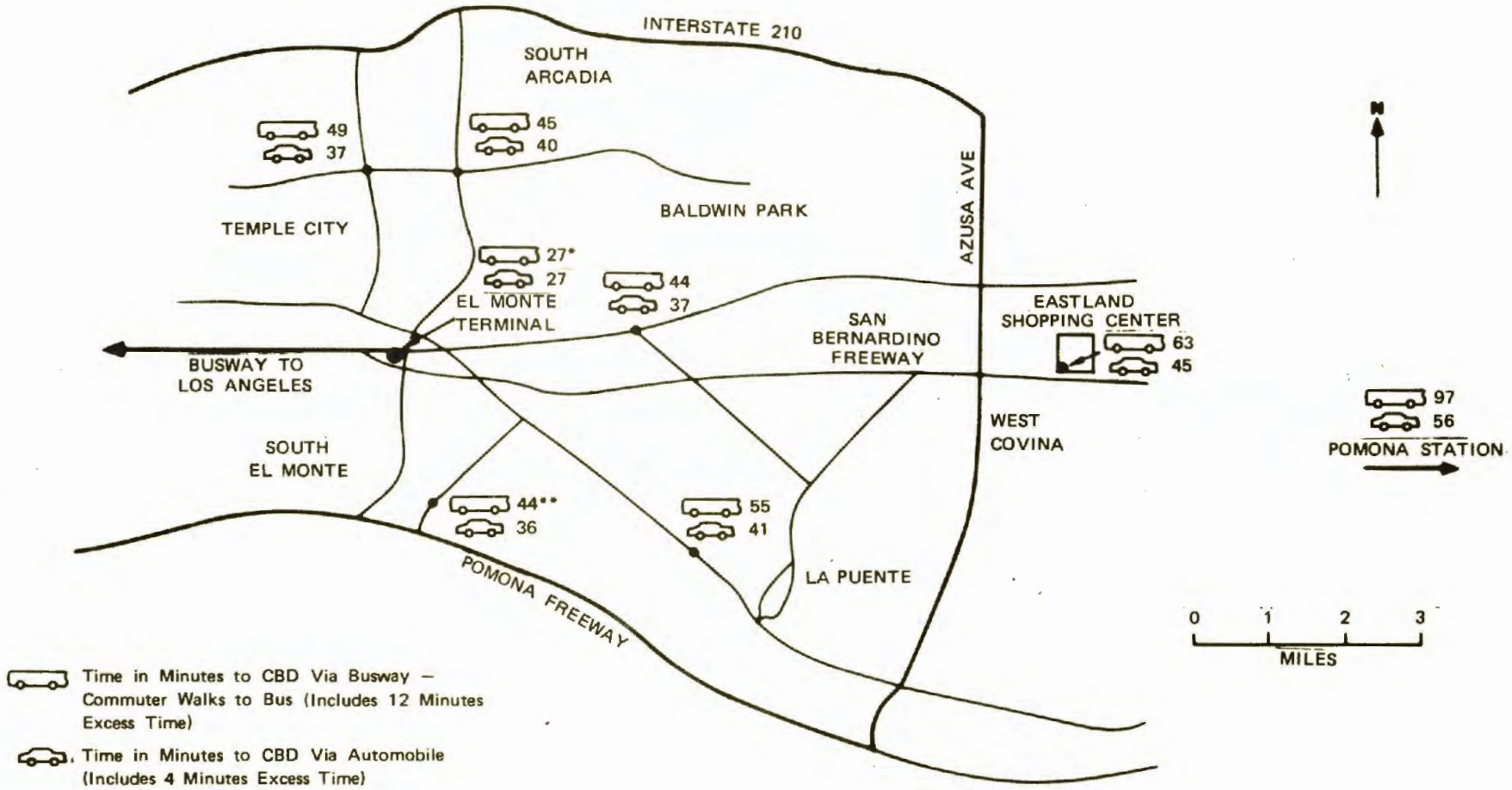
FIGURE 18 BUSWAY TRUNK LINES SERVICE FREQUENCIES (DEPARTURES FROM EL MONTE TERMINAL TO LOS ANGELES CBD, 6 AM-9 AM, WEEKDAYS)

terminal. The figure shows that between 6:05 AM and 7 AM, departure headways vary from one to four minutes, between 7 AM and 8 AM from one to three minutes, and between 8 AM and 9 AM from three to five minutes. A similar arrival pattern of outbound buses would be found between 4 PM and 6:30 PM. Midday headways vary between three and eight minutes.

Present running times between the El Monte terminal and First and Spring Streets in downtown Los Angeles (a distance of 12.2 miles) are approximately 16-18 minutes during the morning rush and 22 minutes during the afternoon rush. Beyond First and Spring Streets, buses average 8.5 mph,[1] including stops, during the morning and afternoon rushes. Patrons commuting from more distant points than the El Monte terminal will encounter somewhat longer trip times. Figure 19 illustrates several representative cases of travel times to First and Spring Streets in the Los Angeles CBD. Decreases will occur as the busway is completed to Mission Road by the end of Phase I. For comparison, travel times by automobile are also indicated. An improved downtown bus circulation plan, still under discussion, would result in even further time savings for bus users - especially those commuters traveling beyond First and Spring Streets.

Compared to service frequencies and running times offered by the trunk lines (lines 60 and 401 through 405), service provided by feeder lines is somewhat less convenient. Line 38 from Long Beach provides six one-way trips daily - none useful to peak period CBD-bound commuters. Line 53 eastbound to the El Monte terminal provides four runs between 7 AM and 9 AM which are useful for CBD-bound commuters from Rosemead and El Monte who live in the vicinity of Valley Blvd. Similarly, four westbound runs from El Monte terminal are provided between 4 PM and 6 PM. Line 63 eastbound to the El Monte termi-

[1] Downtown Bus-Auto Interaction Traffic Study, Los Angeles Traffic Department, Summer 1973.



**Includes additional 4-minute transfer delay. *Includes only 9 minutes excess time due to high departure frequency

SOURCES: Bus travel times from appropriate timetables, 15 July 1973.
Automobile travel times from Household Survey Population File, with 35 mph freeway speed west of El Monte
Excess times from Household Survey Population File.

FIGURE 19 CBD ACCESS TIMES—BUSWAY VERSUS AUTOMOBILE

nal provides seven morning runs useful to CBD-bound commuters from Rosemead and South El Monte who live in the vicinity of Garvey Avenue. Similarly, four westbound runs are provided during the afternoon rush period. (Upon commencement of operations via the recently completed Del Mar Avenue access ramps, busway commuters using lines 53 and 63 will be able to enter the busway at Del Mar Avenue instead of having to travel to the El Monte terminal. Discussion of operational changes resulting from the Del Mar ramps will be undertaken in the Phase II evaluation report.) During the morning rush, line 134 provides two runs to El Monte terminal from South El Monte and two from North El Monte. Two runs each are also provided from the terminal during the afternoon rush. Line 135 offers similar service. In summary, lines 134 and 135 offer such long headways that the service could be useful only to a limited number of commuters. Lines 53 and 63 offer somewhat better headways and may thus be more attractive to commuters.

The basic one-way fare from El Monte to the Los Angeles CBD is 70¢. For $25 per month, the Busway Monthly Pass gives the commuter an unlimited number of trips between El Monte and the CBD. In addition, the commuter may purchase a Ten-Ride Ticket which provides a 5% discount over individual purchases.

DOWNTOWN DISTRIBUTION

Present downtown circulation of busway lines is illustrated in Figure 20. Under this plan, buses share lanes with automobile rush hour traffic. As stated above, buses in the CBD during rush hours currently average only 8.5 mph including stops. Automobiles average 14.5 to 15 mph under the same conditions.[1] Thus, a major shortcoming of the existing busway is the absence of any expeditious treatment of bus movements in the CBD.

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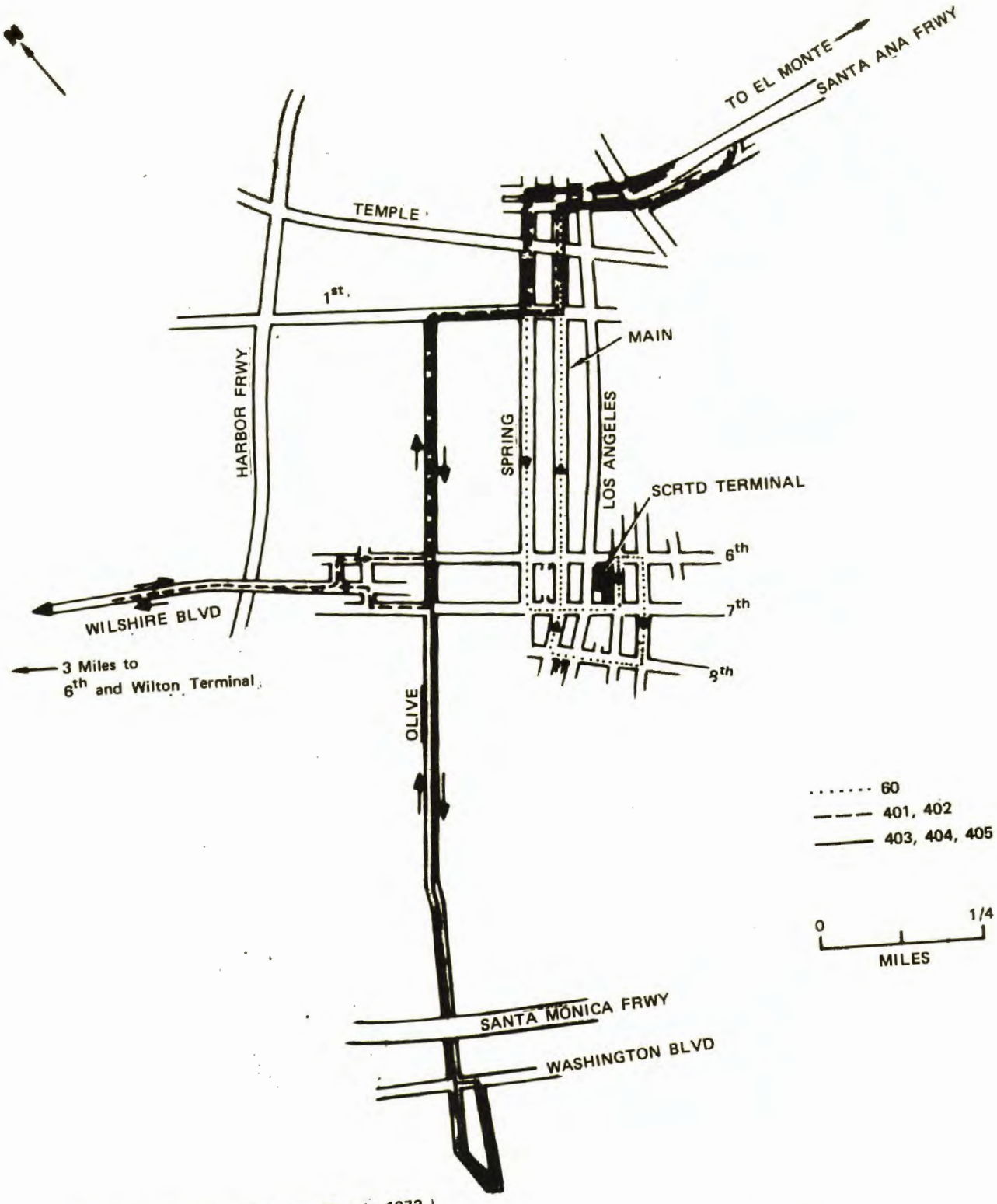
[1] Downtown Distribution Plan, San Bernardino Freeway Express Busway, Wilbur Smith and Associates, March 1973, p. 70.



SOURCE: Appropriate timetables, 15 July 1973

FIGURE 20 DOWNTOWN CIRCULATION OF BUSWAY LINES

Wilbur Smith and Associates has prepared a downtown distribution study for SCRTD in connection with the new busway.[1] Of the several alternatives studied, a plan was selected utilizing reserved contra-flow bus lanes and exclusive median bus lanes. The expected improvements in travel time under this system are detailed in Table 3. For instance, on a trip from El Monte terminal to Olive and 7th Streets, a passenger previously requiring seven minutes to cross the CBD from 1st and Spring would need only four minutes under the Wilbur Smith proposal. His total trip time would be cut by three minutes, for a 14% total trip time savings (assuming busway fully operational).

Table 3

TRIP TIMES AND DOWNTOWN DISTRIBUTION

(Minutes Inbound from El Monte Terminal to Downtown Destinations)

Downtown Distribution Plan	Destinations		
	1st & Spring	7th & Olive	Wash. & Olive
Present Plan - No Bus Preference	14*	21	31
Wilbur-Smith Contra-Flow Plan	14*	18	24

*Assumes fully completed busway, no station stops, and 62 mph average speed on busway.

SOURCE: Crain & Associates, based on Wilbur-Smith Downtown Distribution Plan

[1] Downtown Distribution Plan, San Bernardino Freeway Express Busway, Wilbur Smith and Associates, March 1973.

As the commuter travels farther across the CBD (to Olive and Washington, for instance), his total trip time savings under the Wilbur Smith plan would be seven minutes, or a 23% total trip time savings. If no changes were made in downtown distribution, a busway commuter utilizing the completed busway would require 17 minutes to travel from 1st and Spring Streets to Olive and Washington - more time than he would need for the entire trip to the edge of the CBD. Even though 31 minutes is not an unreasonable travel time to the CBD during the peak period, a prospective patron might find it psychologically disturbing to spend more time traversing the CBD than arriving there from El Monte.

Thus, a downtown circulation plan that reduces cross-CBD time to considerably less than that spent approaching the CBD would appear to be quite advantageous in the attraction of patronage.

SPECIAL PROBLEMS

SCRTD and Cal Trans have reported that no special problems have been encountered with the busway or as a result of its presence. Fears of automobiles and other vehicles straying into busway lanes have proved to be unfounded.

Collision data from Cal Trans covering the period from initial busway opening to 17 October 1973 indicate that 18 accidents have occurred along the busway in which automobiles have entered the busway lanes. In every case, the vehicles involved entered the busway lanes due to circumstances arising in the adjacent freeway lanes. None of the 18 accidents were the result of the busway or its buses. No bus-automobile accidents have been reported on the busway.

VI. MARKET ANALYSIS - HOUSEHOLD SURVEYS

This section reports on the marketing analysis and the mode split evaluation, both of which are based on the results of the household surveys and are best understood if reported on together.

METHODOLOGY OF HOUSEHOLD SURVEY

The survey technique employed was a double sample, stratified, random, clustered household approach. One sample was drawn at random from throughout the corridor. A second sample was drawn at random from a select area east of El Monte where commute conditions are favorable to the busway. These were called the random and select samples. Each was based on clusters of households drawn at random from the prescribed areas. The clusters were stratified by income and geography.

The purpose of the random survey was to analyze a cross-section of the entire corridor populace. The select sample was intended to produce a deeper analysis of those most likely to use the busway and to obtain statistically reliable data points on the "transit better" portion of the mode split curve (explained later).

Origin and Destination Area Definitions

For survey purposes, the corridor and relevant portions of Los Angeles were subdivided into origin and destination areas. Figure 6 has described the subdivisions of the corridor. These subdivisions were the "served-now", "served-later", and "not served" areas. As stated earlier, the served-now and served-later portions together make up what is herein

called the served corridor. The random sample was drawn from throughout the total corridor; the select sample was drawn from within the served-now area.

Similarly, the Los Angeles central area was subdivided into three destination areas: 1) the CBD; 2) an area somewhat larger than the CBD referred to as downtown; and 3) an area referred to as Central Los Angeles. The boundaries of these areas are defined in Figure 21. The area referred to as Central Los Angeles is an ill-defined catch-all of commuter destinations coming from the corridor who cross the screenline (the Los Angeles River) and travel to points inside or outside of the downtown area. The area outside the CBD but within the downtown is occassionally referred to in the report as the non-CBD; the area beyond the downtown but within Central Los Angeles is sometimes referred to as the non-downtown.

Spring and Fall Surveys

Two 1973 household surveys were conducted, one in April and one in October. The spring survey was a preliminary measurement, about half the scale of the fall survey. It measured the early response to the newly opened busway and provided a final shakedown of the survey procedures. This work was reported on in an interim report provided to the busway committee as a project document. Extracts from that report are used herein. The fall survey was more comprehensive and is the focus of the reporting which follows.

Sample Design

The spring survey employed a 2000-household sample. Thirty clusters of about 65 houses each were to be approached which, in turn, were to produce 180 households where one or more

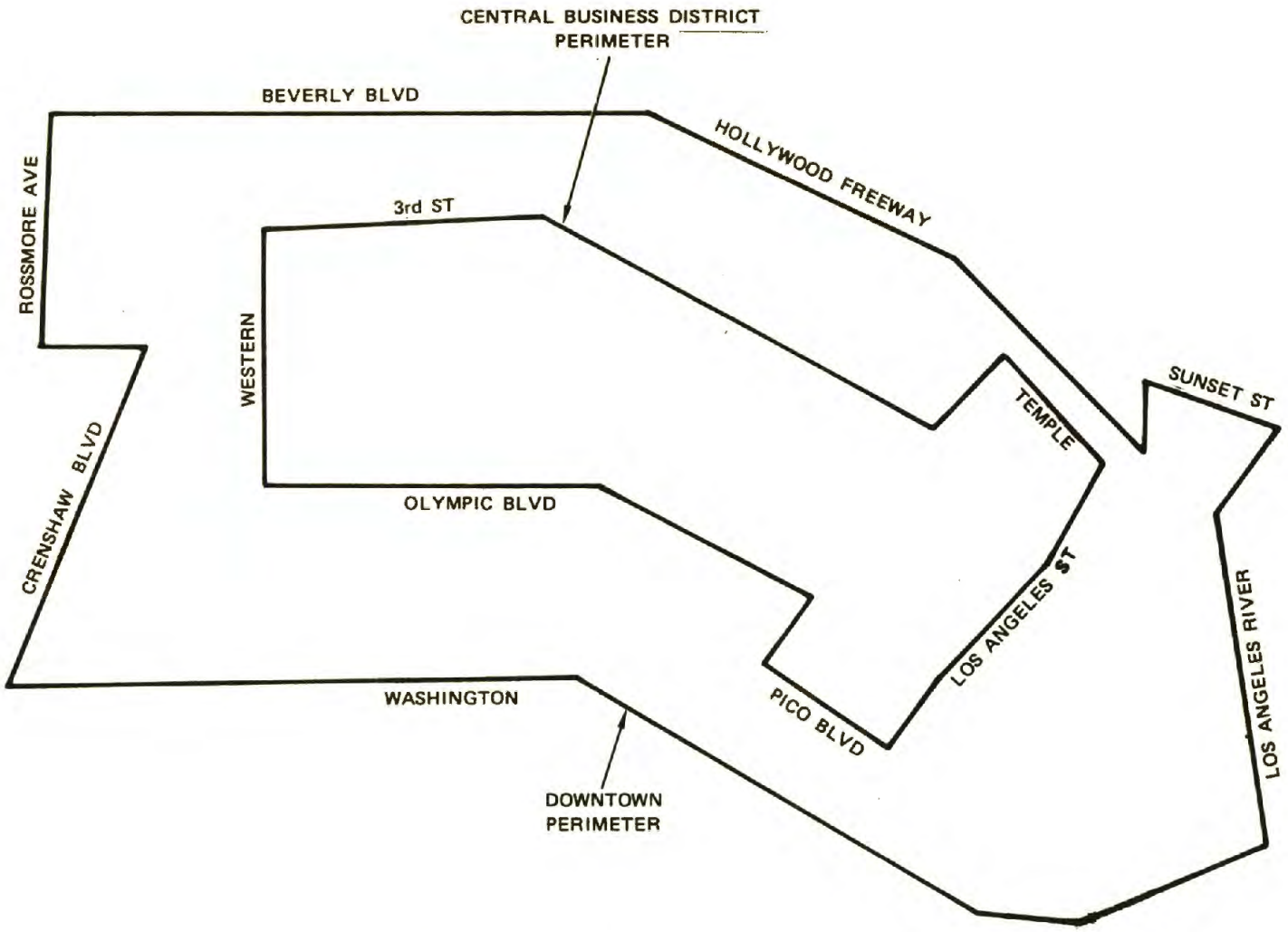


FIGURE 21 DEFINITION OF LOS ANGELES DOWNTOWN

commuters resided. The 30 clusters were drawn at random, after stratification by income. Income stratification was done by drawing clusters in correct proportions from high, medium, and low income census tracts. This sample is referred to as the spring random sample; no select sample was drawn. (The details of this sample design are given in Appendix B.)

The fall survey repeated this process selecting this time a second 36 clusters each located immediately adjacent to the spring clusters. About 100 houses were approached in each cluster to obtain contacts at 85 houses. Thus, residential type and income stratification were held constant without visiting the same households. A select sample was also drawn (36 clusters of 85 houses each) from areas where excellent service was provided by the busway.

Analysis of the pattern of disutility values throughout the corridor dictated that the select sample should be drawn at random from throughout the served-now portion of the corridor. That entire area appeared to have a rather constant disutility value of about zero for the park-ride commute mode. This is to say that all commuters in the served-now area could drive to El Monte and transfer to the busway or drive to downtown Los Angeles at about equal total commute cost (time plus monetary cost).

The actual sample sizes that resulted from the two surveys are as follows:

	Fall		Spring	
	Select	Random	Select	Random
Houses Contacted	3077	3595	1706	0
Valid Commuter Interviews	148	428	192	0

A more elaborate breakdown of the fall sample is given in Table 4. The commuter data is, of course, the basic data used for much of the analysis. However, limited data was taken from the very large sample of all households contacted.

Table 4

BREAKDOWN OF FALL SURVEY SAMPLE

	Select	Random	Supplemental[1]	Total
Households Approached	3570	3627	811	8008
Houses Contacted	3077	3068	527	6672
Commuters				
Valid responses used	148	313	115	576
Valid responses not used	90	51	-	141
Invalid, non-response	89	153	-	242
	327	517	115	959
Non-commuter Households	2750	2551	412	5713
Contacts/Approaches	.87	.86	.65	.83
Valid Responses/Commuters	.73	.70	1.00	.74
Commuters/Contacts	.11	.17	.22	.14

The Questionnaire

The questionnaires and other field materials used in the surveys are included in Appendix C. The questionnaire design was derived from the questionnaire used on the Shirley Highway Busway project in an attempt to gain continuity of data between the two busway projects. The concept of the questionnaire

[1] The supplemental data was a last minute correction to improve geographical spread; see explanation under field procedures. These data act as a supplement to the random sample.

and the analysis that flows from it were also based on a behavioristic approach to travel behavior modelling. The behavioristic approach deals with individual trips, rather than the average trip of all travelers from a geographical area. Each completed questionnaire represented a detailed accounting of the time and cost of an individual commute trip plus related marketing information. This data was reduced and placed in a population file designed to perform various analyses. The details of the data contained in this population file are given in Appendix C.

Field Procedures

The survey was performed between the hours of 6 P.M. and 9 P.M. Sundays through Thursdays, 19 September through 12 October. Previous surveys had demonstrated this to be a time of day when many people are at home. At the starting point of the cluster, the data-taker worked house-to-house consecutively until an adult had been contacted in each of approximately 85 houses.

If no one was at home, this was so noted and the house was dropped from further consideration.[1] Considerable effort was expended to keep the refusal rate to a low 5.6%.

For houses where contacts were established, an introductory statement was given (see Appendix C) and two questions were

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[1] On the spring survey, a questionnaire was left if no one was at home with a well-written request to fill it out and mail it in. (See questionnaire material attached to Appendix C.) However, this procedure tended to overrepresent transit users in the sample and was discontinued. The procedure to drop the house from further consideration also produces biases, but these are believed to be smaller than those produced by the drop-off, mail-in approach.

asked: "Are you aware of the busway?" and "Do any commuters to downtown Los Angeles live here?" If there was a yes response to the second question, one of three things happened:

- the commuter filled out the questionnaire
- a questionnaire was left for the commuter with a plan for picking it up later or mailing it in
- the household refused to be interviewed further

There was a telephone/postcard follow-up when contacted commuters did not mail in their questionnaires. This complete procedure produced contacts at 85% of the houses approached and obtained completed valid questionnaires from 75% of commuters identified in contacted houses.

The person contacted was allowed to determine what "downtown" meant geographically. Thus, many people filled out the questionnaire who did not work in the downtown areas as defined. Their questionnaires were used only in selected parts of the analysis and comprised the non-downtown data.

The questionnaire required four minutes to complete. A Spanish-speaking member of the team was used for Spanish surname clusters. Extensive reviews of the data were performed in the field to check for consistency and completeness. Telephone follow-ups were conducted to obtain missing data or to clear up inconsistent information.

The commuter filled out the questionnaire with help from the data-taker where needed. When there were two commuters in the same house, responses were obtained from both.

Finally, to make some corrections in the geographical balance, some last-minute supplemental data were taken. The random drawing of clusters left three areas of the corridor unsampled and all three were lightly served by transit. Because this might cause an understatement of automobile users, six clusters were added and sampled over the weekend of 15-16 December. This did reduce the transit market share but only by a small amount. The "Aware of busway?" and the "Does commuter live here?" questions were asked. Where commuters were found, they were asked only where they work and what mode they used. Last-minute survey results are herein referred to as the supplemental survey data.

Analysis Procedure

The data were edited, coded, and keypunched with each card containing all the data obtained from a single interview. Computations were then performed to identify the total commute cost by the mode used and the probable cost for the mode not used. The difference between the two, i.e., the disutility value, was then computed. Disutility values were computed for only 50 of the non-downtown trips and on none of the supplemental data for which the necessary cost input data were not collected. The disutility values were then added to the card so it would contain all the information needed for the population file (see Appendix C).

The data were then given an initial analysis using a computational software package termed the Statistical Package for the Social Sciences (SPSS), created at Stanford University. This provides cross-tabulations of the data that are desired along with Chi Square values describing the confidence that can be placed in the relationships involved.

Extracts from these cross-tabulations were then presented orally to the Busway Evaluation Committee along with preliminary interpretations. These presentations and interpretations were then refined and are now presented as the research findings which follow.

COMMUTER PROFILE AND TRIP PATTERNS

Origin-Destination Patterns

The following is a breakdown of the fall survey data showing the pattern of origins and destinations of trips.

Table 5

FALL SURVEY ORIGINS AND DESTINATIONS
SAMPLE SIZE

Origin Area	Destination Area			
	CBD	Not CBD	Non-Downtown	Total
Served-Now	37	6	29	72
Served-Later	91	25	36	152
Not Served	46	17	26	89
Totals	174	48	91	313

Source: Random, Fall (does not include supplemental data)

At this point, the reader might wish to refer to the origin-destination pattern of pre-busway transit users drawn from the extensive on-board survey performed in the spring of 1971. This is included in Appendix A.

There is some understatement of the flow to the non-downtown area. It was never intended that a complete set of non-downtown

commuters be obtained. However, because some people who were interviewed indicated themselves as downtown commuters and were not, we obtained this by-product of extra data. Since they were usable for mode split analysis, they were retained and classified as non-downtown trips. However, they represent only some unknown fraction of all such non-downtown trips.

As stated earlier, the analyses primarily used data representing served corridor origins to downtown locations. Each crosstabulation of the data which follows is footnoted as to the specific data used.

Submode Splits

Table 6 gives a breakdown of commute travel by submode. This breakdown and the breakdown which follows on average commute times and costs for these submodes are relevant to a transit marketing analysis of commuters who are using the competitive travel service, the automobile.

As of the fall survey, nearly two-thirds of the automobiles in rush hour traffic carried only the driver. The occupancy factor, the number of commuters per automobile, is obtainable directly from the population file. We obtained from each commuter interviewed the number of persons who regularly travel in the automobile in which the interviewee commutes. The average occupancy factor was 1.6. Section V has shown this corresponds to a 1.3 factor as observed in actual traffic conditions.

It is also noteworthy that 24%[1] of the automobile users claimed they needed their cars during the day (and thus

[1]This value extracted from population file; based on all served corridor to downtown trips.

Table 6

SUBMODE SPLITS
(%)

Automotive Submodes

	Fall	Spring
Driver traveling alone	64	77.7
Regular driver (with paying riders)	5	8.5
Regular driver (non-paying riders)	7	
Alternate driver	12	7.4
Regular rider (who pays)	8	6.5
Regular rider (non-paying)	5	

Transit Submodes

	Fall	Spring
Park-Ride	21	(not collected)
Kiss-Ride	12	
Walk-Ride	67	

Source: Fall data include served corridor to downtown trips; spring data include full corridor to CBD trips.

must drive to work). This is a high percentage; a 17% figure was measured on the Shirley Highway Project. A shocking 44% was measured on the spring survey, but this was suspected to be the result of an overly liberal interpretation by the survey participants of the phrase "need your car". The question was made more explicit in the fall, and the response dropped to 24%. (See Appendix B for the phrasing of the question on the spring and fall surveys.) The 24% figure pertains to commuters from both the served-now and served-later sections of the corridor.

Commute Costs and Times

Table 7 provides a breakdown of commute costs and times by submode. The data presented includes only the random survey results, served corridor to downtown. This is not enough to be studied in terms of nine submodes. However, even at these very small sizes, these data appear to be internally consistent and reveal an interesting pattern of costs.

The submode breakdown results indicate that there are not major monetary savings in traveling by bus except for those who would drive alone. Those who share automobiles enjoy very low cost transportation. The transit submodes suffer from the high cost of in-vehicle time and excess time. (However, later discussion will indicate that the monetary value associated with transit excess time does not appear to be appropriate for all highway-busway comparisons.)

Socio-Economic Profiles

After the first year of application of the evaluation process, it is possible to perform several interesting comparisons of the socio-economic backgrounds of commuters. Table

Table 7
COMMUTATION COSTS AND TIMES

Commute Costs	Driving Alone	Reg. Driver w/Pass. (Pay)	Reg. Driver w/Pass. (No Pay)	Alt. Driver, Passenger (No Pay)	Regular Pass. (Pay)	Regular Pass. (No Pay)	Walk-Bus	Auto-Bus (Park)	Auto-Bus (No Park)
Sample	81	6	8	13	11	7			
Economic									
Operating (*per Occupant)	.87	.90	.34	.38		.39	----	----	----
Parking Cost per Person	.16	.20	.10	.14	.12	.02	----	----	----
Carpool Payments (Doesn't Include Parking)	----	----	----	----	.04	----	----	----	----
Carpool Receipts (Doesn't Include Parking)	----	.54	----	----	----	----	----	----	----
Auto Feeder Cost (per Vehicle)								.31	.07
Parking Cost for Auto (per Vehicle)								.03	
Fare							.51	.41	.57
TOTAL	1.03	.56	.44	.52	.16	.41	.51	.75	.64
Time									
In Vehicle Time (x $2/Hr)	.88	.68	.90	.92	1.04	.64	1.20	1.26	1.38
Excess Time (x $5/Hr)	.23	.67	.25	.33	.23	.23	.72	.65	.32
TOTAL	1.11	1.35	1.15	1.25	1.27	.87	1.92	1.91	1.70
GRAND TOTAL	2.14	1.91	1.59	1.77	1.43	1.28	2.43	2.66	2.34

NOTES: Average commute distances: for auto users 15.3 miles, for bus users 11.7 miles (includes supplemental data).
Cost data based on all served corridor to downtown trips.
Operating costs based on $0.071 per mile, value of time set at $2 per hour, excess time set at $5 per hour.

8 lists a number of attributes of four different sets of commuters.

- Automobile Commuters - a sample of 272 regular auto users interviewed during the fall household random survey. This includes data from served and not served portions of the corridor

- Pre-Busway Transit Users - about 3300 persons interviewed during the 1972 spring on-board survey. This represented people from throughout the corridor but generally excluded the not served area

- Spring Bus Users - 28 bus users from throughout the served and not served sections of the corridor

- Fall Busway Users - 28 users of the busway who live in the served-now area and who completed full interviews during the fall household survey

These data strongly indicate that as the busway patronage grows, the socio-economic mix is changing. The new busway user is apparently coming from the ranks of the general automobile commuter population. Although the sample of busway users is small, one can observe the dissimilarity between them and the pre-busway transit user or the spring general transit user. There is a striking similarity, however, between the busway user and the automobile commuter. Significance tests comparing the pre-busway data column and the busway users column indicate the differences to be statistically significant at about the 80% confidence level, i.e., the differences are marginally significant.

Table 8

COMMUTER PROFILES
(Percent)

Attribute	Fall Auto Commuters	Pre-Busway Commuters	Fall Busway Users	Spring Bus Users
Sex				
Male	49	36	48	74
Female	51	64	52	36
Income				
0 - $9,999	21	53.5	15	42
$10,000 +	79	46.5	85	58
Age				
16-39	60	46	64	54
40 +	40	55	36	46
Auto Availability				
Cars/Household				
1.0 or less	25	NA	40	NA
2.0 or more	75	NA	60	NA
Cars/Driver				
1.0 or less	23	NA	21	NA
More than 1.0	77	NA	79	NA
Sample:	272	3300	28	28

Source: See discussion, previous page.

This difference between the previous users and the growing group of new users of the busway is important in terms of market penetration by transit. It suggests that there is penetration into the basic ranks of the auto commute market. This suggestion, based on the above limited statistical data, is supported by other observations: the rising busway patronage, the minor patronage losses on parallel bus routes, the rise in park-ride submode, and other points developed later.

PERCEPTIONS AND ATTITUDES

Awareness of Existence of Busway

Before proceeding to the central analyses concerning market share and mode split, certain background data collected on public perceptions and attitudes is presented.

All of the household contacts in the survey were asked if they were aware of the existence of the busway. The results were as follows.

	(% Aware)	
	Fall	Spring
Commuter Households	88	82
Non-Commuter Households	75	75

The fall awareness data was further analyzed relative to household location within the corridor.

	(% Aware)		
	Total Corridor	Served Now	Served-Later and Not Served
Commuter Households	88	91	85
Non-Commuter Households	75	80	67

This high awareness supports the contention that the busway is self-advertising because of its visibility to the automobile user. People from the served-now area who use the San Bernardino Freeway more should tend to be more aware of the busway. The above data show they are.

General Reactions

All commuters interviewed were asked about their general reaction to "use of the busway for exclusive fast bus travel". Their reactions were:

Table 9

PUBLIC REACTION TO BUSWAY
(%)

	Served-Now	Served-Later
General Praise	70	70
Busway Too Costly	11	6
Other (miscellaneous)	8	10
Safety Concerns	5	6
Exclusive Lanes Wrong	2	4
More Feeder Service Needed	2	3
Will Improve Total Freeway	2	1

Source: Fall survey, above origins to all destinations.

These data indicate a very high acceptance and praise for the busway concept. Only about 15 to 20% appear to have significant negative reactions.

Attitude Measurements

Certain attitude measures have been included repeatedly on the busway surveys. They were derived from earlier market research studies performed in the Bay Area[1] and are believed to gauge certain underlying basic attitudes which affect disposition to using public transportation.

These attitude measures were expressed in terms of statements and the interviewee was asked to express his agreement or disagreement on a five-point scale, with the higher number denoting a pro-transit attitude. The questionnaires in Appendix C show how this is handled. Table 10 indicates the mean scale value for auto and transit commuters over the several surveys. As is revealed in this table, the measure which most reliably discriminates between auto and bus users is the first: "Would you use new, improved transit, etc." This is an excellent measure in that it tests the openmindedness of the commuter relative to public transportation. The measure on "enjoying driving" is weaker in its ability to discriminate and, on the last (fall) survey, did not discriminate at all between auto and bus users. This could reflect some current reduction of emotional attachment to the automobile and to driving brought on by the fuel crisis, but this is speculative. The "hate fixed schedule" measure is interesting because it does discriminate and it is an attitude which is not totally appropriate relative to busway use. The departures from the El Monte terminal during rush period are now so frequent (see Figure 18) that one need not

---

[1] Lovelock, Christopher H., Consumer Oriented Approaches to Marketing Urban Transit, DOT/UMTA University and Training Grant No. CA-11-0008, Stanford University, March 1973.

Table 2

ATTITUDES VS MODES
(Mean Scale Value)[1]

Attitude Statement	Fall		Spring		Pilot[2]	
	Auto	Bus	Auto	Bus	Auto	Bus
If a new and improved and convenient public transportation service were introduced, I would certainly use it.	3.8	4.8	3.9	4.8	4.3	4.9
I don't enjoy driving very much.	3.1	3.2	2.9	3.3	3.0	3.3
I hate to be tied to fixed schedules for travelling.	2.3	2.9	2.2	3.5	2.2	2.8
In this day and age, the only thing public transportation should try to do is to serve the needs of the poor and the disadvantaged.	3.8	3.0	(not asked)		3.5	3.5[3]

[1]Values range from 1 to 5, indicating relative agreement or disagreement with attitude statement. The scoring of the last two attitude statements were inverted so that a high value always denotes a "pro-transit" viewpoint.

[2]Pilot survey done in April of 1972.

[3]This class consciousness measure was phrased as "I would much rather have people see me arriving at work by car than by bus" on this early survey.

Source: Fall survey, total corridor to all destinations.

worry about what the schedule is. Thus, this attitude might be susceptible to change through proper advertisement of the busway departure frequencies.

The last measure of the table is based on the premise that there might be a negative attitude toward bus travel because it is sometimes associated with the poor. If there is such a factor, we have not been able to measure it. In the fall survey the auto commuter is more frequently in disagreement with the "transit for poor" statement than is the bus user.

Some analysis was done on how these attitudes vary with socio-economic and other factors. The analysis was limited to the "would use new, improved transit" statement. It was determined that females rate this significantly higher on the five-point scale than do men, 4.3 to 3.8. There was also a significant variation by income.

Income Group	Scale Value
Less than $10,000	4.6
$10,000 to $15,000	3.9
$15,000 to $30,000	3.7
Over $30,000	4.3

Source: Fall survey, served corridor to all destinations.

The higher values at the low and high income extremes appear to be consistent for both auto and bus users.

There was no significant difference in response to the "use new, improved transit" measure relative to trip origin, trip destination, degree of access to busway, or disutility value. The latter is important since it is the prime determinant of

mode split. Since attitudes do not correlate with disutility, one can accept the sex and income differences as real and not reflections of different commute conditions faced by women and lower incomes.

A general attitude question was also carried on every survey on this busway project and on the Shirley Highway Busway project. The interviewee was asked, "Not thinking of the good or bad points of bus service in your particular area, how would you rate your general attitude toward traveling to work by bus?" He was asked to rate himself on a five-point scale with five corresponding to an extremely positive attitude toward transit and one corresponding to an extremely negative attitude. The following are results obtained in the west (San Bernardino Busway) and in the east (Shirley Highway Busway).

Table 11

ATTITUDE COMPARISON WITH SHIRLEY HIGHWAY
(Mean Scale Value)

	San Bernardino		Shirley Highway	
	Spring '73	Fall '73	Spring '71	Fall '71
Auto Users	2.8	2.6	2.7	3.1
Bus Users	3.4	3.3	3.8	4.2

Sources:
San Bernardino: total corridor, all destinations
Shirley Highway: total corridor to downtown destinations, data from Fisher, expanded from four point to five point scale and inverted.

The data imply that attitudes are more positive toward public transportation in the Shirley Highway corridor.

The Hard-Core Auto Users

There is some suggestion in the data that there are a number of auto users who oppose the idea of using transit from several viewpoints. Intercorrelations were measured between persons who a) claim they must have their car during the business day, b) would not "use new and improved transit", and c) "hate fixed schedules". This is shown in Table 12.

All three of these attributes do appear to be interconnected. Of course, there is a rational reason for "need my car" and "wouldn't use new transit" to go together. It is also interesting to note that the two attitudinal measures "use new transit" and "hate fixed schedules" are only loosely correlated, meaning these cannot be categorized as a single attitudinal element.

MARKET SHARE

Market Share Estimates Versus Time

In order to compare the ridership impacts of the San Bernardino Freeway Busway with other busway facilities, usage figures need to be expressed in terms of transit market share of trips. This is also helpful in transit market research in that it describes something of the size of the total feasible market and the current penetration into this market.

There were a variety of market share estimates measured on the Fall Survey, and these are tabulated in Table 13. They

Table 12

ATTITUDINAL INTERCORRELATIONS

(Commuters Interviewed)

	Hate Fixed Schedules	Don't Hate Them	Total
Need Car	38	16	54
Don't Need Car	72	50	122
Total	110	66	176

Chi Square = 3.0
Significant at 90% Confidence[1]

	Wouldn't Use New Transit	Would Use It	Total
Hate Fixed Schedules	23	86	109
Don't Hate Them	10	57	67
Total	33	143	176

Chi Square = 0.67
Significant at 50% Confidence

	Wouldn't Use New Transit	Would Use It	Total
Need Car During Day	15	39	54
Don't Need Car	18	104	122
Total	33	143	176

Chi Square = 3.4
Significant at 90% Confidence

Source: Total corridor to all destinations.

[1]This first table indicates that of the 54 people who need their cars, 38 or 70% hate fixed schedules. Of 122 who don't need their cars, only 72 or 58% hate fixed schedules. This difference in percentages is significant at the 90% confidence level, i.e., only a 10% likelihood of obtaining such a difference by chance.

are displayed in graphic form in Figure 22. The pre-busway estimates are based on the reported pre-busway modes of commuters to Los Angeles interviewed in the fall. Market share estimates were also obtained from the spring survey, but these were of a smaller sample size and appear to be inconsistent with the ridership data. Only a single aggregate market share representing the spring results is included in Figure 22. The smaller sample components of this aggregate value are not accurate and do not aid the intrepretation.

Table 13

MARKET SHARE TRENDS

Origin	Destination	Size[1] (work trips per day)	Shares in Percent and (Sample Size) Pre Busway	Fall
Served Corridor	CBD	30,000	14 (118)	21 (197)
Served Corridor	Downtown	39,000	12 (148)	16.5 (255)
Served-Now Area	CBD	8,700	4.1 (97)	25 (126)
Served-Now Area	Downtown	10,500	3.8 (106)	19 (173)
Served-Later Area	CBD	21,300	20 (83)	20 (139)
Served-Later Area	Downtown	28,500	17 (107)	17 (181)

[1]Based on the estimated number of households (from census data), the ratio of downtown commuters to households (from survey), 21.6 commute trips per month less 10% for absenteeism.

Although there are sampling errors in these estimates, there appears to be good consistency with the time series data, i.e.,

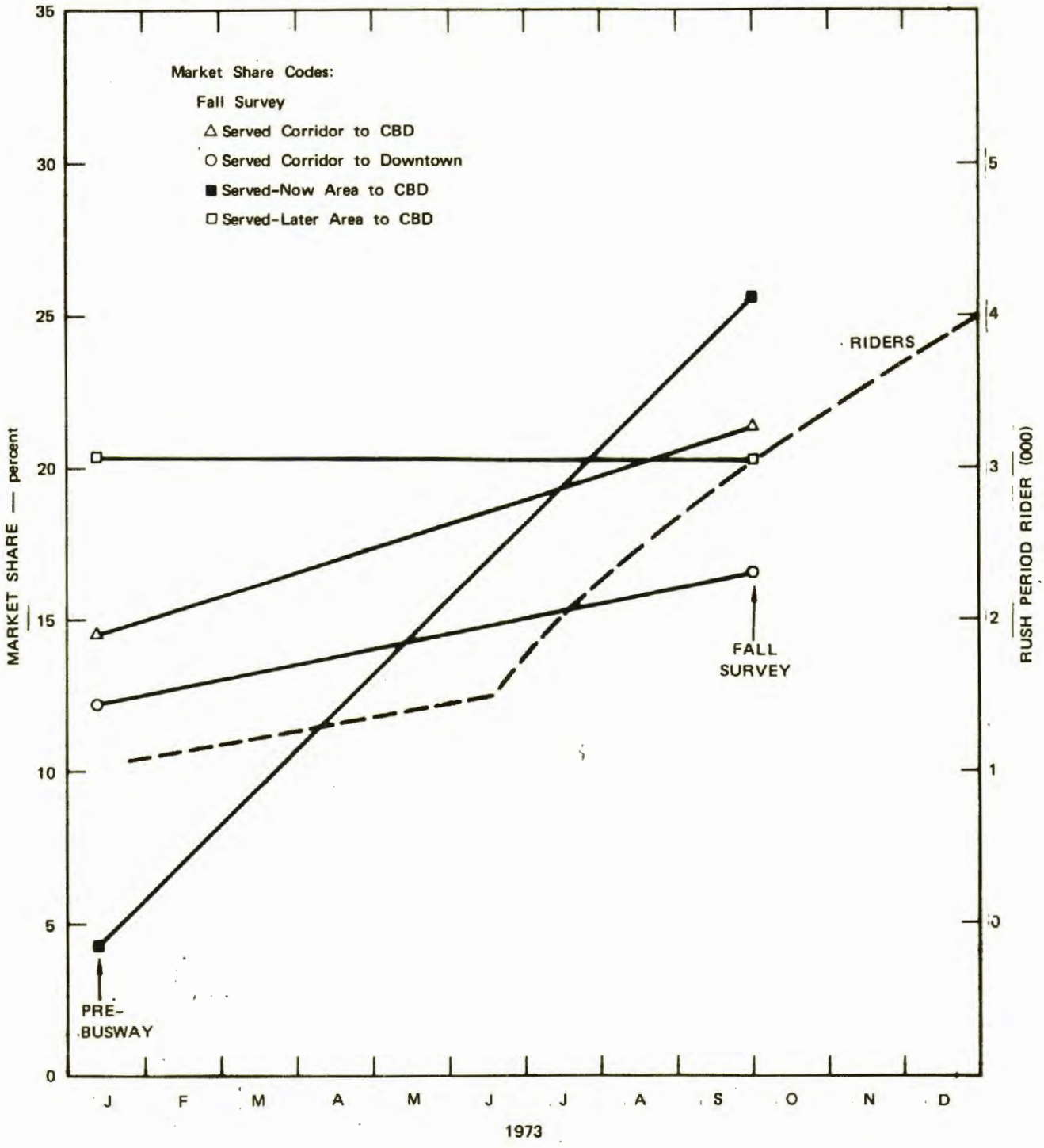

FIGURE 22 MARKET SHARE TRENDS

the 5.5 hour rush period ridership counts shown in Figure 11. Figure 22 depicts, as a backdrop to the market share data, the general upward trend of the time series data.

Figure 22 clearly indicates that the major source of patronage increase has come from the served-now area. About 25% of the served-now area to CBD commuter market has been penetrated. With the small size of that market and the high fraction of people from there who claim they need their car (24%), it might be expected that the current patronage growth would soon begin to flatten. However, with the opening of the Del Mar ramps which tap the much larger market west of El Monte, the patronage data should surge upward again.

Mode Split Check

The evaluation was not designed to develop a mode split function. It was intended that a check be made of the accuracy of the LARTS mode split model relative to busway-automobile mode choice decisions.

There are about 350 trip observations from the fall survey that can be used for mode choice analysis. These were separated by origin/destination categories and by disutility values and plotted for comparison with the LARTS mode split function. These data are illustrated in Figures 23 and 24.

To understand these mode split figures, it is necessary to recall from Section II the theory of the mode split model and the disutility function used for transit planning in the Los Angeles Basin. The disutility function represents the difference in total commute cost between the auto and transit modes. Total cost includes the monetary value of commute time.

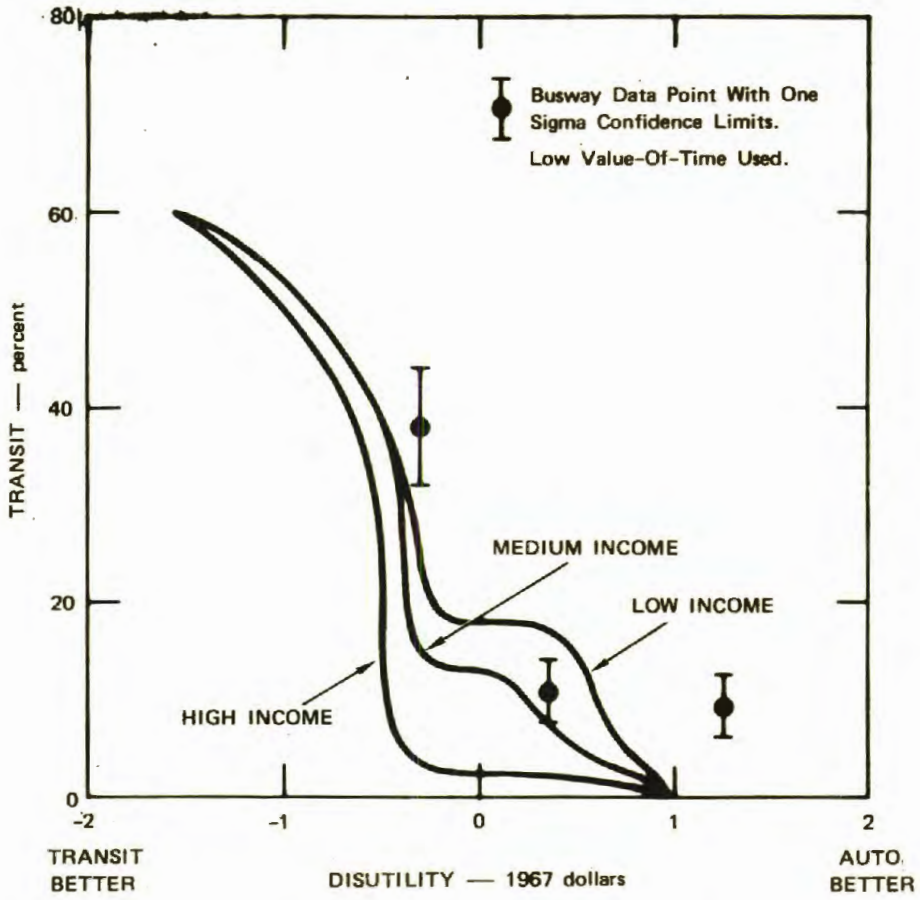

FIGURE 23 MODE SPLIT CHECK (OF LARTS MARGINAL DISUTILITY MODAL CHOICE MODEL)

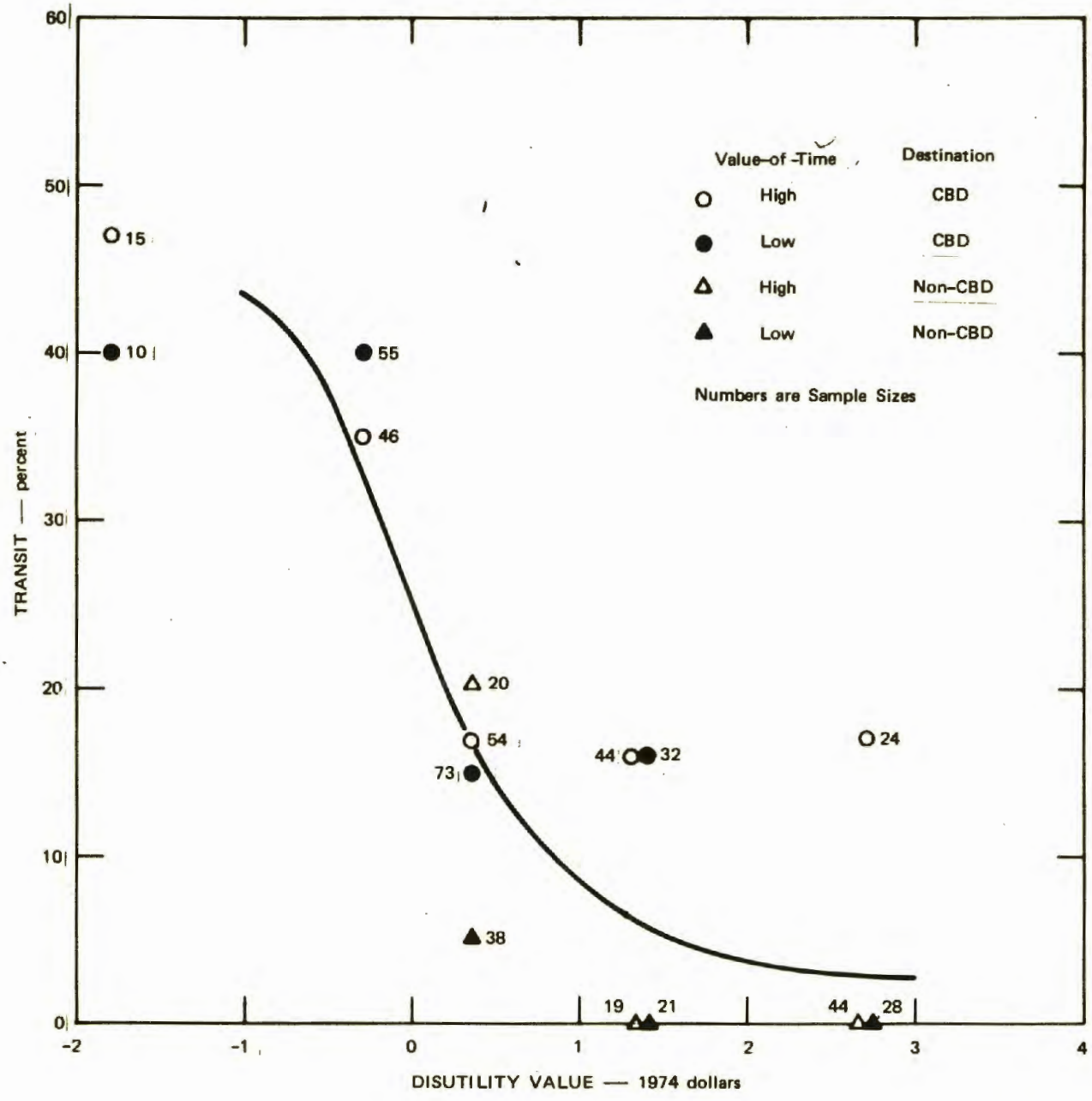

FIGURE 24 MODE SPLIT AS A FUNCTION OF VALUE-OF-TIME AND TRIP DESTINATION

Commute time is valued at one-fourth of household income; i.e., for a household with annual income of $20,800 per year, or $10 per work hour, the travel time of every commuter in this household is valued at $2.50 per hour. Excess time, the sum of time spent walking to or from and waiting on transportation vehicles, is weighted 2.5 times higher. To this total value of commute time, all out-of-pocket monetary costs are added. This includes such detailed items as parking costs, busfare, and carpool payments and receipts. For each commuter interviewed, the total cost for each mode is so calculated and the difference between these costs is called the disutility value. The theory is that transit mode split, the fraction of commuters using transit, will be higher for transit-better disutility values and lower for auto-better values.

Figure 23 presents the LARTS mode split curves as currently used in public transportation in the Los Angeles basin. Different curves are shown representing three different income classes of travelers. Three busway data points, each representing a composite of all incomes, are shown. These indicate the busway mode splits for riders in three disutility categories: a slightly transit favorable condition, a slightly auto favorable condition, and an extremely auto favorable condition. The transit favorable condition represents mainly the survey results of the select survey drawn from the "served now" region of the corridor. The busway data, based on the fall 1973 survey, has been deflated to 1967 dollar values to allow comparison with the LARTS curves which were based on 1967 survey data. The amount of deflation was based on the change in consumers price index between 1967 and 1974, a rise of approximately 37%.

Figure 24 reveals other aspects of the busway data. It presents the busway mode split data based on two value-of-time assumptions: the low value used in the LARTS program (one-fourth of household income) and a higher value (about 43% of household income). The latter percentage is based on the massive studies of value of time conducted by Stanford Research Institute.[1] Figure 24 also shows mode split values disaggregated by destinations.

Relative to both figures there are several sources of error that contribute to the dispersion between the plotted points and the curves. These are:

- sampling errors
- ridership maturing effects (the entire busway curve rises until the patronage increase from a specific busway improvement has died out)
- errors in measuring disutility values for individual trips (e.g., improper weighting of excess time in congested auto travel)
- differences among people in their valuation of time
- imperfections in the model, where the disutility calculation does not properly represent the total cost for certain submarkets

With these thoughts in mind, two conclusions can be drawn

[1] The Value of Time Saved by Trip Purpose, Stanford Research Institute, October 1970.

from the two mode split figures. First, Figure 23 indicates reasonable consistency between the busway mode split data and the LARTS model. In fact, the busway mode split appears to be about five percentage points higher than the LARTS curve. Because of ridership maturing process, it may rise still higher. The most probable reason for this discrepancy is that good transit service in the San Bernardino Freeway corridor has been maintained over the years and this has caused an abnormally high transit market share. The pre-busway on-board results (Appendix A) showed that many choice riders in the corridor have stuck with transit. Many have selected their residential location based on its proximity to transit service. We have demonstrated earlier that attitude and perception affect mode choice decisioning. It would appear that these attitudes and perceptions have been transit-favorable in the San Bernardino Freeway corridor causing transit market share to be higher here than elsewhere in the region.

Second, the data points which represent the non-CBD trips seem to be consistently misplaced below the curve. It seems as if on the auto-better side of the curve, the CBD points belong further to the left and/or the non-CBD and non-downtown points belong further to the right.

The cause would seem to be an improper representation of the value of time or of the value of excess time. However, the data base used in this study is not large enough to determine an improved means of expressing these time values. The sensitivity analysis that was conducted using a higher value of time did not resolve this disparity in mode split values of CBD and non-CBD destined trips.

Commuter Reasons for Mode Used

Two sets of data provide further insight into the mode selection process. People who had made a switch from auto to bus commuting were asked why. Their responses were analyzed, classified, and tabulated. The results were as follows:

Reason for Switching	(%)
Time, Convenience	46
Frustration with Prior Mode	18
Cost Savings	14
Changed Employment	9
Switched, but No Reason Given	9
Other	4

These data indicate nearly two-thirds of the switch decisions are based on time savings or convenience (or its opposite, frustration). The running time for auto travel on the freeway is now a little more than 20 minutes from El Monte to the Los Angeles downtown off-ramp. Another three minutes is required to reach the CBD, i.e., First and Spring streets. The busway schedule in the morning is 16 to 18 minutes to reach First and Spring. This means there is a five to seven minute savings by busway with part of this savings lost in transferring at El Monte. Thus, there appears to be only a few minutes time savings in the busway mode at this time. The major, causal factor in mode switch then appears to be the frustrating, congested, slowed pace of driving on the freeway.

Based on this observation, it would appear that the disutility

function in the LARTS mode split model does not give proper weight to the excess time generated in congested auto travel. A 2.5 multiplier was applied to excess time that involved waiting on or walking to mass transit services. The rationale for switching implies that a similar multiplier should be applied to a congested stop-and-go automobile travel. Were there such a factor, those who were switching to the busway would be identified with a transit-better disutility value and there would be a better mathematical basis for explaining the diversion.

The auto commuters rightly perceive that there is little cost advantage in using the busway, particularly if they share their driving costs with others. The automobile operating cost for the eleven-mile trip paralleling the busway is about the same as the bus fare. Only those few who pay large parking costs downtown would enjoy any significant cost savings in the bus mode.

It is also interesting to note the mode used by the switchers in getting to the busway. Of the 23 persons who switched and who provided full interview data, the access modes were:

	Access Mode	
Origin Area	Auto	Bus or Walk
Served-Now	9	11
Served-Later	2	1

This indicates that much of the new patronage is coming through the park-ride mode. This is consistent with our disutility analysis, which suggested that the entire served-now area, east of El Monte, represented a slightly transit favorable situation if the auto were used as the feeder mode.

The survey questionnaire allowed automobile commuters to tell whether or not they could have used the busway for their last trip and what the reasons for their decisions were. Their responses were:

- 35% said yes, they could have used the busway, but didn't for a variety of reasons
- 36% said no, they couldn't have used the busway, for a variety of reasons
- 29% equivocated on whether they could have or not, or gave no response

The more interesting data are the reasons given; these are tabulated below:

	(%)
Need my Car during the Day	27[1]
Destination Problem	17
Too Many Transfers, Too Slow	15
Inconvenient to Change at El Monte	14
I Like to Drive my Car	10
Have a Good Carpool Arrangement	7
Bus Cost Too High	5
No Explanation	5

Source: All respondents stating they did not use busway

This data seems to support and confirm conclusions previously drawn. The "need car during day" is a large factor limiting penetration. The second, third, and fourth reasons are probably all one, representing persons whose origin/destination patterns are not serviceable by bus. These are probably the non-downtown destinations that are the extreme low points on the mode split curve. The "like to drive my car" percentage

[1]The 24% quoted earlier was in response to a specific question on this issue and was based on the random sample.

indicates that this is still a factor in mode choice, even though our attitude measure ("enjoy driving") failed to discriminate between auto and transit users in the Fall Survey.

Mode Split Function and Attitude

We have previously concluded that mode split is affected by attitude. Figure 25 shows the applicable mode split curve (previously depicted in Figure 24) for commuters with different attitudes toward transit. These graphs show dramatically the scale of the attitude effect on mode choice.

Historically, mode split functions have been shown to vary with income. The Fall Survey data indicate this income effect. However, there was an insufficient number of survey returns to illustrate this difference graphically.

MARKETING SUMMARY

It may be helpful to summarize the major findings from the survey results at this point in the report.

- The patronage increase shown in the time series data is almost totally from former auto users living in the served-now area, most of whom have switched to park-ride at El Monte.

- Transit market share in the San Bernardino Freeway corridor is higher than elsewhere in the region. Thus, the LARTS mode split curve cannot accurately be checked.

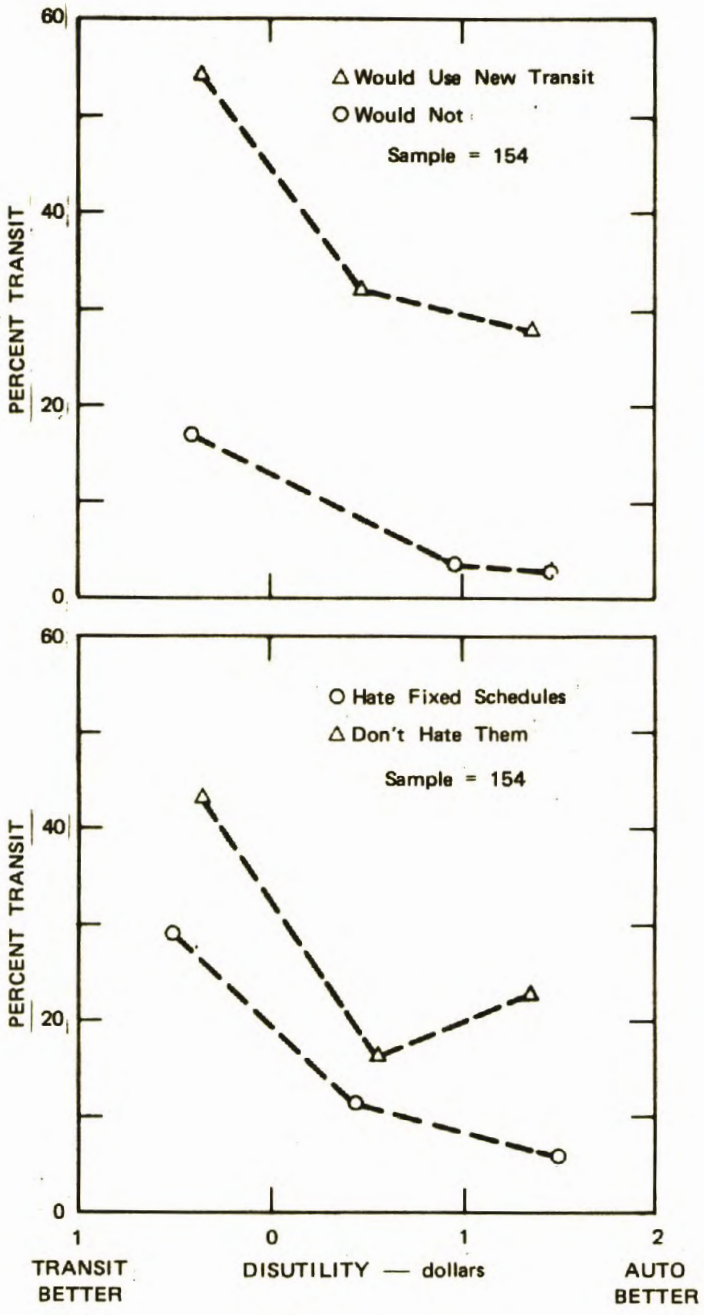

FIGURE 25 MODE SPLIT VERSUS ATTITUDE

- The mode split data imply that the busway form of rapid transit is not inferior to rail rapid transit in terms of ridership attraction. This statement cannot be generalized to other busways. The success in patronage growth of this busway must be noted relative to (a) the type of service provided (suburb-to-downtown), (b) the demand level, and (c) the comparatively high transit market share traditionally enjoyed by SCRTD in this corridor.

- The disutility function as currently applied does not seem to properly deal with the problem of excess time. There is high psychological cost to congested freeway automotive travel that is not represented in the disutility value computation.

- The primary causal factors behind the strong auto to bus diversion is this psychological cost of auto commuting on a congested freeway. Should this congestion be removed (e.g., by adding highway capacity) the busway patronage growth would be halted or even reversed.

- The value of time applicable to commuters in this corridor appears to be a much larger value than that being used in the LARTS model.

- There are significant attitudinal factors at play in the mode choice process. We are only beginning to learn something about these.

VII. BENEFIT-COST EVALUATION

The identification and scheduling of costs and benefits over time is an important part of evaluating the overall implications of a major project such as the San Bernardino Busway. However, both costs and benefits are difficult to identify precisely because data is needed from a number of agencies involved in the project, because the size and timing of future costs is uncertain and because many of the benefits can only be estimated. Thus, the confirmation of data requirements for the benefit-cost analysis during the Phase I effort is especially important so that additional data collections can be organized during Phase II. In addition, priorities for the collection of the more important cost and benefit data can be identified.

The types of costs and benefits that are important to the evaluation of the busway are those that distinguish between 1) those continuing or new costs that would have been incurred without the busway, and 2) the additional costs and benefits, using a "before" and "after" approach, that can be expected with the busway. Not all costs and benefits (social or environmental) can be reduced to dollar terms, so the emphasis of the following discussions will be on quantifiable benefits related to the corridor and busway operation. However, project costs or benefits such as reduced air pollution, increased noise in the off-freeway routes, etc., will be considered in the final analyses.

Economic analyses involving decision-makers in many agencies require that the alternatives be evaluated from a broader viewpoint than that required from a single agency or de-

cision-making group. The following discussion aims at providing the broader orientation, but is also organized so that single agency evaluations can be based on the same data. The broader viewpoint, for example, might be concerned with the overall travel efficiency in the corridor. A single agency question might be oriented toward determining, from a highway construction viewpoint, at what point it is more advantageous to add more lanes for buses than for cars.

The benefit-cost analyses will be completed in the Phase II effort, so the objectives of the following presentations are to 1) identify busway costs and benefits to date, 2) confirm the adequacy of available data for the benefit-cost analyses, and 3) identify additional or new data required to complete the final analyses.

BUSWAY COSTS

The major busway cost categories are presented in terms of administrative, construction (including right-of-way acquisition), busway maintenance, capital equipment (buses and control equipment), and incremental fleet operating costs. Some of these costs are known now - some are not known now and will be difficult to document even in Phase II. However, this is not an unusual situation in so broad an analysis. The important costs will either become available in Phase II or can be estimated with sufficient accuracy so that the overall project evaluation will not be seriously affected.

The basic approach in the cost compilation is to use available reports and data on costs to 1) identify major categories and 2) to schedule expenditures over time. Some

costs are easily identified and are known to have been incurred during a particular year. Others, while easily identified, are spread over several years. In these instances, estimates were made of the amounts that should be assigned to each year. For example, construction costs for a part of the project were spread over two years. For these cases, costs assigned to each year were made in proportion to the number of months spent on constructing the project during that year. Thus, the construction project was assumed to have started when the contract was officially approved, and terminated when the project was officially accepted.

Administrative costs are broken into planning, design and management. Project evaluation costs are not included.

Most of the administrative costs have been estimated for inclusion in Table 14 based on well recognized rules of thumb. Estimates were used since so many agencies were involved with planning, design, and management, estimating their total was deemed to be a more accurate approach than trying to extract such costs from multiple agency records, etc.

Busway maintenance costs (the lanes and ramps) and the incremental costs of operating the new busway fleet have also been based on cost models from earlier operating experience.

A preliminary listing of costs is presented in Table 14. The costs are presented for the period of initial implementation of the busway only, and it is anticipated that new costs and/or cost savings will be added during the Phase II analysis. Furthermore, in accordance with Phase I objectives, it is expected that most of the costs in Table 14 will be subject to confirmation and adjustment as specific accounts are closed out and as final construction contracts are signed.

Table 14

COST SCHEDULE
($000)

		1969	1970	1971	1972	1973	1974	1975	Total
I.	Administrative								
	Planning	300	300	----	----	----	----	----	600
	Design		2,000	3,000	2,000	1,000	----	----	8,000
	Management, etc.		33	100	150	150	100	----	533
II.	Construction								
	Right of Way		4,720	3,445	3,270	----	----	----	11,435
	Express Lanes & Ramps		----	----	10,100	14,750	7,325	----	32,175
	Streets		----	----	----	460	300	----	760
	Stations & Lots		----	----	945	450	1,500	----	2,895
	Maintenance Facilities		----	----	----	----	1,900	----	1,900
III.	Busway Maintenance		----	----	----	6	6	10	?
IV.	Capital Equipment Costs (Buses & Control Equipment		----	----	----	5,781	----	----	5,781
V.	Incremental Fleet Operating Costs								

Following an extension and updating during Phase II, the cost scheduling will be extended to cover the full time period chosen for the benefit-cost analysis. After that period, costs for additional new buses and confirmed operating and maintenance costs will be added to the schedule. In addition, a further aggregation or subdivision of the cost categories shown in Table 14 can be made to improve the utility of the cost breakdown for future decision-makers.

BENEFITS

Auto User Savings

The rationale for including auto user savings in the busway benefit-cost analysis stems from the diversion of automobile commuters to transit, reducing the total auto traffic on the freeway and increasing speed and time savings for the remaining drivers.

As shown earlier in Figure 10, Section III, the traffic volumes on the freeway have been at or near maximum capacity for the last ten years. Volumes have ranged from about 140,000 to 170,000 vehicles per day in both directions. This volume is so high that speeds during the peak hours have been unstable, with the maximum speeds being between 30 and 35 mph. Such a congestion corresponds to a level of service rating of "E", which is used to designate a full capacity, unstable flow, traffic condition.[1]

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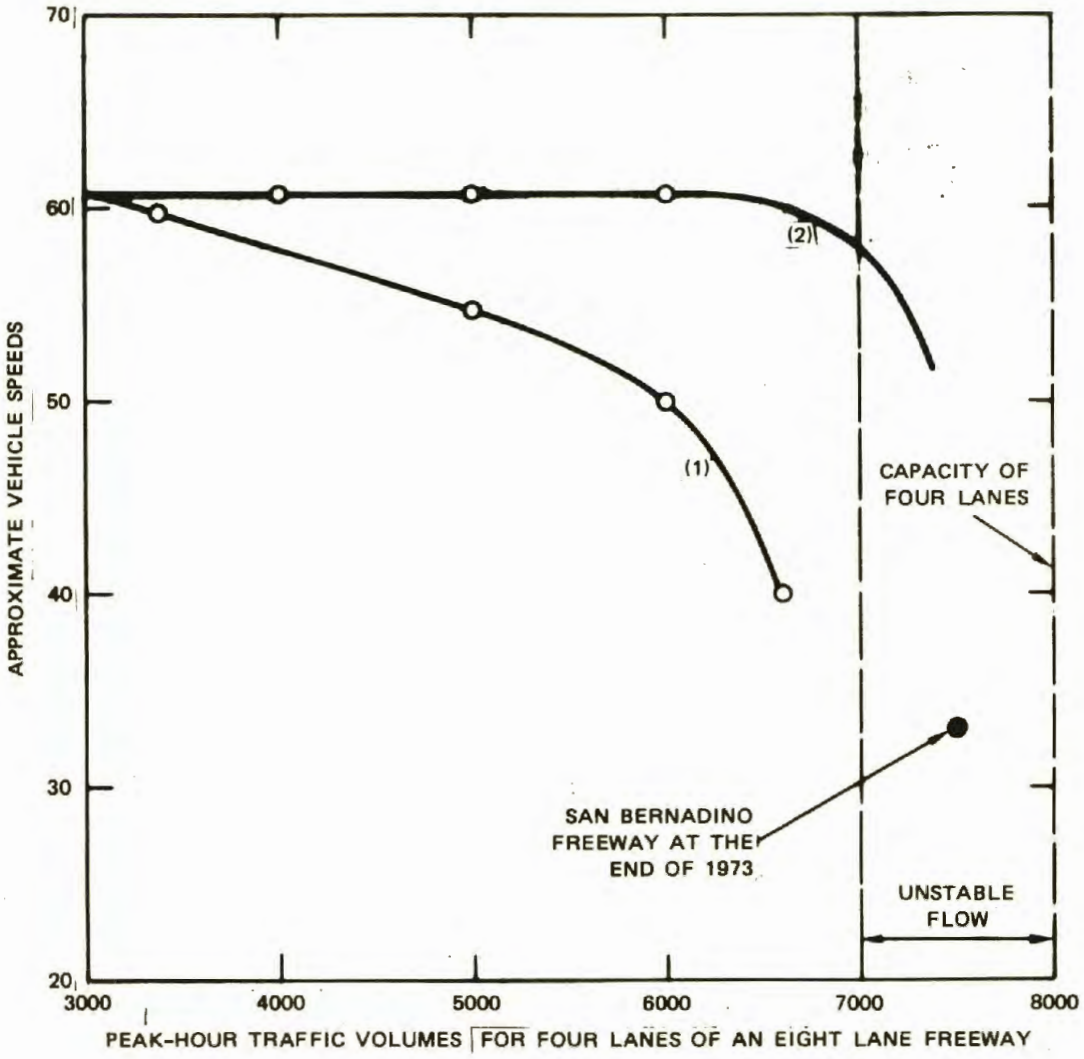
[1] Highway Capacity Manual

Figure 10 also shows that the volumes in 1973 have been falling slightly and are now very close to borderline between service levels "D" and "E", where "D" is described as "approaching unstable flow" with speeds of 40 to 45 mph. The implication of this borderline condition is that, if the busway were able to draw even a small number of drivers from their cars, freeway speeds might increase sufficiently to cause a significant savings in travel time to the remaining auto users.

To indicate the volume-speed relationship more clearly, Figure 26 shows peak hour, volume-speed relationships for four lanes of an eight-lane freeway. Two curves are shown. One is based on national statistics; the other on data taken in Los Angeles. Either curve indicates that higher speeds occur when traffic volumes are low, and speeds drop off sharply at the higher volumes (6000 to 7000 vehicles per hour). At volumes higher than 7000 vehicles per hour, the speeds become increasingly unstable and, at capacity, vary between zero and 30 mph. The San Bernardino Freeway peak hour volume is about 7500 vehicles.

Figure 26 indicates that the current peak hour volume of traffic on the freeway is in the unstable, 30 to 35 mph flow range. It also shows that if the busway ridership resulted in a vehicle volume drop of 1500 vehicles (all other conditions remaining constant), freeway speeds might increase to 60 mph, based on the speed volume curve provided by Caltrans. That is, with moderate volume decreases, speed and time savings due to the busway could increase markedly. The only questions remaining about auto user savings are 1) how many auto drivers have switched to the busway?", 2) what is the current and potential impact of their action on remaining auto users?, and 3) how should one account for other factors such as freeway speeds increasing



SOURCE: (1)Highway Capacity Manual 1965 (drawn from national statistics) and (2)Cal Trans (based on Los Angeles area data)

FIGURE 26 | APPROXIMATE VOLUME-SPEED RELATIONSHIPS

so much as to draw drivers who formerly were driving on other more circuitous routes?

First, by the end of 1973, about 4000 peak period commuters (or about 730 in the peak hour) were using the busway. Approximately 80%, or 580, or these peak hour riders had been driving prior to initiation of the busway service and must have made the choice between the auto and busway commute. However, some may have been riding in carpools with other drivers, so the estimated number of peak hour drivers attracted to the busway commute is about 450, based on a ratio of 1.3 persons per auto.

Looking back at Figure 26, the implication of the Caltrans curve is that the diversion of 450 peak period automobiles should cause a significant improvement in speeds. However, no such improvement occurred. This could have been caused by an offsetting increase in trip making or a diversion of existing trips from parallel arterials onto the freeway. The only other possibility is that the speed-volume relationship degrades faster, above 6500 vehicles than is depicted by the Caltrans curve and the relationship is insensitive to a 450 vehicle decrease.

The lower (national) curve of Figure 26 leads to a more conservative estimate of auto travel time savings and we have used this more conservative estimate in this analysis.

The national curve shows (for volumes between 6000 and 7000 vehicles per hour) that for every reduction of 50 vehicles per hour, speeds might increase as much as 1 mph. However, for volumes between 7000 and 8000 vehicles per hour, speeds can be highly erratic, so we have no easily identifiable

relationship between volume and speed. We do know that the curve in this area is not nearly so steep as that between 6000 and 7000 vehicles per hour, except that when the capacity of the freeway is reached, speeds are likely to be falling fairly rapidly. Thus, for purposes of this analysis, it is assumed that a reduction of 150 vehicles per hour would be required to permit a 1-mph speed increase over the 7000 to 8000 vehicles-per-hour range. This is about one-third the rate estimated above for the 6000 to 7000 vehicles-per-hour range.

Given a 450-vehicle reduction due to the busway, speeds at the end of 1973 would then be calculated to have increased 3 mph. Caltrans speed measurements taken in the spring and fall of 1973 indicate that such a 3 mph speed increase did not occur. As stated above, either the peak period volumes did not decrease or the speed-volume relationship is insensitive to small volume changes in the 7000 to 8000 vehicles per hour range. The more logical conclusion is that additional auto users joined the peak period freeway traffic either as new trip makers or by diverting themselves from alternative highway routes. In either case, there would be a benefit to remaining auto users in that if the 450 auto-to-busway diversions had not occurred, speeds would have degraded further, supposedly by 3 mph. The other possibility is that some users would have been forced back onto slower alternative routes. In either case, there would be a benefit and this benefit can best be calculated by making the simplistic assumption that 450 cars are diverted from the freeway flow and the flow speed changes by 3 mph.

Using this assumption for computations time savings for the remaining automobile traffic over the completed seven-mile

section would be 1.25 minutes for about 7000 automobiles, or about 9000 commuters. At travel savings of $2.00 per hour, these savings amount to $2,100 per day for a 5.5 hour peak period.[1] Using a 254 workday year, the annual savings amount to about $530,000 per year at the $2,100-per-day rate. For the partial year of 1973, the savings were approximately $35,000 prior to the opening of the El Monte station and approximately $160,000 after the station opened.

This is only the first year of operation for the busway, and Figure 11, shown earlier, indicates that busway ridership is on a steep part of the growth curve. Furthermore, the busway is not even complete yet, so many more riders can be anticipated in the future, and the auto commuter savings can be expected to rise accordingly.

The attraction of another 500 drivers to the busway could cause freeway speeds to increase dramatically. Obviously, the higher speeds then will result in much higher auto user savings.

The identification of more accurate techniques for assessing the magnitude of such savings will be part of the Phase II effort. Included in these future savings will be a reduction in auto accidents based on reduced vehicle mileages.

Busway User Benefits

For purposes of the following discussion, "busway users" are defined as those commuting by the busway as of 31 December 1973. This definition pinpoints one number in the constantly

[1] However, Section VI shows that the $2.00-per-hour figure, an average value based on the "one-fourth of income" assumption, understates the true value of time, probably by as much as $2.00 per hour. Thus, the benefit computation shown here would appear to be highly conservative.

changing number of busway users at the end of the first year of operation.[1] It also permits an identification of specific numbers of busway users in each of several categories for which different user benefits must be calculated.

Figure 27 shows the total number of commuters in the busway corridor, broken down by number of commuters in each of several categories. The numbers of commuters in each category as of the end of the year are listed. Other commuter counts could be listed to represent conditions at any other point in time, say, as of 15 July 1973, when the El Monte terminal was opened.

Prior to discussing these user categories and benefits, several comments about Figure 27 are appropriate.

First, the numbers of trip makers in each category are peak hour and peak direction, auto occupants or busway riders. The number of auto riders is derived from the number of peak hour, peak direction vehicles (7500), the 5.5-hour peak period, and the 1.3 auto occupancy figures developed earlier in this report. The 4000 busway users are also peak period riders. The peak period is selected for the Phase I analysis of benefits since the busway was developed primarily to assist with peak period volumes and most benefits will be derived from the peak period analysis.

This approach misses several classes of trip makers. For example, the approach excludes two types of non-project trips - those using the busway but traveling past the downtown area and those coming from outside the project corridor to use the busway. Appendix A further describes the first type, but both types are small and will result in a minor understatement of project benefits.

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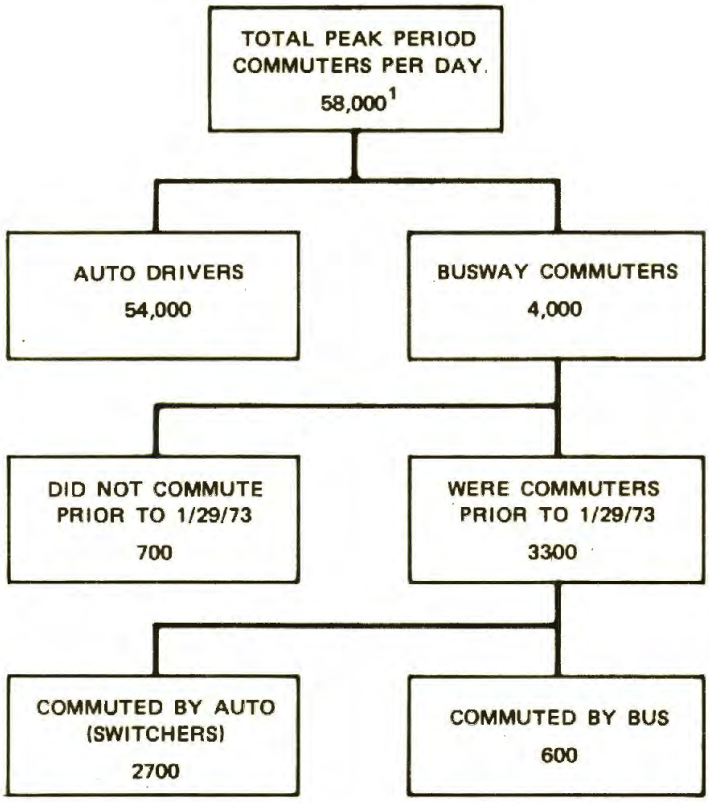
[1] Actually, the busway did not open until 29 January 1973, so it is not quite a full year to 31 December 1973.



[1] = Number of Commuters Cited as of 12/31/73

FIGURE 27 BENEFIT CATEGORIES, CORRIDOR COMMUTERS

was introduced. Thus, there are at least three categories of busway users for which different benefit calculations must be made:

- The 700 busway riders who were not commuters prior to busway services
- The 2700 busway riders who were commuting by automobile prior to the busway
- The 600 busway riders who were commuting by bus prior to the busway

a. Non-Commuters Prior to 29 January 1973

This is a category of new commuters to the downtown or larger Los Angeles area. As such, they were faced with the same automobile-or-busway decision that is facing all other corridor commuters. Thus, this group may be viewed as identical to the "switchers" category both in terms of the decision they faced and the decision that they made. Consequently, for purposes of analyzing benefits, this group of 700 is added to the switcher category discussed below.

b. Auto Commuters Prior to 29 January 1973.

This is and will continue to be the largest category of busway users. At the end of the first year of service, they numbered 2700 riders. For purposes of analyzing benefits, another 700 is added to this group, as explained above.

The daily benefits for switchers (and former bus commuters) are detailed in Table 15 by type of trip, i.e., park-ride,

Table 15

DAILY USER SAVINGS
(by traveler group and origin of saving)

	Travel Time @ $2.00/hr.	Excess Time @ $5.00/hr.	Parking Savings
Former Auto Commuters (Switchers)			
Park-Ride	+ $0.37[1]	- $0.36[2]	$0.03[5]
Kiss-Ride	0.37	- 0.03[3]	0.13[6]
Walk-Ride	0.37	- 0.44[4]	0.13
Former Bus Commuters			
Park-Ride	$0.70[7]	$0.25[8]	- $0.10[9]
Kiss-Ride	0.70	0.25	None
Walk-Ride	0.70	0.25	None

[1]Based on a 51 minute former auto, round trip time (see p. 97), a current 40 minute busway round trip time (see p. 48), and a $2.00/hr. value of time.

[2]Based on a time increase from 3.7 for auto commuters to 8.0 minutes for the park-ride trip.

[3]Based on a time increase from 3.7 for auto commuters to 4.0 minutes for kiss-ride trips.

[4]Based on a time increase from 3.7 for auto commuters to 9.0 minutes for a walk-ride trip.

[5]Based on an average 13¢ cost saving downtown (see note 6 below) and an added 10¢ cost at the El Monte station (see note 9 below).

[6]Based on an average 13¢ cost for all commuters where most of those outside the CBD have free parking available.

[7]Based on the 61.3 minute round trip time for pre-busway buses, the 40 minute round trip time for the busway (see p. 48), and the $2.00 per hour value of time.

[8]Based on a 3 minute time saving due to the increased frequency of the busway operation (see Figure 20).

[9]Based on a $2.00 parking sticker cost and 21.2 working days per month.

kiss-ride, or walk-ride. For the switcher group, there are some travel time savings, added costs due to increases in the walking and waiting times (excess time), and some parking savings. A weighted savings for the switcher group, assuming 50% are park-ride trips and 10% are walk-ride trips, is about $0.21 per commuter. Given a switcher group of 3400, the rate of time and parking savings for this group is $710 per day. To this must be added the auto operating costs minus the busway fare costs.

The average switcher previously drove 19.8 miles to work and now drives about 5.4 miles to the El Monte station. Thus, he saves 14.4 miles one way or 28.8 miles on a round trip basis. At an automobile operating cost of $0.071 (See Table 7), this amounts to $2.04 per day. This savings is partially offset by his new busway fare of about $1.18 per day ($25.00 per month for a commuter pass), for a net savings of $0.86. Daily savings for the 3400-switcher category is therefore about $2900 per day, assuming the rider is able to take full advantage of the monthly pass.

Daily time, parking, and auto operating savings for the switcher category was $710 plus $2910, or about $3610 on 31 December 1973. This rate was effectively zero on 28 January 1973, growing moderately until the El Monte station opened, when it started rising rapidly to the $3610-per-day rate at the end of the year. Estimates for the pre and post El Monte time periods are $60,000 and $270,000, for a total of $330,000 since the busway opened.

c. Bus Commuters Prior to 29 January 1973.

This is the group that was commuting by bus prior to the initiation of the busway service. It is a group of riders that

is diminished by people who have moved, who have found new jobs that do not require the bus commute, etc. It has been estimated that these losses are about 3% per month and that, by 1983, this group will have disappeared statistically.

Table 15 shows that the former bus commuters are saving travel time and excess time for the faster, more frequent, busway service. The park-ride group, however, is paying a new parking charge which was initiated at the El Monte station after the busway service began. The weighted savings for all groups in this category is estimated to be about $0.90 per commuter per day.

As mentioned above, this is a category which diminished from the level at the initiation of the busway service to about 780 at the end of the year. Thus, for the first year of operation of the busway, the savings for this commuter category was about $190,000. Using the 3% per month attrition rate estimated earlier, the annual benefit to this group can be calculated at this time and confirmed during the Phase II evaluation.

Summation of Benefits

First-year savings for users of the busway corridor are shown in Table 16 in a format similar to that for busway costs, shown earlier in Table 14. Additional line items for savings can be expected for 1974 and later years due to automobile operating cost changes stemming from recent fuel price increases, fare increases due to rising labor costs, etc. Such changes should be reflected in the savings categories up to the year chosen as the base year for the final benefit-cost analysis (say, 1 January 1975). No inflationary changes will be projected beyond that base year

Table 16

BENEFIT SCHEDULE
($000's)

		1973	1974	1975	1976	1977	1978
I	AUTO USER SAVINGS						
	Pre El Monte opening	$ 30	-	-	-	-	-
	Post El Monte opening	120					
II	BUSWAY USER SAVINGS						
	Pre-busway users	$190	$130	$ 93	$ 66	$ 46	$ 32
	Pre-busway auto drivers						
	Pre El Monte opening	60	-	-	-	-	-
	Post El Monte opening	270					
	TOTAL	$670					

unless large disparities between the inflation rates for different categories (such as fuel costs and labor rates) are anticipated.

Table 16 shows first year savings of $150,000 for auto users in the corridor, $190,000 for pre-busway bus users, and $330,000 for switchers. All of these benefit categories are of the same order of magnitude now, but can be expected to change radically as the busway operation matures. For example, the pre-busway bus user category will probably disappear due to attrition during the period chosen for the benefit analysis. Both the auto user benefits and the switcher benefits can be expected to increase as busway ridership increases, but at quite different rates.

The earlier analysis shows that benefits accruing to switchers will probably increase linearly with the category size. On the other hand, auto user benefits may increase non-linearly since they are quite sensitive to reductions in the number of freeway drivers. Moderate decreases in the freeway traffic volumes could result in large speed and travel time savings. Thus, the auto user benefit category could easily become the predominant source of benefits. Both the method of analysis and possible relationships between freeway volumes and busway ridership will be given careful attention during Phase II.

ADMINISTRATIVE AND OPERATING SAVINGS

The busway evaluation must include an analysis of the impact of the introduction of busway service on SCRTD operations. These considerations will not have a significant effect on the benefit-cost analysis, but are of concern to any operator

who may be faced with the provision of bus rapid transit service. These considerations include manpower scheduling efficiencies, per-mile unit costs, depreciation, etc.

Manpower scheduling efficiency can be evaluated in a number of different ways. One method would be to analyze the overall efficiency before and after the busway service was initiated. A second method would be to analyze the efficiency of the various types of bus runs or trips to identify those trips for which scheduling difficulties were experienced. Both evaluations would be helpful in understanding the effect of the busway operations on manpower efficiency.

Most of the data needed for the above calculations is presented in Table 17. These data are presented first in general breakdowns of (1) an average scheduled day's work, and (2) daily manpower requirements. The scheduled day's work is further broken down by various pay categories for straight runs, split runs, non-biddable trippers and biddable trippers, and for four points in time: 29 January 1973, 8 April 1973, 17 June 1973, and 15 July 1973. The daily manpower requirements for the same time period and type of run are identified by bus line or route. Note that the complete data on manpower requirements for the split run category were not available in time for inclusion in this report. This temporary data void prevents an evaluation of possible scheduling efficiency changes for the overall fleet. It does not, however, prevent some limited comments on the efficiency for the different types of runs or trips.

One measure of manpower efficiency can be identified by the percentage of scheduled pay hours to platform time. Pay hours are the numbers of hours paid at regular wage rates. A driver working for two hours at "time and a half" would

Table 17

TRANSIT MANPOWER SCHEDULING

	STRAIGHT RUNS[1]								SPLIT RUNS							
	Avg. Time in run platform 1-29-73	% of	Avg. Time in run platform 4-8-73	% of	Avg. Time in run platform 6-17-73	% of	Avg. Time in run platform 7-15-73	% of	Avg. Time in run platform 1-29-73	% of	Avg. Time in run platform 4-8-73	% of	Avg. Time in run platform 6-17-73	% of	Avg. Time in run platform 7-15-73	% of
Platform Time (vehicle hours) Includes Layover Pull Outs & Pull Ins	8:05	100.0 %	8:24	100.0 %	8:48	100.0 %	8:24	100.0 %	9.0	100.0 %	9.0	100.0 %	10:06	100.0 %	8.58	100.0 %
Sign On & Sign Off Time	:08	1.65	:08	1.59	:08	1.52	:08	1.59	:14	2.59	:16	2.96	:17	2.81	:17	3.16
Travel Time	:11	2.27	:10	1.98	:11	2.08	:07	1.39	:28	5.19	:24	4.44	:27	4.46	:24	4.46
Paid Breaks (Premium)[2]	-	-	-	-	-	-	-	-	:03	0.06	:06	1.11	:03	0.50	:07	1.30
Time to Make 8 Hours (Premium)	:10	2.06	:09	1.79	:09	1.70	:11	2.18	:02	0.04	:03	0.60	:03	0.50	:02	0.37
Overtime Penalty	:17	3.51	:27	5.36	:26	4.92	:15	2.98	:49	9.07	:53	9.81	:53	8.7	:55	10.22
Scheduled Pay Hours	8:51	109.48	9:32	113.49	9:30	107.95	9:18	110.71	10:36	117.78	10:42	118.89	11:54	117.82	10:46	120.07
Difference			+:40	+4.01	-:02	-5.54	-:12	+2.76			+:06	+1.11	+1:12	-1.07	-1:08	+2.25

DAILY (Manpower Requirements)

	REGULAR RUNS			
Line Number	1-29-73	4-8-73	6-17-73	7-15-73
52	12	12	12	12
53	18	18	18	11
60[3]	28	23	23	23
63	10	10	10	11
69	3	3	3	3
	71	66	66	
Added Busway Lines				
401				13
402				12
403				6
404				8
405	—	—	—	4
Totals	71	66	66	103
Difference		-5	no change	+37

[1] Analysis of average scheduled days work for lines 52, 53, 60, 63, & 69 before & after busway.

[2] Continuous time (subject to overtime) to satisfy spread provisions & minimum break provisions of contract.

[3] Includes Div's 9-11 & 13.

Table 17 (continued)

EXTRA BOARD [1]

Platform Time (vehicle hours) Includes Layover Pull Outs & Pull Ins	Avg. Time 1-29-73	% of Comb Platform	Avg. Time 4-8-73	% of Comb Platform	Avg. Time 6-17-73	% of Comb Platform	Avg. Time 7-15-73	% of Comb Platform
	6:36	100.0 %	6:00	100.0 %	6:18	100.0 %	5:34	100.0 %
Sign On & Sign Off Time	:14	3.54	:14	3.89	:16	4.23	:29	8.68
Travel Time	:16	4.04	:14	3.89	:17	4.50	:46	13.77
Paid Breaks (Premium) [2]	2:23	36.11	2:18	38.33	2:15	35.71	2:56	52.69
Time to Make 8 Hours (Premium)	-	-	-	-	-	-	-	-
Overtime Penalty	:58	14.65	:41	11.39	:52	13.76	:54	16.17
Scheduled Pay Hours	10:27	158.33	10:00	166.67	10:30	166.67	10:43	192.51
Difference			-:27	+8.34	+:30	no change	+:13	+25.84

BIDDABLE TRIPPERS

Platform Time (vehicle hours) Includes Layover Pull Outs & Pull Ins	Avg. Time 1-29-73	% of BID Platform	Avg. Time 4-8-73	% of BID Platform	Avg. Time 6-17-73	% of BID Platform	Avg. Time 7-15-73	% of BID Platform
	1:48	100.0 %	1:54	100.0 %	1:48	100.0 %	1:42	100.0 %
Sign On & Sign Off Time	:15	13.89	:15	13.20	:15	13.89	:15	14.71
Travel Time	:17	13.89	:15	13.20	:13	12.04	:22	21.57
Paid Breaks (Premium) [2]	-	-	-	-	-	-	-	-
Time to Make 8 Hours (Premium)	-	-	-	-	-	-	-	-
Overtime Penalty	1:10	64.81	1:08	59.65	1:09	68.39	1:10	68.63
Scheduled Pay Hours	3:30	194.44	3:24	178.95	3:26	190.74	3:29	204.90
Difference			-:06	-15.94	+:02	+11.79	+:03	+14.16

DAILY (Manpower Requirements)

NON BIDDABLE TRIPPERS

Line Number	1-29-73 AM	1-29-73 PM	4-8-73 AM	4-8-73 PM	6-17-73 AM	6-17-73 PM	7-15-73 AM	7-15-73 PM
52	3	2	3	2	3	2	2	4
53	5	5	5	5	5	5	3	3
60 [3]	1	-	-	-	-	-	4	-
63	3	4	3	4	3	4	5	3
69	-	-	-	-	-	-	-	1
Added Bus Lines	12	11	11	11	11	11		
401							4	5
402							3	4
403							3	1
404							-	-
405							3	1
Totals	12	11	11	11	11	11	27	22
Difference			-1	no change	no change		+16 [4]	+16

BIDDABLE TRIPPERS

Line Number	1-29-73 AM	1-29-73 PM	4-8-73 AM	4-8-73 PM	6-17-73 AM	6-17-73 PM	7-15-73 AM	7-15-73 PM
52	3	2	3	2	3	2	3	3
53	6	4	6	4	8	4	2	3
60 [3]	1	3	2	2	4	4	6	6
63	4	3	4	3	4	3	-	3
69	-	-	-	-	-	-	-	-
Added Bus Lines	14	12	15	11	19	13		
401							2	2
402							3	2
403							2	1
404							-	-
405							2	3
Totals	14	12	15	11	19	13	20	23
Difference			+1	-1	+4	+2	+1	+5

[1] Analysis of average scheduled days work for all lines - non biddable AM and PM trip per combinations.

[2] Continuous time (subject to overtime) to satisfy spread provisions & minimum break provisions of contract.

[3] Includes Div's 9-11 & 13.

[4] Took five biddable PM and moved them to the nonbiddable category to balance extra board.

generate three pay hours. Platform time is that time when vehicles are in service carrying passengers plus the time consumed in pulling in or out of the garage.

The bottom line in the analysis of scheduled work days shows this relationship between pay hours and platform time. For example, the percentage on 29 January 1973 was 109.5%. The other three points in time show similar percentages of 113.5%, 109.5% and 110.7%. One of the inferences to be drawn from this series is that, over a six-month period of busway operations, only small variations occurred in the pay hours as a percent of operating or platform time.

It is worth noting that the periods of 8 April 1973 and 17 June 1973 were times at which SCRTD divisional reorganizations were accomplished. Thus, these data indicate that the divisional reorganizations have had more of an impact on this efficiency measure than did the busway startup or the opening of the El Monte station on 15 July 1973.

Since the data in Table 17 are not complete, there is little to be gained by further evaluations of efficiency at this time. However, it is anticipated that data in addition to that missing in Table 17 will be available for more detailed analysis in Phase II.

With regard to unit operating costs, it is only possible to identify areas of anticipated change until such time as the operational changes are completed in mid-1974. For example, unit costs per bus mile will continue to change with further reductions in trip time. Reductions in labor cost, direct operating supplies, and depreciation may occur, but may also be offset somewhat by wage increases and increased

fuel and tire costs. For example, the labor cost component per bus mile has already dropped as a result of decreased round trip times of 20 minutes from El Monte to Los Angeles. Additionally, depreciation was previously based on 40,000 miles per year of operation for each bus. With decreased round trip schedules, the busway vehicles may accumulate more than 40,000 miles per year so that depreciation charges would change.

Some marginal operating cost changes are known now and will be used in the final analysis. They include the following:

		Before 12/3/73	After 12/3/73
1	Wages	$4.86/hr	$5.32/hr
2	Fringe Benefits	38% of wages	38% of wages
3	Direct Operating Supplies	10¢/mi @ 8-12 mph 8¢/mi @ 13-17 mph 6¢/mi @ 18-22 mph	? ? ?
4	Insurance	6¢/bus mi	6¢/bus mi
5	Depreciation	$1,450/bus/yr 40,000 mi/yr operation	?
6	Maintenance and Indirect Costs	15% of Items 1 thru 5	15% of Items 1 thru 5

The two time periods above are a reflection of the date when new wage scales became effective. A later period, about mid-1974, is another point at which wage negotiations will be held and, at which time, some other unit cost changes might be made.

The results of these changes will be applicable to the annual operating costs required for Table 14 as well as having an effect on the analysis of unit cost changes in the SCRTD operations. Thus, the benefit-cost analysis of Phase II will also be affected by these changes.

BENEFIT-COST ANALYSIS SUMMARY

Costs for all busway elements have been collected and placed into the time scheduled format for the benefit-cost analysis. Order-of-magnitude cost estimates for the remaining elements have been made subject to confirmation in Phase II. Thus, most of the cost analysis is complete and data are available for the Phase II analysis.

First-year benefits have been calculated based on values of time from the LARTS model, busway ridership data, freeway traffic data, and data from the population file, Fall Survey. This preliminary, peak period, benefit analysis was completed for three categories of corridor commuters for whom different benefit analyses are needed. They are the current and future auto commuters and busway users who (1) switched from commuting by auto and (2) were bus commuters prior to initiation of the busway service.

The results of the benefit data collection and analysis indicate that:

- Collection of cost data will present no problem in Phase II

- Most of the benefits will probably accrue to auto commuters and to auto drivers who switch to the busway

- The benefit analysis is very sensitive to freeway traffic reductions due to auto-to-transit diversion. Thus, Phase II data collections might include improved corridor screenline counts and improved attrition rates for pre-busway bus riders who move,

change jobs, or for other reasons, stop commuting by bus

- Caution will be required in the final selection of values, estimates, etc., used in developing all benefits for the final analysis

- The incorporation of busway runs into the SCRTD system does not appear to have adversely affected manpower scheduling

Finally, no new or difficult analyses have been identified as necessary to the Phase II analysis. Limited additional data collection appears desirable, but is well within the anticipated scope of the Phase II evaluation.

APPENDIX A

TRANSIT RIDER ATTRIBUTES

INTRODUCTION

Herein is a list of tables and figures that describe pre-busway transit rider attributes discussed in Section IV and based on the April, 1972, on-board survey. The tables are grouped according to principal topics delineated in the text:

- Profile of the transit rider
- Description of trips
- Degree of influence of availability of transit on home selection
- Relationships between transit advertising, provision of information, and transit rider type

PROFILE OF THE RIDER

The majority of riders sampled during an on-board survey of riders westbound on RTD buses through the San Bernardino Freeway corridor during April, 1972[1] tended to be females 40 years old or older, and to have incomes of less than $10,000. The characteristics found

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[1] See on-board questionnaire at end of Appendix.

in the sampled population were like those of the "captive" transit rider population, i.e., those persons with the best access and ability to use the principal alternative to public transportation, the automobile. These persons tend to take transit not by choice, but by necessity as it is the only means available for going places.

Table A-1
RIDER PROFILE

Sex	%	(n)[1]	Age	%	(n)	Income	%	(n)
M	34.5	1249	20	11.7	422	$5,000	24.8	733
F	65.6	2369	21-29	22.7	82.	$5-10,000	30.9	912
			30-39	14.0	507	$10-15,000	24.2	713
			40-49	18.1	655	$15-30,000	18.5	547
			50-64	27.9	1007	$30,000	1.6	46

The following tables show that over half of the transit riders sampled did not have access to a car. For 15.2%, use of an automobile adversely affected other household members. Of equal importance, however, is the fact that the remaining one-third are "choice" riders, meaning that the SCRTD service, even prior to the busway, was superior to automobile travel for a significant number of persons.

Table A-2
AUTO AVAILABILITY

Auto Available?	%	(n)
Yes	32.0	1198
Yes, but	15.2	571
No	52.8	1977

(1) n = Sample Size

As shown in the tables below, persons most often without the choice of traveling by auto tended to be female, among the young or old, and among the lower income groups. Again, it is important to note, however, that there are significant numbers of choice riders in all socio-economic categories.

Table A-3
AUTO AVAILABILITY BY SEX

Auto Available?	Male %	Male (n)	Female %	Female (n)
Yes	38.7	498	28.3	688
Yes, but	19.6	253	13.0	315
No	41.7	537	58.7	1427

Table A-4
AUTO AVAILABILITY BY AGE

Auto Available?	<20 Years %	<20 Years (n)	20-29 %	20-29 (n)	30-39 %	30-39 (n)	40-49 %	40-49 (n)	50-64 %	50-64 (n)	65+ %	65+ (n)
Yes	23.2	97	26.5	217	36.8	186	39.6	258	33.9	339	28.6	58
Yes, but	19.6	82	17.6	144	13.9	70	13.5	88	15.0	150	11.3	23
No	57.2	240	55.9	458	49.3	249	46.9	305	51.1	512	60.1	122

Table A-5
AUTO AVAILABILITY BY INCOME

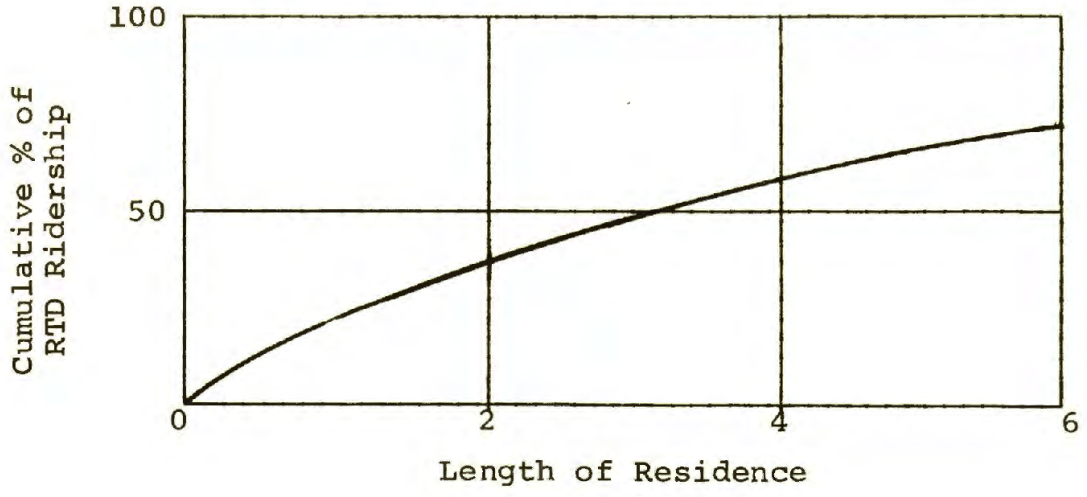
Auto Available	<$5,000 %	<$5,000 (n)	$5-10,000 %	$5-10,000 (n)	$10-15,000 %	$10-15,000 (n)	$15-30,000 %	$15-30,000 (n)	$30,000+ %	$30,000+ (n)
Yes	21.5	157	32.3	293	38.2	271	43.8	239	39.1	18
Yes, but	13.0	95	15.3	139	16.5	117	20.9	114	19.6	9
No	65.5	479	52.3	474	45.3	321	35.3	193	41.3	19

Approximately 65% of the RTD's ridership as sampled on the on-board survey have lived at present locations two or more years, while about 44% have lived at current addresses for five or more years. However, the graph below indicates that during April, 1972, the RTD received a proportionate share of commuters of all lengths of residence. In fact, other analyses of the data revealed that trip frequency was essentially not correlated (R = -.0366) with length of residence.

Table A-6
LENGTH OF RESIDENCE

	%	(n)
1 year	21.3	777
1-2 years	13.3	485
2-5 years	31.7	795
5 years	43.7	1599

Cumulative % of RTD Ridership
by Length of Residence



An examination was also made of whether transit rider attributes vary by geographic location of trip destination. To perform this analysis, riders were separated into two groups:

- The busway market - persons deboarding east of the Long Beach Freeway at points which are near the planned sites of the college and hospital busway stations or in the Los Angeles downtown area

- The non-busway market - people deboarding at all other points. 2160, or about two-thirds, fell in the busway market; 1000, or about one-third, fell in the non-busway market. Nearly all of the busway market represents trips to the Los Angeles downtown area

The following characteristics of both groups have been looked at: sex, age, income, auto availability, licenced drivers, and length of residence.

On the basis of where riders deboard, there did not seem to be a significant difference in percentages of male and female riders, as shown in the following table:

Table A-7

BUSWAY MARKET BY SEX
(%)

	Male	Female
Busway	36.7	63.3
Non-Busway	30.7	69.3

This lack of difference appears to hold for the busway market and non-busway market when one looks at a spectrum of age groups.

However, persons constituting the busway market tended to have slightly higher incomes than those not traveling to the downtown area.

Table A-8

BUSWAY MARKET BY AGE
(%)

	<20 Yrs.	21-29	30-39	40-49	50-64	65+
Busway	9.1	21.0	14.8	19.6	29.5	6.0
Non-Busway	15.7	24.2	12.3	14.7	26.8	6.2

Table A-9

BUSWAY MARKET BY HOUSEHOLD INCOME
(%)

	<$5,000	$5-10,000	$10-15,000	$15-30,000	$30,000+
Busway	21.2	32.3	24.4	20.5	1.6
Non-Busway	30.2	28.7	23.7	16.0	1.5

The busway and non-busway markets also tended to be somewhat variant in terms of auto availability. Almost two-thirds of the persons not traveling to downtown stated that no auto was available for their trip. Proportionately more persons going dowtown were riding the bus rather than driving by choice; that is, cars were available to over half the busway market riders, but 37% preferred bus to auto travel.

Table A-10

BUSWAY MARKET BY AUTO AVAILABILITY
(%)

	No	Yes	Yes, But Prefer Bus
Busway	47.4	15.6	37.0
Non-Busway	62.7	14.7	22.6

The difference in degree of mode choice between the two markets is further indicated by the percentages of persons with and without drivers' licenses.

Table A-11

BUSWAY MARKET BY POSSESSION OF DRIVER'S LICENSE
(%)

	Yes	No
Busway	63.3	36.7
Non-Busway	52.2	47.8

Persons riding to the downtown area had lived at current addresses slightly longer than had the non-busway market.

Table A-12

BUSWAY MARKET BY LENGTH OF RESIDENCE
(%)

	1 Yr.	1-2 Yrs.	2-5 Yrs.	5+ Yrs.
Busway	19.6	13.3	22.8	44.4
Non-Busway	23.6	12.7	19.4	44.3

DESCRIPTION OF TRIPS

The tables and figures below illustrate the intensity of trip destination locations and define relationships between trip frequency, trip purpose, and the socio-economic characteristics of persons sampled during the on-board survey.

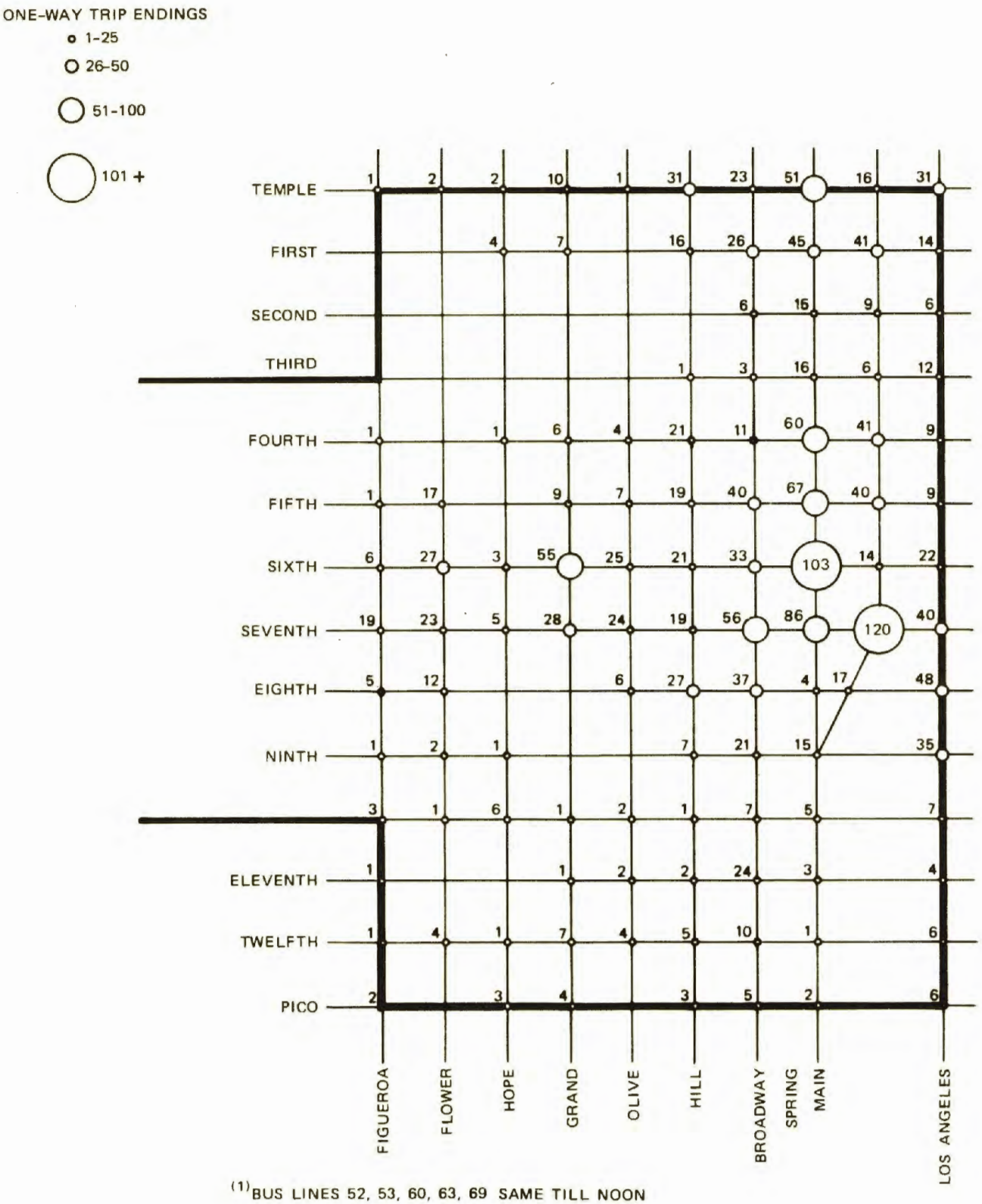
It is clear from the RTD destination figures that the prime busway market was comprised of trips to the central business district and to areas immediately east and south. On each of the lines the ratio of CBD destinations to others was at least 2:1.

Table A-13
ALIGHTING LOCATIONS BY BUS LINE (1)

	Line					Total	
Alighting Location	52	53	60	63	69	(n)	%
Before CBD	162	296	3	197	14	672	23
In CBD	538	553	241	386	121	1859	64
After Entering CBD	62	98	121	75	22	378	13

Within the CBD, destinations were concentrated near Spring and Seventh Streets. Significantly more persons deboarded north of Seventh than alighted to the south. See Figure A-1. The distribution of destinations of persons alighting beyond the central business district was concentrated to the west and the south of the CBD; almost two-thirds of the passengers deboarding beyond the CBD alighted in these areas. See Figure A-2.

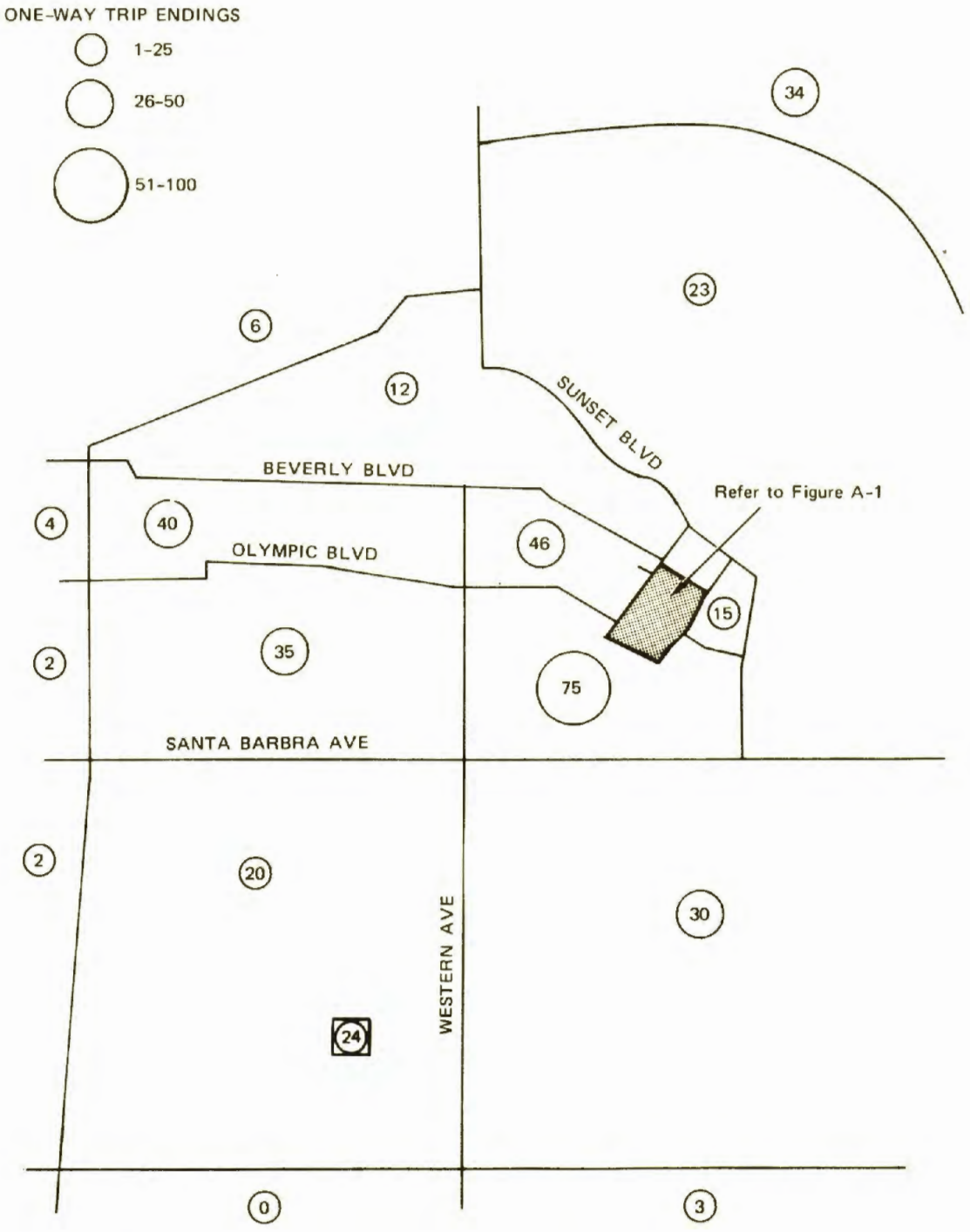
(1) 5:00 A.M. to noon.



(1) BUS LINES 52, 53, 60, 63, 69 SAME TILL NOON

FIGURE A-1 DESTINATIONS IN CBD(1)

(Excluding Wilshire Corridor)



[1]BUS LINES 52, 53, 60, 63, 69

FIGURE A-2 DESTINATIONS BEYOND CBD[1]

The destination data was used by the RTD to aid planning for the busway. Crain & Associates also used this data to design the busway evaluation plan and as an aid to the analysis of data collected during the spring and fall of 1973.

According to the on-board survey, the distribution of trip purposes varied by trip frequency. However, trip purpose varied more widely than did trip frequency among the different socio-economic groups studied.

As shown in the next table, the commuter represented over two-thirds of the total transit market. All of the remaining market was evenly spread over a variety of trip purposes and over a range of trip frequencies.

Table A-14
TRIP PURPOSE BY TRIP FREQUENCY

	Trip Frequency					
	Regular		Occasional		Seldom	
	%	(n)	%	(n)	%	(n)
Work	85.1	2574	31.7	145	17.4	53
Business	1.8	53	19.9	91	19.3	59
Shop	1.3	38	11.6	53	12.8	39
School	8.5	256	6.3	29	3.3	10
Social	0.6	19	11.6	53	11.8	36
Personal	1.4	42	8.8	40	21.0	64
Other	1.4	41	10.1	46	14.4	44

The distribution of trip purpose varied widely between the socio-economic characteristics studied. For the most part, persons taking work trips differed from those with other trip purposes. The female-to-male ratio was lowest for work trips, while the middle-aged high-income group with mode choice seldom took transit other than for work. In addition, newcomers used transit more often and for varied purposes than did the more long-term residents.

Below, it is shown that the male-female split varied slightly with trip purpose. The 2:1 female-to-male ratio climbed to 3:1 for shopping and personal trips and dropped to 55%-to-45% for business, school, and social trips.

Table A-15
TRIP PURPOSE BY SEX

	Male		Female	
	%	(n)	%	(n)
Work	33.4	920	66.6	1831
Business	46.0	93	54.0	109
Shopping	22.0	27	78.0	96
School	42.9	126	57.1	168
Social	43.9	47	56.1	60
Personal	28.6	42	71.4	105
Other	35.7	46	64.3	83

The fraction of trips that were work trips varies with age in accordance with the higher employment and labor participation rates of the prime working years, 30 through 64. The pattern of seniors' trip purposes is interesting. Home-to-work was the dominant purpose even for these supposedly retired people. They did, of course, use transit considerably for shopping, social, and personal reasons.

Table A-16

TRIP PURPOSE BY AGE

	20		21-29		30-39		40-49		50-64		65+	
	%	(n)	%	(n)	%	(n)	%	(n)	%	(n)	%	(n)
Work	45.6	193	73.9	609	81.0	414	85.5	561	83.4	485	40.2	82
Business	6.9	29	3.8	31	3.9	20	4.4	29	5.6	57	9.8	20
Shopping	2.1	97	2.8	23	2.3	12	2.1	14	2.9	29	10.8	22
School	37.6	159	12.0	99	2.5	13	1.2	8	0.4	4	1.0	2
Social	2.1	9	2.3	19	1.2	6	0.8	5	2.0	20	15.7	32
Personal	3.1	13	3.2	26	4.5	23	3.7	24	2.9	29	11.3	23
Other	2.6	11	2.1	17	4.5	23	2.3	15	2.9	29	11.3	23

The majority of each of the income groups tended to take work trips rather than to take non-work trips.

Table A-17

TRIP PURPOSE BY INCOME

	$5,000		$5-10,000		$10-15,000		$15-30,000		$30,000+	
	%	(n)	%	(n)	%	(n)	%	(n)	%	(n)
Work	64.5	477	78.8	721	82.9	590	88.9	488	67.4	31
Business	7.4	55	4.0	37	3.7	26	2.4	13	2.2	1
Shopping	4.9	36	1.6	15	1.7	12	0.9	5	2.2	1
School	9.3	69	6.9	63	6.0	43	4.4	24	19.6	9
Social	3.9	29	2.3	21	1.1	8	1.1	6	8.7	4
Personal	5.4	40	3.2	29	2.5	18	1.1	6	0.0	0
Other	4.6	34	3.2	29	2.1	15	1.3	7	0.0	0

The fraction of riders taking transit by choice was highest for work trips, but varied little with other trip purposes.

Table A-18

TRIP PURPOSE BY AUTO AVAILABILITY

	No		Yes, But		Yes	
	%	(n)	%	(n)	%	(n)
Work	50.3	1381	15.3	421	34.3	942
Business	55.1	113	19.0	39	25.9	53
Shopping	67.7	84	6.5	8	25.8	32
School	60.0	174	17.2	50	22.8	66
Social	57.5	61	14.2	15	28.3	30
Personal	61.2	90	11.6	17	27.2	40
Other	56.9	74	16.2	21	26.9	35

Newcomers to a neighborhood appeared to use transit more frequently than did others for business, school, and social trips.

Table A-19

TRIP PURPOSE BY LENGTH OF RESIDENCE

	1 Year		1-2 Years		2-5 Years		5 Years	
	%	(n)	%	(n)	%	(n)	%	(n)
Work	66.9	520	73.6	357	77.5	616	76.5	1224
Business	8.5	66	3.9	19	4.8	38	3.9	62
Shopping	3.3	26	3.9	14	2.8	22	3.3	52
School	11.5	89	12.0	58	5.5	44	5.9	95
Social	3.0	23	1.4	7	1.8	14	3.1	49
Personal	3.6	28	3.5	17	3.9	31	3.8	60
Other	3.2	25	2.7	13	3.8	30	3.6	57

Although trip frequency did not vary as widely as trip purpose by the interviewee characteristics studied, some trends are clear. Senior citizens and the poor tended to ride transit less often than did others. However, respondents with mode choice were regular users more often than were the more transit-dependent group.

Males and females had the same trip frequency pattern; about 80% of the passengers of either sex were regular riders.

Table A-20
TRIP FREQUENCY BY SEX

	Male		Female	
	%	(n)	%	(n)
Regular	78.0	1008	81.1	1981
Occasional	12.7	164	11.5	280
Seldom	9.3	120	7.4	182

The fraction of riders riding regularly, occasionally, and seldom did not appreciably vary in age group except for seniors, the majority of whom rode occasionally or less often.

Table A-21
TRIP FREQUENCY BY AGE

	20		20-29		30-39		40-49		50-64		65+	
	%	(n)	%	(n)	%	(n)	%	(n)	%	(n)	%	(n)
Regular	81.3	343	83.2	683	80.5	408	84.3	552	83.6	842	49.3	100
Occasional	9.0	38	9.6	79	12.2	62	8.7	57	10.6	107	36.5	74
Seldom	9.7	408	7.2	62	7.3	37	7.0	46	5.8	58	14.3	29

Similarly, the trip frequency distribution is generally not related to income, except that poorer passengers did not ride as regularly, undoubtedly because of the higher unemployment rate of that group.

Table A-22

TRIP FREQUENCY BY INCOME

	$5,000		$5-10,000		$10-15,000		$15-30,000		$30,000+	
	%	(n)	%	(n)	%	(n)	%	(n)	%	(n)
Regular	22.0	538	31.3	766	25.4	620	19.8	484	1.5	37
Occasional	35.7	107	30.7	92	19.7	59	11.7	35	2.3	7
Seldom	42.7	88	26.2	54	16.5	34	13.6	28	1.0	2

The "choice" rider did represent a slightly larger proportion of the "regular" user group and a lesser proportion of the "occasional" and "seldom" user groups.

Table A-23

TRIP FREQUENCY BY AUTO AVAILABILITY

	No		Yes, But		Yes	
	%	(n)	%	(n)	%	(n)
Regular	51.9	1550	53.5	437	59.7	997
Occasional	14.6	240	17.1	77	13.3	132
Seldom	33.4	179	29.4	55	22.0	66

DEGREE OF INFLUENCE OF AVAILABILITY OF TRANSIT ON HOME SELECTION

Apparently, RTD services has affected residential location decisions. Over half of all riders said that their decision was influenced by the proximity of public transportation. As might be expected, the degree of influence was slightly greater with women than with men.

Table A-24

DEGREE OF INFLUENCE BY SEX

	Male		Female	
	%	(n)	%	(n)
Yes	34.7	432	41.0	969
Slightly	15.1	188	15.4	363
No	50.2	624	43.7	1032

The influence tended to increase with the age of the rider, being the greatest with the 50-64 group and dropping off slightly with the over-65 group.

Table A-25

DEGREE OF INFLUENCE BY AGE

	<20		20-29		39-39		40-49		50-64		65+	
	%	(n)	%	(n)	%	(n)	%	(n)	%	(n)	%	(n)
Yes	16.7	70	32.7	265	35.5	177	41.0	259	49.7	493	52.9	101
Slightly	17.7	74	17.7	143	18.4	92	14.9	94	13.2	131	5.8	11
No	65.6	274	49.6	402	46.1	230	44.1	279	37.1	368	41.4	79

Relative to income, influence is greatest among the under-$5,000 group. This is to be expected, since they are more transit dependent. What might not be expected is that the degree of influence does not decrease significantly at the higher income levels.

Table A-26

DEGREE OF INFLUENCE BY INCOME

	<$5,000		$5-10,000		$10-15,000		$15-30,000		$30,000+	
	%	(n)	%	(n)	%	(n)	%	(n)	%	(n)
Yes	44.8	326	41.7	377	36.0	256	31.6	171	35.6	16
Slightly	15.1	110	15.7	142	16.7	119	17.0	92	11.1	5
No	40.0	291	42.6	385	47.3	337	51.4	278	53.3	24

Shopping was the only trip purpose where a greater number of persons stated that service influences home location than stated that service has no influence.

Table A-27

DEGREE OF INFLUENCE BY TRIP PURPOSE

	Yes		Slightly		No	
	%	(n)	%	(n)	%	(n)
Work	41.4	1113	15.7	422	43.0	1156
Business	29.6	55	14.0	26	56.5	105
Shopping	46.3	50	11.1	12	42.6	46
School	22.5	64	17.5	50	60.0	171
Social	42.4	39	8.7	8	48.9	45
Personal	36.2	50	15.2	21	48.6	67
Other	28.5	35	13.8	17	57.7	71

RELATIONSHIPS BETWEEN TRANSIT ADVERTISING, PROVISION OF INFORMATION, AND TRANSIT RIDER TYPE

A question was asked regarding the ways the rider finds out about bus service. As the tables indicate, people find out in various ways. No comment is offered as to the effectiveness of the various media, since we do not know the RTD expenditures by media. However,

there are some differential values that are interesting. Women (more so than men) tend to obtain information by calling RTD.

Table A-28
TRANSIT INFORMATION BY SEX

	Male		Female	
	%	(n)	%	(n)
Radio	5.2	67	5.9	143
Television	4.4	57	2.8	68
Newspaper	1.2	15	0.8	19
RTD/Phone	23.4	302	32.1	782
RTD/Materials	31.2	403	26.2	638
Posters	0.7	9	0.7	16
Information on Bus	2.9	37	3.2	77
Friends	19.8	256	20.3	495
Other	11.2	144	8.2	201

The RTD phone service tends to be used disproportionately less by older people. On the other hand, RTD information materials tend to be used more with increasing age. Being advised by friends is still an effective medium, but used proportionately less with age.

Table A-29

TRANSIT INFORMATION BY AGE

	< 20		20-29		30-39		40-49		50-64		65+	
	%	(n)	%	(n)	%	(n)	%	(n)	%	(n)	%	(n)
Radio	20.4	40	31.1	61	16.8	33	13.3	26	15.8	31	2.6	5
Television	18.2	22	37.2	45	19.0	23	11.6	14	12.4	15	1.7	2
Newspaper	0.0	0	10.3	3	20.7	6	13.8	4	34.5	10	20.7	6
RTD/Phone	11.5	123	25.6	273	16.4	175	19.1	204	23.1	246	4.3	46
RTD/ Materials	5.8	58	14.5	144	13.6	135	20.2	201	38.2	380	7.6	76
Posters	9.5	2	28.6	6	0.0	0	14.3	3	38.1	8	9.5	2
Info on Bus	9.3	10	23.1	25	13.0	14	23.1	25	21.3	23	10.2	11
Friends	19.3	142	30.5	225	10.6	78	15.7	116	21.2	156	2.7	20
Other	7.8	26	12.3	41	13.5	45	18.0	60	39.2	131	9.3	31

Radio messages appear to be more effective with the poor than with those with higher income. The RTD phone service has nearly equal effectiveness across income groups, but the RTD informational materials do not tend to be used by the poor.

Table A-30

TRANSIT INFORMATION BY INCOME

	< $5,000		$5-10,000		$10-15,000		$15-30,000		$30,000+	
	%	(n)	%	(n)	%	(n)	%	(n)	%	(n)
Radio	7.6	56	5.4	49	3.1	22	2.6	14	4.3	2
Television	4.7	35	2.9	26	2.1	15	2.0	11	8.7	4
Newspaper	0.9	7	0.9	8	0.6	4	0.2	1	4.3	2
RTD/Phone	28.7	213	30.7	279	30.1	214	33.3	181	23.9	11
RTD/Matls.	21.7	161	27.2	247	32.8	233	29.2	159	26.1	12
Posters	1.2	9	0.3	3	0.3	2	0.4	2	0.0	0
Info on Bus	4.9	36	3.4	31	2.4	17	1.1	6	0.0	0
Friends	22.4	166	19.9	181	19.4	138	19.5	106	19.6	9
Other	7.8	58	9.4	85	9.2	65	11.8	64	13.0	6

No. ____ (1–4)

RTD BUS SURVEY

(5)

1A. Where did you board this bus? _____ (location of bus stop) (6-7)

B. Where did you start this trip? ○ home ○ other (8)

C. The address there is: _____ (or nearest intersection)

D. What time did you begin this trip? _____ (left above address) (9–12)

2A. How did you get to the bus stop from where you started your trip? (Check one)

1 ○ Drove car and parked
2 ○ Driven by someone else
3 ○ Rode another bus
4 ○ Walked
5 ○ Took taxi
6 ○ Other _____ (13)

B. If "walked", how many blocks did you walk? _____ (blocks) (14)

3. What is the purpose of this trip? (Check one)

1 ○ Work (regular commuting)
2 ○ Business (other work-related trips)
3 ○ Shopping
4 ○ School or University
5 ○ Social, entertainment, recreation
6 ○ Personal services (lawyer, dentist)
7 ○ Other _____ (15)

4A. Where will you get off this bus? _____ (location of bus stop) (16-17)

B. Where will this trip end? ○ work ○ other (18–22)

C. The address there is _____ (or nearest intersection)

5A How will you get there when you leave the bus? (check one)

1 ○ Drive in car parked near bus stop
2 ○ Be picked up by car
3 ○ Take another bus
4 ○ Take taxi
5 ○ Walk
6 ○ Other (23)

B. If "walk" how many blocks will you have to walk?

_____block(s) (24)

6. How often do you make this trip? (check one)

1 ○ Regularly - (at least four rides per week)
2 ○ Occasionally - (one to three rides per week)
3 ○ Very seldom (25)

7. If "regularly", when did you begin using this bus

____ / ____ ○ I am not a regular passenger. (26–29)
month year

8A. Do you usually use the bus on both your inbound and return trips? ○ Yes ○ No (30)

B. If no, why is this? _____ (31)

9. How did you make this trip before using this bus?

1 ○ Didn't make this trip
2 ○ Drove my car (alone)
3 ○ Was an auto passenger
4 ○ Was a driver (carrying passengers)
5 ○ Was an alternate driver (drove __ days per week)
6 ○ Used another bus
7 ○ Taxi
8 ○ Other _____

32-33

10A. Was a car available to you for this trip?

1 ○ No (bus only practical means)
2 ○ Yes, but with considerable inconvenience to others
3 ○ Yes, but I prefer to take the bus

34

B. Do you have a license to drive? ○ Yes ○ No

35

11. In what ways did you find out about the bus service?

1 ○ Radio
2 ○ TV
3 ○ Newspapers
4 ○ RTD phone information
5 ○ RTD schedules, brochures, etc.
6 ○ Billboards, posters
7 ○ Information on other buses
8 ○ Friends, relatives
9 ○ Other _____

36 41

12A. If you are employed, what are your working hours?

_____ - _____ (indicate AM or PM)

○ Not employed.

42 49

B. What is your sex? ○ Male ○ Female

50

C. What is your age group? (check one)

1 ○ 20 or under
2 ○ 21 - 29
3 ○ 30 - 39
4 ○ 40 - 49
5 ○ 50 - 64
6 ○ 65 and over

51

D. What is the combined income of all household members?

1 ○ $5,000 or under
2 ○ $5,001 - 10,000
3 ○ $10,001 - 15,000
4 ○ $15,001 - 30,000
5 ○ Over $30,000

52

13A. How long have you lived at your present address?

1 ○ Less than 1 year
2 ○ Between 1 and 2 years
3 ○ Between 2 and 5 years
4 ○ More than 5 years

53

B. Did SCRTD bus service influence the choice of your present address? (Check one)

1 ○ Yes, definitely
2 ○ Slightly
3 ○ Not at all

54

14. Any comments? _____

_____

_____

55 60

APPENDIX B

"BEFORE-AFTER" HOUSEHOLD SURVEY

During a two-week period around April 1, 1973, a household survey was conducted to evaluate initial public reaction to the newly opened busway. The objectives were to:

- Measure the transit market share before and two months after the opening of the busway
- Measure awareness of and general public reaction to the new facility
- Obtain sufficient data on commute time and cost for a preliminary mode split assessment
- Obtain socio-economic and attitude data of both auto and transit commuters

1800 houses were to be approached, 30 clusters of 60 houses each, each cluster randomly selected from within the San Bernardino Freeway corridor. The intent was to locate 180 persons who commute to the Los Angeles downtown area.

The procedure was to survey every evening from 6:00 until 8:30 P.M. to obtain as many completed questionnaires as possible at the door step or, if not possible, to leave mail-in questionnaires to be completed later and to execute a mail follow-up of those who did not return the questionnaires left for them.

The results were 2122 houses approached and 268 downtown commuters found. Contact in some form was made with 1895 households, 89% of the houses approached. 240 completed questionnaires were obtained from an estimated 333 commuters living in the 2122 households approached. The data obtained was of generally high quality. Appendix II-1 presents the details of the sample size, the numbers of questionnaires analyzed, and a copy of the questionnaire.

The returned data has been analyzed and grouped in terms of specific questions, as follows.

Question No. 1. What is the mass transit market share of the total corridor commuter market?

At every house approached, the busway project was described and the person interviewed was asked if he was aware of the busway and if he knew it was in partial operation. The following results were obtained.

	Sample Size	% Aware of Busway
Non-Commuter Households	1438	75.8
Households With a Commuter	268	82.3
All Households	1706	76.9

Thus, we see that there is broad awareness of the new facility even without an explicit advertising program.

To measure the transit market share, the commuter data was separated into two groups: those who commute to the Los Angeles CBD as defined by the evaluation plan and those who commute to the general downtown area, but not to the CBD. The CBD has been defined as the Los Angeles River to Figueroa, Pico to 3rd Street, plus the Wilshire corridor to Western.

The transit market share, in %, was measured as follows:

	Sample	Before Busway	2 Months After
Commuters to LA CBD	113	14.2	16.8
Commuters to LA Downtown (not to CBD)	79	9.9	11.4
Total Sample	192	12.4	14.6

The estimate of market share obtained is a few percentage points larger than predictions based on the LARTS mode split model. This is principally caused by a slight bias in the data collection process used in this survey. The lower than expected response rate at the doorstep and the consequent large mailed questionnaire follow-up probably produced a one or two percentage point overstatement of the market share estimate. This small overstatement is probably present in the before and after, and in the CBD and total sample estimates. There is also a sampling error generated by this random-cluster process. There is a slight increase in sampling error over a purely random process; but this is small and justified by the efficiency of the clustered data collection process.

The 113 CBD commuters who returned usable data represent a slightly small sample to estimate market share percentages. The standard error for this clustered random sample of 113 responses is about 4%, i.e., the estimated market share is 16.8 $\pm$4% at 68% confidence. The total sample gives a more accurate estimate with a standard error of about 3%.

It is important to remember that busway patronage is increasing, and will likely have a dramatic upturn when the El Monte Station opens. The market share will increase accordingly. The upward bias in the market share estimates obtained are peculiar to this survey and are not expected to reappear in the fall survey.

Question No. 2. What is known about the auto commuter?

Since about 85% of the commuters use the automobile for their home-to-work travel and since the intent of the busway project is to divert some of these to transit, it is important to determine what we can about the automobile user and the trip he takes.

The following table describes the automobile submodes in terms of the absolute and relative frequencies (%).

	CBD Sample		Downtown (Not CBD)		Total	
	Abs	%	Abs	%	Abs	%
Drives Alone	73	77.7%	56	80.0%	129	78.7%
Regular Driver (with Passengers)	8	8.5%	5	7.1%	13	7.9%
Alternate Driver	7	7.4%	4	5.8%	11	6.7%
Regular Passenger	6	6.4%	5	7.1%	11	6.7%
Total	94	100%	70	100%	164	100%

The predominant submode is "drives alone". The automobile occupancy factor is very low, 1.3 persons per car (total sample).

A key determinant of mode choice is the parking cost. The relative frequencies of parking costs per trip are as follows (%):

	None	1-24¢	25-49¢	50-74¢	75-99¢	$1.00	Total
CBD Commuter	42.6	10.6	20.2	10.6	9.6	6.4	100%
Downtown (Not CBD)	78.6	10.0	7.1	1.4	0	2.9	100%
Total Sample	57.9	10.4	14.6	6.7	5.5	4.9	100%

For many people, this cost is zero, as they park on unmetered off-streets or in employee-paid parking. Commuters to the

CBD have a median cost per trip of about 20¢, with over 40% paying nothing. Nearly 80% of those who work outside the CBD pay nothing.

The survey also returned some information on carpool arrangements and costs. Looking at the total sample only, there were only a few passengers, and these were generally non-paying passengers.

Passenger Costs

Pay Zero	7
Pay 25¢	3
Pay $1	1
Total	11
Avg.	16¢

Driver Receipts

	Regular Drivers	Alternate Drivers
Receive Zero	8	10
Receive cash	5	1
Total	13	11
Avg.	12¢	5¢

The above data suggest that more than half of the passengers pay nothing and the remainder pay between 25¢ and 50¢ per trip.

Survey Question 9 asked whether the commuter "usually needed his car during the business day". The results were:

	% Yes	% No
Commuters to LA CBD	43.0	57.0
Commuters to Downtown (Not CBD)	45.7	54.3
Total Sample	44.2	55.8

These responses are discouraging to those who hope for large auto-to-transit diversion. The 44% who claimed they need their car is 2½ times larger than the 17% figure obtained in the Shirley Highway evaluation. Possibly, the LA commuter is overstating his

need thinking in terms of needing his car to go to lunch or to shop.

Question No. 3. What differentiates the auto users from the transit users?

The table below compares the age-sex-income profile of auto users with transit users from the household and on-board surveys. The number of transit users (28) from the household survey is too small for this kind of breakdown. They are included here next to the large on-board sample to show that they do not represent an abnormally biased small sample.

	Household Survey		On-Board Survey
	Auto	Transit	Transit
Sample	164	28	3289
% Male	63.8	35.7	34.8
Age			
16-29	29.6	42.9	30.1
30-39	20.4	10.7	14.8
40 +	50.0	46.4	55.1
Income			
0-$10,000	19.0	42.3	53.5
10,001-15,000	35.9	34.6	24.4
15,001-30,000	37.3	15.4	19.1
30,001+	7.8	7.7	1.6
Cars per Family	1.9	no data	no data

The data indicates, as expected, that the auto user is more often male and older, and has a higher income. Our particular sample of transit users from the household survey is only slightly biased. There is a slight over-representation of the under-30 age group

and an under-representation of the under-$10,000 income bracket. These biases tend to offset each other, indicating that no error is being introduced into the market share estimate.

A second comparison can be made in terms of the relative commute costs of the auto and transit trips. The following were obtained from calculations on the total sample.

	Auto User	Transit User
Commute Time (Min)		
In Vehicle	30.5	30.2
Excess	3.8	10.3
Total	34.3	40.5
Commute Cost ($)		
Time	2.48	3.83
Economic	.82	.44
Total	3.30	4.27

The commute time is compared in terms of the in-vehicle time (the time spent riding) and the excess time (spent walking to or waiting for buses, parking the automobile, walking from garage, etc.). Both are reported times. These data indicate that the in-vehicle travel time is about the same; however, the auto commuter comes from a longer distance at a slightly higher speed. The major difference is that the transit user reports having a three-times-larger excess time. This is a slight overstatement, since automobile users tend to understate the excess time spent in the downtown area after parking their cars.

A better understanding of the relationship of these trip costs to mode choice decisioning is obtained later in this report when the same data is presented in mode split format.

To calculate the total commute cost, we have converted the reported commute time to dollars using the 1966 SRI value-of-time figure of $2.82 per hour inflated by the consumer price index change as of first quarter, 1973. This brings the current value-of-time estimate to $3.72. Excess time was weighted by the usual 2.5 psychological factor used in the LARTS mode split model. This brings excess time to a value of $9.30.

These time costs may seem high, but the best known research (by SRI on the value-of-time and by Alan M. Voorhees on the 2.5 psychological weighting factor) indicates this is the best way to compare the auto and transit commute times relative to mode choice decisioning.

The economic costs were computed using a 6.4¢ per mile plus parking minus carpool receipts as the marginal cost of operating a car. The carpool passenger was charged for commute time and any carpool payments. Where members of the same family commute in a carpool, the out-of-pocket costs were assumed to be shared. Automobile mileage was computed from the reported origin/destination; all of the other costs were as reported.

Question No. 4. What basic attitudes interplay in the mode choice decisions and in the public reaction to the busway?

An attempt is being made within the busway evaluation to isolate and measure basic attitudes and perceptions that relate to transit usage and busway operations.

First, five basic questions measuring attitudes toward transit have been included on an earlier pilot survey and on this "before-after" survey (see Question 15 on the survey instrument). These questions were isolated in a major San Francisco Bay Area study

by Christopher Lovelock of Stanford University, as being discriminatory between auto and transit users, i.e., auto and transit commuters tend to respond differently to the two questions.

However, on both the pilot and the before-after survey, only the last three questions proved to have significantly different response patterns, in Los Angeles, between the two modes. The results of the three questions that do discriminate are given below, along with the general attitude question carried on the San Bernardino and Shirley Highway Evaluations. The mean attitude scores* from these questions were:

Attitude Statement	Auto	Transit
If a new and improved and convenient public transportation service were introduced, would you use it?	3.91	4.79
I don't enjoy driving very much.	2.86	3.27
I hate to be tied to fixed schedules	2.23	3.50
Mean Value	3.00	3.87
General attitude (Question 19)	2.76	3.43

The consistent tendency of these three questions to discriminate between auto and transit users indicates that there is a basic attitudinal component to the mode choice decision. With the larger sample size of the planned fall survey, some form of analysis of variance will be undertaken to determine the importance of this factor in comparison with the major determinant of mode

*The interviewee is asked whether he strongly disagrees, disagrees, is indifferent, agrees, or strongly agrees with each attitude statement. These responses are rated with scores of 1 to 5, such that 1 represents a pro-auto attitude and 5 represents a pro-transit attitude.

choice, the LARTS model disutility value.

The questionnaire gave two opportunities for the interviewee to offer his perceptions of the busway. Survey Question 18 asked "What are your feelings toward allowing fast bus travel on the San Bernardino Freeway through use of exclusive bus lanes?". The responses were grouped and the absolute frequencies were tabulated as follows:

	Commuter	
Response Category	Auto	Transit
General praise for busway	11	6
"Will make freeway free-flowing, dependable"	15	3
Busway may be too costly	16	0
Concerned about Busway safety	4	0
Better feeder service needed to Busway	2	3
Other, no comment	116	16
Total	164	28

Also, Survey Question 11 asked automobile commuters "Could you have used the busway for your morning trip that day?". The responses were:

Yes	39
No	99
Don't Know	26
Total	164

However, this information has doubtful validity, since the reasons why the busway could or could not be used were often similar, e.g., yes, but going by bus would be inconvenient; no, going by bus would be inconvenient.

The content analysis of the reasons offered regarding why they could or could not use the Busway are much more informative:

Response Category		Frequency
(a)	Yes, but no answer	5
(b)	Don't know	26
(c)	No, but no answer	7
(d)	Bus is inconvenient to me	72
(e)	Like to drive my car	19
(f)	Need car during day	35
	Total	164

The above response categories are listed in order of decreasing likelihood of switching from automobile commute. Categories (a), (b), and (c) are probably the most penetrable. Category (d) can be penetrated with increasing improvement in service. Category (e) represents an attitude problem, related to one of our most discriminating attitude questions, as discussed earlier. Category (f) appears to pose an impenetrable barrier unless people are overstating this need as discussed previously.

Question No. 5. What do these data tell of mode split probability and the validity of the existing LARTS mode split model?

A value of the LARTS disutility function was calculated for each observed trip. The disutility value is the independent variable in the LARTS mode split model. It is the difference in total commute cost (time plus economic costs) between the mode used and the mode not used. The elements of the total commute cost and their prices were as previously discussed under auto-transit comparisons. An example calculation of a disutility value is as follows.

A specific commuter might have a total commute cost of $3.00 if he uses his automobile, and $4.00 if he takes transit. The result is a $1.00 (auto better) disutility value. The higher the (transit better) disutility value, the higher the mode split for transit.

For every interviewed commuter, three total commute costs were computed: (1) the "real" cost for the mode used based on his origin/destination mileage and his reported actual times and incidental costs; (2) a standard cost for the mode used calculated for his residential cluster and based on the automobile mileage from the cluster centroid to Los Angeles downtown, average walking time to the nearest bus line, etc.; (3) a standard cost for the mode not used calculated as just described. Two estimates of the disutility value are then obtainable: the real cost (mode used) minus standard cost (mode not used) and standard cost (mode used) minus standard cost (mode not used). The first is more precise and feasible to do on this small survey. The second is analogous to standard transportation planning procedures.

Below are the results from both methods.

	Disutility Value (Real Minus Standard Costs)			
	Transit Better	Auto Better		
	$2-0	0-$2	2-$4	≥$4
Frequency of Occurrence	21	91	72	8
Mean Disutility Value	$1.01	$1.15	$2.70	$4.76
Mode Split	.19	.17	.10	0

	Disutility Value (Standard Minus Standard Costs)			
	Transit Better	Auto Better		
	$2-0	0-$2	2-$4	> $4
Frequency of Occurrence	9	136	44	1
Mean Disutility Value	$.31	$1.22	$2.50	$4.44
Mode Split	.33	.15	.09	0

In either case, the mode split values are higher for transit than those being used in the LARTS model. As stated in the market share discussion, this is at least partially caused by the slight bias in the data collection procedure used. It can also be caused in part by sampling errors, by the fact that transit ridership in the San Bernardino corridor is higher than in other regional corridors, or to some overstatement in the LARTS mode split curve.

BEFORE/AFTER
SPRING 73-SURVI
QUESTIONNAIRE

Household Survey

In order to serve you better, the San Bernardino Freeway has been rebuilt with an improved highway and an exclusive busway. Please help us evaluate this transportation project by taking the five minutes necessary to fill out this confidential questionnaire.

1. What is the intersection (names of cross streets) nearest to your place of work? _____ & _____

2. How did you travel from your home to work on your last morning commute trip?
   a.___car, b.___bus, c.___other (specify) _____

If you checked bus, please skip to Question #12

Auto Users Answer 3-11

3. When you made this trip, were you:
   a.___driving alone?
   b.___the regular driver, carrying regular passengers?
   c.___an alternate driver, whether you were the driver or a passenger that day. How many days a week do you drive?__
   d.___a regular passenger?

4. How many people traveled together, including yourself, in the automobile that you drove or rode to work (do not include children)? ___

5. a. If you were in a carpool, how much did you pay (or usually pay) the others for riding? ($____per____(day, week, month)
   b. How much did you receive (or usually receive) for driving? $____per____(day, week, month)

6. a. What was the vehicle parking cost? $____per____(day, week, month) Who paid this cost? _____
   b. What other costs did you have, if any (e.g., downtown bus travel)? $____per____(day, week, month) for _____.

32

Auto users answer 3-11

7. What time did you leave your home for work in the morning? _____A.M. (34-37)
   What time did you arrive at your office or work station? _____A.M.

8. How much of this time was spent in driving or riding as opposed to time spent in parking, walking, or waiting for your carpool? _____minutes

9. Do you usually need your car during the business day? ___yes, ___no

10. How many autos are available for use by you and other members of your household? ___

11. Could you have used the San Bernardino Freeway Express Busway for your morning work trip that day?
    a.___yes, but I chose not to because _____
    b.___no, because _____
    c.___I don't know

Auto users, now skip to Question #15

Bus users answer 12-14

12. If you went by bus, what time did you leave your home in the morning? _____A.M.
    What time did you arrive at your office or work station? _____A.M.

13. How much of this time did you spend riding on the bus as opposed to walking to or from bus stops or waiting for buses? _____minutes

14. How much did you pay to ride the bus to work? (58-60)
    Monthly Pass: $_____per month + cash per ride? _____¢
    Commuter Ticket: $_____per 10 rides
    Cash only (including transfers) $_____

EVERYONE

15. Now, we would like to know something of your attitudes about traveling. Please give us your response to the following statements:

	Strongly Agree	Agree Somewhat	Indifferent	Disagree Somewhat	Strongly Disagree	
a. Everyone has a right to drive his car just as much as he wants.	___	___	___	___	___	61
b. I'd much rather people saw me arriving at work by car than getting off a bus.	___	___	___	___	___	
c. If a new and improved and convenient public transportation service were introduced, I would certainly use it.	___	___	___	___	___	
d. I don't enjoy driving very much.	___	___	___	___	___	
e. I hate to be tied to fixed schedules for traveling	___	___	___	___	___	

16. Sex: ___male, ___female
Age: ___16-29, ___30-39, ___40 or over

17. What is the combined income of all household members? 68
a.___zero to $10,000
b.___$10,000 to $15,000
c.___$15,001 to $30,000
d.___more than $30,000

GENERAL
NOT-AT-HOME
NOTICE

We missed you while you were out...

We are conducting a survey (sponsored by the Southern Los Angeles Association of Governments) of the public's reaction to the new highway improvements on the San Bernardino Freeway. Besides the improvements in the regular highway lanes, we have built an exclusive busway in the median strip that will give you rapid transit bus service to the Los Angeles downtown area. You can help us with our evaluation by answering the following questions and using the pre-addressed and pre-stamped envelope provided.

Are you aware that the busway is being built and is in partial operation?

☐ Yes ☐ No

Do you, or some other member(s) of your household, regularly commute to the Los Angeles downtown area?

☐ Yes ☐ No ☐ Number of commuters

If your answer to the last question is "NO", you need not fill out the rest of this questionnaire.

If your answer is "YES" to the last question and there is only one regular commuter, please have that person complete the rest of the questionnaire. If there is more than one commuter, please contact us at 691-7013 and we will send a questionnaire for each additional commuter.

In both cases, please return the questionnaire materials in the pre-addressed and pre-stamped envelope provided.

thank you — for your help

18. What are your feelings toward allowing fast bus travel on the San Bernardino Freeway through use of exclusive bus lanes? 69 ☐ ☐

_____

_____

_____

19. Not thinking of the good or bad points of bus service in your particular area, how would you rate your general attitude toward traveling to work by bus? ☐

___very positive, ___positive, ___negative, ___very negative

20. The busway, an exclusive lane for buses running down the median strip of the freeway, was opened from El Monte to the Long Beach Freeway on January 29. How were you commuting to work before the busway opened? ☐

a.___car

b.___bus

c.___did not commute to work downtown or live in the San Bernardino Freeway area prior to the inauguration of the busway

21. If you have switched from auto to bus or from bus to auto since the busway opened, why have you switched? ☐☐ 74-75

_____

_____

In case we need to check back with you, could you provide us with your telephone number? _____

thank you —

for your help

NO ONE AT HOME
Q. LEFT AT DOOR
MAILING FROM
MENLO PARK

Crain & Associates

Urban Consultants

883 SANTA CRUZ AVE., SUITE 29
MENLO PARK, CALIFORNIA 94025
(415) 323-2637

Dear Citizen:

Five minutes on your part can help your local government plan transportation improvements in the Los Angeles area. These improvements are needed to combat air pollution and automobile congestion, etc. They can also come in many ways and can cost billions of dollars. The question is, will your opinions be part of the planning process?

Your assistance is VERY IMPORTANT because your household is part of a small group of households that has been scientifically selected to represent the whole population. This is the only inexpensive and statistically valid method for government to know what the public wants. Please help us!

We are a research organization retained by the Southern California Association of Governments to evaluate one transportation alternative for your area: exclusive lanes for buses on the San Bernardino Freeway. One of our survey data-takers has been to your home and has left a questionnaire. We need the questionnaire left with you to be filled out and returned as soon as possible. If you have lost it, here is another one - along with a return envelope all ready for mailing.

Thank you very much for your help.

Peter B. Fitzgerald

Survey Coordinator

COMMUTER NOT HOME
MAILING FROM
MENLO PARK

Crain & Associates

Urban Consultants

883 SANTA CRUZ AVE., SUITE 29
MENLO PARK, CALIFORNIA 94025
(415) 323-2637

Dear Citizen:

Five minutes on your part can help your local government plan transportation improvements in the Los Angeles area. These improvements are needed to combat air pollution and automobile congestion, etc. They can also come in many ways and can cost billions of dollars. The question is, will your opinions be part of the planning process?

Your assistance is VERY IMPORTANT because your household is part of a small group of households that has been scientifically selected to represent the whole population. This is the only inexpensive and statistically valid method for government to know what the public wants. Please help us!

We are a research organization retained by the Southern California Association of Governments to evaluate one transportation alternative for your area: exclusive lanes for buses on the San Bernardino Freeway. One of our survey data-takers has been to your home and was told that at least one household member regularly works in downtown L.A. We need the questionnaire left with you to be filled out and returned by the downtown worker. If you have lost it, here is another one - along with a return envelope all ready for mailing.

Thank you very much for your help.

Peter Fitzgerald

Survey Coordinator

HOUSEHOLD SURVEY CONTROL SHEET

SPRING '73 SURVEY CONTROL SHEET

Good evening, my name is ________. We are conducting a survey of the public's reaction to the new highway improvements on the San Bernardino Freeway. Besides the improvements in the regular highway lanes we have built an exclusive busway in the median strip that will give you rapid transit bus service to the Los Angeles downtown area.

Are you aware that the busway is being built and is in partial operation?

Do you regularly commute to the LA downtown area (twice/week or more)?

"No." Thank you very much for helping us in our evaluation.

"Yes." Now, I would like for you to take five minutes to fill out this questionnaire for me. It is entirely confidential. Do not include your name.

INTERVIEWER ____________________

CLUSTER ______ **Page** of ___

DATE __________________

House #	Address	At home?	Aware of busway?	# CBD commuters	Q. Serial #	Remarks

APPENDIX C

FALL SURVEY QUESTIONNAIRE, DATA FORMAT

Includes:

- Questionnaire Covering Letter
- Questionnaire
- Household Survey Control Sheet
- Population File Format

Cover Letter for
Those Commuters
Not Home

We missed you while you were out...

Dear Commuter:

Five minutes on your part can help your local government plan transportation improvements in the Los Angeles area. These improvements are needed to combat air pollution and automobile congestion, etc. They can also come in many ways and can cost billions of dollars. The question is, will your opinions be part of the planning process?

Your assistance is VERY IMPORTANT because your household is part of a small group of households that has been scientifically selected to represent the whole population. This is the only inexpensive and statistically valid method for government to know what the public wants. Please help us!

We are a research organization retained by the Southern California Association of Governments to evaluate one transportation alternative for your area: exclusive lanes for buses on the San Bernardino Freeway. One of our survey data-takers has been to your home and was told that you regularly work in the downtown LA area. We need the questionnaire left with you to be filled out and returned to us. If you will be home later this evening, we have made arrangements to come back to collect the questionnaire. Otherwise, please use the attached envelope -- all ready for mailing.

Sincerely yours,

Peter FitzGerald

Peter FitzGerald
Survey Coordinator
Crain & Associates

thank you — for your help

Questionnaire
Int. _____
Cl. # _____
Q. # _____

FALL 1973

Household Survey

The San Bernardino Freeway has been rebuilt with improved highway lanes and an exclusive busway. Please help us evaluate this transportation project by taking the five minutes necessary to fill out this confidential questionnaire.

1. What is the intersection (names of cross streets) nearest to your place of work? _____ & _____

2. How did you travel from your home to work on your last morning commute trip? a.___car (used for the entire trip to work)
   b.___bus (whether or not you used an auto to get to the bus)

If you checked bus, please skip to Question #12

3. When you made this trip, were you:
   a.___driving alone?
   b.___the regular driver, carrying regular passengers?
   c.___an alternate driver, whether you were the driver or a passenger that day. How many days a week do you drive?___
   d.___a regular passenger?

4. How many people traveled together, including yourself, in the automobile that you drove or rode to work (do not include children)? ___

5. a. If you were in a carpool, how much did you pay (or usually pay) the others for riding? ($____per____(day, week, month)
   b. How much did you receive (or usually receive) for driving? $____per____(day, week, month)

6. a. What was the vehicle parking cost? $____per____(day, week, month) Who paid this cost? _____
   b. What other costs did you have, if any (e.g., downtown bus travel)? $____per____(day, week, month) for _____.

ito sers swer -11

OMB Approval
No. 041S71085

Auto Users Answer 3-11

7.a. When did you leave your home for work? _____ A.M.
b. When did you arrive at your office or work station? ___ A.M. 34-35

8. Not counting time spent in parking, walking, or waiting for your carpool, how much of your total commute time was driving or riding time inside the car? _____ minutes

9. Could you have used the San Bernardino Freeway Express Busway for your work trip that day?
a. ____ yes, but I chose not to because _____
_____
b. ____ no, because _____
c. ____ I don't know

10. Do you usually have a need such that you must use your car during the working day for purposes other than driving to and from work? ____ yes, ____ no

11. How far is it from your home to the nearest bus service?
a. ____ (no.) blocks, b. ____ none nearby, c. ____ I don't know

Auto users, now skip to Question #15

Bus Users Answer 12-14

12.a. If you went by bus, when did you leave your home? ____ A.M.
b. When did you arrive at your office or work station? ___ A.M.
c. How much of this time was spent riding on the bus? ___ min.

13.a. If you walked to the bus: how many blocks? _____ blocks
b. If you went by car to the bus: how many miles? ____ miles
- how much time was spent riding in the car? _____ minutes
- was the car driven back home by someone else ___ yes, ___ no

14. How much did you pay to ride the bus to work? 58-60
Monthly Pass: $_____per month + cash per ride? _____¢
Commuter Ticket: $_____per 10 rides
Cash only (including transfers) $_____ per one-way trip.
Parking cost? ____ 25¢/day, ____ $2/month, ____ other

EVERYONE

15. Now, we would like to know something of your attitudes about traveling. Please give us your response to the following statements:

	Strongly Agree	Agree Somewhat	Indifferent	Disagree Somewhat	Strongly Disagree	
a. If a new and improved and convenient public transportation service were introduced, I would certainly use it.	▱	▱	▱	▱	▱	61
b. I don't enjoy driving very much.	▱	▱	▱	▱	▱	
c. I hate to be tied to fixed schedules for traveling.	▱	▱	▱	▱	▱	
d. In this day and age, the only thing public transportation should try to do is to serve the needs of the poor and the disadvantaged.	▱	▱	▱	▱	▱	

16a. How many autos are available for use by you and other members of your household? _____

b. How many drivers are there? _____ 68 69

17. Sex: ___male, ___female
Age: ___16-29, ___30-39, ___40 or over

18. What is the combined income of all household members?

a.___zero to $10,000
b.___$10,000 to $15,000
c.___$15,001 to $30,000
d.___more than $30,000

19. What are your feelings toward allowing fast bus travel on the San Bernardino Freeway through use of exclusive bus lanes? [ ] 73

_____

_____

_____

20. Not thinking of the good or bad points of bus service in your particular area, how would you rate your general attitude toward traveling to work by bus? [ ] 74

___very positive, ___positive, ___negative, ___very negative

21. The busway, an exclusive lane for buses running down the median strip of the freeway, was opened from El Monte to the Long Beach Freeway on January 29. How were you commuting to work <u>before</u> the busway opened? [ ] 75

a.___car

b.___bus

c.___did not commute to work downtown <u>or</u> live in the San Bernardino Freeway area prior to the inauguration of the busway

22. If you have switched from auto to bus or from bus to auto since the busway opened, why have you switched? [ ] 74-75

_____

_____

In case we need to check back with you, would you please provide us with your telephone number? Telephone: _____

thank you —

for your help

Fall '73

PHASE I HOUSEHOLD SURVEY CONTROL SHEET

Good evening, my name is _____. We are conducting a government survey (So. Calif. Assoc. of Gov'ts) concerning the public's reaction to the new highway improvements on the San Bernardino Freeway. Besides the improvements in the regular highway lanes, they have built exclusive busway lanes that will provide rapid transit bus service to the Los Angeles downtown area.

- Are you aware that the busway is being built and is in partial operation?
- Do you or other members of your household regularly work in the Los Angeles downtown area or in the Wilshire district?

Int._____

Cl, # __ Pg. __ of __

Date _____

	all	eve.....
NH	®	☐
HL	®	☐
TB	®	☐
Ref	--	--
CQ.	--	--

Houses Approached	Contact?	Aware of Busway?	Commuters?	Q.#	Remarks	Name & Phone #

Number of Contacts _____

SAN BERNARDINO BUSWAY HOUSEHOLD SURVEY

PHASE I, FALL 1973: POPULATION FILE INDEX

DESCRIPTION OF CONTENT

A. The first column of figures gives the questionnaire item numbers for each data item.

B. The second column describes the data item and gives the cost breakdown.

C. The third column gives the column numbers on the code sheets used for each data item.

D. The fourth column gives the variable name used in computer programming.

E. Whenever figures given for day, week, or month were to be translated into one-way trip figures, the guidelines were:

1) amount per day divided by 2 = amount per one-way trip

2) amount per week divided by 10 = amount per one-way trip

3) amount per month divided by 40 = amount per one-way trip

Question #	Data Item	Column	Variable Name
	1 denoted Phase I Household Survey	1	PHASE
	Cluster # 01-40 Denoted Random Sample 51-90 Denoted Select Sample	2-3	CLUSTER
	Destinations		
	01-29 CBD, Central Business District 31-49 NCBD, Not Central Business District 50-99 NDT, Not Downtown but West of Los Angeles River	4-5	
	Doorstep or Mail Return Questionnaire? 1. Doorstep Completed Questionnaire 2. Mail-Returned Questionnaire	6	DSMQ
1	Cross-Streets Nearest Place of Work Downtown (CBD + NCBD Only) Column # 7-8: North-South Street 9-10: East-West Street See Attachment A for CBD Codes, Attachment B for NCBD NDT not coded	7-10	STREETS
	Status of Busway Service 1. Served (Clusters #51-86 + 3, 6, 18, 24) 2. Served Later (Clusters #4, 5, 12, 13, 15, 16, 19, 21, 22, 25, 26, 29, 31, 34, 35) 3. Not Served (Clusters #1, 2, 7, 11, 23, 28, 32)	11	SERVED
2	Mode 1. Auto 2. Bus	12	MODE

Question #	Data Item	Column	Variable Name
3	General Submode	13	SUBMODE
	11. Auto - Driving Alone 12. Auto - Regular Driver Carrying Passengers 13. Auto - Alternate Driver/Passenger 14. Auto - Regular Passenger 21. Bus - All the Way 22. Bus - Auto to Bus - Auto Parked 23. Bus - Auto to Bus - Given Ride to Bus 99. Other (Motorbike, Taxi)		
	Auto Submode by Who Pays	14	AUTOMODE
	1. Driving Alone 2. Regular Driver Carrying Passengers (Pay) 3. Regular Driver Carrying Passengers (No Pay) 4. Alternate Driver/Passenger (No Pay) 5. Alternate Driver/Passenger (Driver Paid) 6. Alternate Driver/Passenger (Passenger Paid) 7. Regular Passenger (Pay) 8. Regular Passenger (No Pay)		
	Blank for Bus Mode; Auto Mode Break-Down as Follows:	15-30	BLANK
4	# of Car Occupants, Including Respondent	15	CAROCCUP
	1-7 The Number 8. Eight or More 9. No Answer or Unclear		
	Reported Costs per One-Way Trip (See Attachment C for Coding Details)	16-23	
6a	Vehicle Parking Cost per One-Way Trip per Person (in Cents)	16-18	PRKCOST
	000 No Cost 999 Not Given or Unclear		

Question #	Data Item	Column	Variable Name
	Blank	19	BLANK
5-6	Respondent Received Revenue or Made Payments to Others	20	REVPAY
	Blank - Payments (to be Added to Costs): Regular Passenger, Alternate Passenger Who Paid That Day, or Regular Driver w/ Passengers Where Driver Made Payments Over and Above That of Revenue Received		
	- (Minus) - Revenue (to be Subtracted from Costs): Regular Driver Who Received Payments from Passengers, or Alternate Driver Who Was Paid That Day		
	0. Driver, Alone 8. Alternate Driver/Passenger Who Shared Driving Expenses, Regular Driver w/Passengers Who Received No Payments		
	9. Unclear		
	Total Amount Paid (by Respondent) or Received (from all Passengers): Cents per One-Way Trip	21-23	REVPAY
	000. Driving Alone or Alternate Driver/Passenger Who Shared Driving Expenses		
	999. Unclear		
8	Auto Driving Time in Minutes per One-Way Trip	24-25	CARDRVTM
	99. Not Given or Unclear		
(7)	Auto Excess Time in Minutes per One-Way Trip	26-27	CAREXCTM
	(Subtract Question 8 from Question 7)		
	Does not include time not related to trip purpose, e.g., eating breakfast.		
	99. Not Given or Unclear		

Question #	Data Item	Columns	Variable Name
9-10	Could Person Have Used SBFEB?	28	USESBE
	1. Yes 2. No 3. Don't Know 4. Busway Does Not Serve Our Area 9. No Answer Given by Auto User		
	Explanation of Above Responses	29	USESBE
	0. For Codes 3, 4, 9 in Column 28 above, if they do not need car during business day		
	1. No explanation given for 1 or 2 above		
	2. Specifically mentions inconvenience of mode change at El Monte ("I would have to drive to station" or "How would I get to El Monte Station?") or need better feeder service or confusion about service		
	3. Too many transfers and/or too slow, schedule problems		
	4. Cost of bus		
	5. Destination problem - no bus stop near work		
	6. I like to drive my car		
	7. I have a good car-pool arrangement		
	8. I need my car for personal reasons outside of work (Question 10)		
	9. I need my car <u>during</u> business day (Question 10)		

Question #	Data Item	Columns	Variable Name
11	# of Blocks to Nearest Bus Service	30	BLK
	1-7 # of Blocks 8 Miles Away, None Nearby or More Than 7 Blocks 9 Don't Know		
	Blank for Auto-Mode	30-42	
	Bus-Mode Breakdown as Follows:		
12c	Bus Riding Time in Minutes per One-Way Trip	31-32	BUSRDETM
	99 Not Given or Unclear		
12ab	Bus Excess Time in Minutes per One-Way Trip (Subtract Question 12c from Question 12 a,b)	33-34	BUSEXCTM
	Does not include time not related to trip purpose, e.g., eating breakfast		
	99 Not Given or Unclear		
13a	# of Blocks Walked to Bus Stop by Bus User	35	BLKWLK
	0 Did Not Walk to Bus 1-7 # of Blocks 8 8 or More Blocks 9 No Answer for Those Who Did Walk		
13b	# of Miles Driven to Bus Stop (Rounded Off to a Whole Number)		
	0 For Those Who Walk to Bus 1-7 # of Miles 8 8 or More Miles 99 No Answer for Those Who Did Go By Car to the Bus		

Question #	Data Item	Columns	Variable Name
13b	Auto to Bus Driving Time in Minutes per One-Way Trip	37-38	CARBUSTM
	00 For Those Who Walk to the Bus 99 For No Answer for Those Who Did Go by Car to the Bus		
14	Bus Fare: Cents per One-Way Trip	39-40	FARE
14	Parking Cost for Bus User	41-42	CARBUSPK
	Blank - If No Cost for Bus Users (Walk or Auto to Bus)	43	BLANK
15	Average of Attitudes (if 3 or More Answers to 15a-d)	44-45	ATTAVG
	(1: Pro-Auto; 5: Pro-Transit)		
15a	Would Use New, Improved, Convenient Public Transit	46	ATTA
	Blank - No Answer 1. Strongly Disagree 2. Somewhat Disagree 3. Indifferent 4. Somewhat Agree 5. Strongly Agree		
15b	"I Don't Enjoy Driving Very Much"	47	ATTB
	Blank - No Answer 1. Strongly Disagree 2. Somewhat Disagree 3. Indifferent 4. Somewhat Agree 5. Strongly Agree		

Question #	Data Item	Columns	Variable Name
15c	"I Hate to be Held to a Fixed Schedule"	48	ATTC
	Blank - No Answer 1. Strongly Agree 2. Somewhat Agree 3. Indifferent 4. Somewhat Disagree 5. Strongly Disagree		
15d	Transit Here Only to Serve Poor and Disadvantaged	49	ATTD
	Blank - No Answer 1. Strongly Agree 2. Somewhat Agree 3. Indifferent 4. Somewhat Disagree 5. Strongly Disagree		
	Blank	50	BLANK
16a	# of Automobiles per Household	51	CARS
	# of Automobiles Blank - No Answer		
16b	# of Drivers per Household	52	DRVRS
	# of Drivers Blank - No Answer		
17	Sex	53	SEX
	1. Male 2. Female Blank - No Answer		

Question #	Data Item	Columns	Variable Name
17	Age 1. 16-29 Years 2. 30-39 3. 40 or Over	54	AGE
18	Combined Household Income Blank - No Answer 1. Zero to $10,000 2. $10,000 to $15,000 3. $15,000 to $30,000 4. More Than $30,000	55	INC
19	Basic Feelings about the Busway (Room for Two Comments) Blank - No Comment or Indifferent 0. No Second Comment for One Comment 1. General Praise for Busway 2. Will Improve Conditions on the Freeway (Traffic Conditions) 3. Will Help with Pollution 4. Busway May Be Too Costly; Too Many Empty Buses 5. Concerned about Busway Safety 6. Better Feeder Service to Busway Needed 7. Should Not Have Special Lane for Buses - Could Have Six-Lane Highway Instead 8. General Negative Comment 9. Other	56-57	ATTABUSW
20	General Attitude on Buses Blank - No Answers 1. Very Negative 2. Negative 3. Positive 4. Very Positive	58	ATTBUS

Question #	Data Item	Columns	Variable Name
21	Switch From Mode Used Before January 29, 1973?	59	SWITCH
	Blank - No Answer 0. No Switch 1. Bus to Car 2. Car to Bus 3. Did Not Commute to L.A. or Live in S.B. Freeway Area Before 9. Other or Unclear		
22	If Switched, Why?	60	WHYSWITCH
	0. No Switch 1. Time, Convenience 2. Cost Savings 3. General Frustration with Mode Used Before (Including Car Pool Breakup) 4. Other 5. Have a Ride Now 6. Changed Employment 9. No Answer, But Did Switch		
	Auto Miles Driven (Map Calculation)	61-62	CARMI
	Total Economic Cost (Reported in Cents/Trip)	63-65	ECONCOST
	Standard Cost (From Cluster) of Mode Not Used (Cents/Trip)	66-68	SCMNU
	Blank	69	BLANK
	Total Real Cost of Mode Used (Cents/Trip)	70-72	RCMU
	Auto or Bus Better (Referring to Individual Disutility Values)	73	SRBETTER
	1. Auto Better 2. Walk to Bus Better 3. Auto to Bus Better 4. No Bus Options for Auto-Mode Comparison		

Question #	Data Item	Columns	Variable Name
-	Actual Individual Disutility Value: Absolute Difference Between Real Cost (Col. 70-72) and Standard Cost (Col. 66-68) (Cents/Trip)	74-76	SRDUV
	Auto or Bus Better (Referring to Disutility Values by Cluster)	77	SSBETTER
	0. Neither 1. Auto Better 2. Walk to Bus Better 4. No Bus Options for Auto-Mode Comparison		
-	Aggregate Disutility Value: Absolute Difference Between Standard Cost of Mode Used and Standard Cost of Mode Not Used (Cents/Trip by Cluster) ($5.00, i.e., 500, If No Bus Option)	78-80	SSDUV

PHASE I HOUSEHOLD SURVEY CODING INDEX

Attachment A (Columns 7-10)

Listing of Streets of L.A. CBD
in Alphabetical Order with Code Number

North-South (Col. 7-8)

83	Alexandria	25	Fremont	50	Mercury
01	Alvarado	26	Garland	51	Midway
02	Arapahoe	27	Grand	52	New Hampshire
03	Ardmore	28	Grandview	53	Normandie
04	Beacon	79	Gratten	54	Occidental
05	Beaudry	29	Green	55	Olive
06	Benton	30	Harlem	56	Oxford
07	Berendo	31	Hartford	57	Parkview
08	Bixel	32	Harvard	58	Pembroke
09	Blackstone	77	Hill	59	Rampart
75	Blaine	33	Hobart	60	Reno
10	Bonnie Brae	34	Hoover	61	St. Paul
11	Boylston	35	Hope	52	Serrano
12	Broadway	86	Irolo	53	Shatto Pl.
13	Broadway Pl.	36	Kenmore	64	Spring
14	Burlington	37	Kingsley	65	Sunbury
15	Carondolet	38	Lafayette Pk	66	Union (dr/st/ave)
16	Catalina	39	Lake	78	Valencia
17	Columbia	40	Lebanon	80	Vendome
18	Commonwealth	41	Lindley	67	Vermont
19	Coronado	42	Little	68	Vincent
76	Cottage Pl.	43	Loma	81	Virgil
84	Dewey	44	Los Angeles	69	Werdin
20	Elden	45	Lucas	70	Western
85	Fedora	46	Magnolia	71	Westlake
21	Figueroa	47	Main	72	Westmoreland
22	Flower	48	Mariposa	73	Wilshire Pl
23	Francisco	49	Menlo	74	Witmer
24	Frank				

East-West (Col. 9-10)

32	Boyd	23	Ocean View	02	2nd St.
13	Cambria	24	Olympic	03	3rd St.
34	Diamond	25	Pico	04	4th St.
14	Dianna	26	San Moreno	05	5th St.
15	Florida	30	Shatto St.	06	6th St.
16	Francis	27	Sunset Pl.	07	7th St.
17	Geneva	28	Temple	08	8th St.
18	Ingraham	33	Weller	09	9th St.
19	Leeward	31	Winston	10	10th St.
20	Linwood	29	Wilshire Blvd	11	11th St.
22	Monette	01	1st St.	12	12th St.

PHASE I HOUSEHOLD SURVEY CODING INDEX

Attachment B (Columns 7-10)

Listing of Streets of L.A. NCBD
in Alphabetical Order with Code Number

North-South Going East (Col. 7-8) (Col. 7-8)	
01	Norton
02	Alvarado
03	Albany
04	Figueroa
05	Broadway
07	Los Angeles
08	Santee
09	Maple
10	Wall
11	San Pedro
12	Central
13	Hooper
14	Alameda
15	Vignes
15	Mateo
17	Santa Fe
18	Wall
19	Beverly (not in order)
20	Mission (not in order)
21	Blaine

East-West Going South (Col. 9-10	
01	Macy
02	Sunset
03	Ducommun
04	Temple
05	1st Street
06	Beverly
07	2nd Street
08	3rd Street
09	Hunter
10	4th Street
11	Olympic
12	5th Street
13	Willow
14	6th Street
15	Wilshire
16	7th Street
17	8th Street
18	9th Street
19	10th Street
20	11th Street
21	12th Street
22	Pico
23	14th Street
24	15th Street
25	16th Street
26	Venice
27	Santa Monica Freeway
28	Washington
29	Main

PHASE I SURVEY CODING INDEX

Attachment C (Columns 16-18 and 20-23)

This appendix gives details as to how parking costs and carpool arrangements for auto users were coded. In all cases, the amounts were in cents per one-way trip.

Person Filling Out Questionnaire	Coding
1. Driver - Driving Alone	Parking cost coded if driver paid it; otherwise 000 was coded.
2. Regular Driver with Passengers	a. Payments by passenger(s) involved: per person parking cost was coded in col. 16-18. For col. 21-23, his revenue minus his share of parking and whatever he may have paid over and above his share was coded; i.e., revenue = reported revenue minus the difference between the whole parking cost and one person's cost for a one-way trip. b. If no payments by passenger(s): parking cost per auto occupant was coded in col. 16-18; a household or family relationship was presumed which would dictate dividing all economic costs for multiple occupant trips where there were no payments.
3. Regular Passenger	a. Payments by passenger: per person parking cost was coded in col. 16-18. For col. 21-23, per person parking cost was subtracted from payment. b. If no payments, per person parking cost in col. 16-18 was coded.
4. Alternate Driver/Passenger	a. If driving and parking costs were shared (no payments back and forth), then parking cost per occupant was coded in col. 16-18. (Code 8000 in col. 20-23)

b. If an Alternate Driver was being paid that day, it was coded as in case 2 (a) above.

c. If an Alternate Passenger was paying that day, it was coded as in case 3 above.

The objective was to focus on person-vehicle parking costs. No company paid parking costs were coded.

San Bernardino freeway express busway evaluation