ANALYSIS OF THE

1983 SCRTD ON-BOARD SURVEY

Prepared for:

Southern California Rapid Transit District

BY
JAMES M. LEFTON
PETER R. DE HAAN
June, 1985

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
1.0	INTRODUCTION	7
1.1	Objectives	7
1.2	Background to Survey	8
1.3	Outline of Report	9
2.0	SURVEY METHODOLOGY	12
2.1	Selection of Survey Objectives	12
2.2	Questionnaire Design	12
2.3	Sample Selection	13
2.4	Survey Administration	14
2.5	Factoring Procedures	15
2.5.1	Overview	15
2.5.2	Response Factor	20
2.5.3	Transfer Factor	21
2.5.4	Bus Factor	22
	FOOTNOTES	24
3.0	SUMMARY OF SURVEY RESULTS	25
3.1	Transit Service Characteristics	26
3.1.1	Total Transit Service Consumption	26
3.1.2	Method of Fare Payment	30
3.1.3	Activities at Origins and Destinations	32
3.1.4	Mode of Access to Bus	35
3.1.5	Transfer Patterns	36
3.1.6	Type of Bus Service	37
3.1.7	Planning Sectors	39
3.1.8	Frequency of Buses	42
3.2	General Rider Demographic Characteristics	43
4.0	ACCURACY OF RESULTS	48
4.1	Comparison of Survey with Control Data	48
4.1.1	System-Wide Comparison	51
4.1.2	Comparison for Groups of Lines	52
4.2	Potential Survey Bias Against Rider Groups	60
4.3	Calculation of Confidence Intervals	63
	FOOTNOTES	65
5.0	CONCLUSIONS AND RECOMMENDATIONS	67
5.1	Conclusions Regarding Survey Data Results	67
5.2	Conclusions Regarding Survey Methodology and Data Accuracy	69
5.3	Recommendations	71

TABLE OF CONTENTS (Continued)

APPENDIX

APPENDIX	TITLE	PAGE
A-I	Outline of Survey Objectives.....	75
A-II	Description of Factoring Methodology.....	78
A-III	Definition of Master Groups.....	85
A-IV	Bus Lines Not Surveyed With Estimated Daily Patronage.....	86
A-V	Selected Survey Data Results.....	87
A-VI	Comparison of Line Groups.....	137
A-VII	Discussion and Explanation of Chi-Square Test Used in Survey vs Ridecheck Comparisons.....	141
A-VIII	Calculation of Confidence Intervals.....	143
A-IX	Methodology for Tables 4-2, 4-3.....	145
A-X	Survey Questionnaire.....	146

INDEX OF TABLES

TABLE	TITLE	PAGE
3-1	Total Daily Ridership by Annual Household Income	28
3-2	Total Daily Ridership by Method of Fare Payment	31
3-3	Total Daily Ridership by Trip Purpose (Origin-Destination)	33
3-4	Type of Bus Service by Annual Household Income	37
3-5	Annual Household Income by Ethnic Background	43
3-6	Auto Ownership/Availability by Ethnic Background	44
4-1	System-Wide Comparison: Ridecheck Versus Survey Proportions	52
4-2	Comparison of Fare Payment	55
4-3	Comparison of Time Period Data	57
4-4	95% Confidence Intervals: Master Group 2 Excluding Evening/Night Period	64
A V-1	Weekday Ridership by Fareclass	88
A V-2	Total Daily Ridership by Fareclass	89
A V-3	Total Daily Ridership by Trip Purpose (Origin-Destination)	90
A V-4	Trip Purpose by Annual Household Income	91
A V-5	Trip Purpose by Ethnic Background	92
A V-6	Total Daily Ridership by Mode of Access to Bus	93
A V-7	Mode of Access to Bus by Annual Household Income	94
A V-8	Mode of Access to Bus by Ethnic Background	95
A V-9	Total Daily Ridership by Number of Buses for Trip	96
A V-10	Number of Buses for Trip by Vehicle Availability	97
A V-11	Number of Buses for Trip by Number of Household Cars	98
A V-12	Number of Buses for Trip by Ethnic Background	99
A V-13	Number of Buses for Trip by Annual Household Income	100
A V-14	Total Daily Ridership by Type of Service	101
A V-15	Type of Service by Annual Household Income	102
A V-16	Type of Service by Ethnic Background	103

INDEX OF TABLES (Continued)

TABLE	TITLE	PAGE
A V-17	Type of Service by Availability of Auto for Trip	104
A V-18	Total Daily Ridership by Planning Sector.	105
A V-19	Planning Sectors by Ethnic Background....	106
A V-20	Planning Sectors by Annual Household Income	107
A V-21	Total Daily Ridership by Frequency of Bus Use	108
A V-22	Frequency of Bus Use by Annual Household Income	109
A V-23	Frequency of Bus Use by Ethnic Background	110
A V-24	Frequency of Bus Use by Fare Class.....	111
A V-25	Total Daily Ridership by Age.....	112
A V-26	Age by Ethnic Background.....	113
A V-27	Total Daily Ridership by Ethnic Background	114
A V-28	Total Daily Ridership by Gender.....	115
A V-29	Gender by Ethnic Background.....	116
A V-30	Gender by Employment Status.....	117
A V-31	Total Daily Ridership by Annual Household Income	118
A V-32	Annual Household Income by Ethnic Background	119
A V-33	Total Daily Ridership by Year Began Riding RTD	120
A V-34	Year Began Riding RTD by Fare Class.....	121
A V-35	Year Began Riding RTD by Gender.....	122
A V-36	Year Began Riding RTD by Annual Household Income	123
A V-37	Year Began Riding RTD by Ethnic Background	124
A V-38	Total Daily Ridership by Schedule Source.	125
A V-39	Total Daily Ridership by Residence in Los Angeles Area	126
A V-40	Total Daily Ridership by number of Drivers in Household	127
A V-41	Total Daily Ridership by Size of Household	128
A V-42	Total Daily Ridership by Number of Workers in Household	129
A V-43	Total Daily Ridership by Employment Status	130
A V-44	Employment Status by Ethnic Background...	131
A V-45	Total Daily Ridership by Number of Automobiles in Household	132

INDEX OF TABLES (Continued)

TABLE	TITLE	PAGE
A V-46	Number of Household Cars by Ethnic Background	133
A V-47	Total Daily Ridership by Availability of Auto for Trip	134
A V-48	Vehicle Availability for Trip by Ethnic Background	135
A V-49	Total Daily Ridership by Knowledge of Metro Rail	136
A VI-1	Definition of Line Groups Compared	138
A VI-2	Time Period Percentages: Survey vs Ride Check	139
A VI-3	Fare Payment Percentages: Survey vs Ride Check	140

1.0 INTRODUCTION

1.1 OBJECTIVES

This report has been prepared to assist the Southern California Rapid Transit District (RTD) in its analysis of the 1983 On-Board Survey, conducted by Barton-Aschman and Associates. Several District personnel have already done their own analyses of the survey and have reached various conclusions concerning its design and application. The purpose of this report is not to duplicate their work but to build upon what already is known. For this reason, the report is intended to fill the following objectives:

- Provide a written documentation of the survey methodology. This documentation is intended to be a resource which can be used to achieve better understanding of the survey results.
- Provide a summary of survey results, which can be used as a basic reference by District personnel.
- Compare survey results based on their conformance to other sources of data. This analysis is performed at two different levels of aggregation, with the intention of determining at what point the survey results become too disaggregated to be reliable.

It should be noted that no attempt is made in this report to focus on the reliability of results for individual questions. Aside from the fare payment, stop-on, stop-off, and time period questions, none of the survey questions yield results which can be corroborated with other data. Logical conjectures can be made regarding possible biases in these questions; however, this study will not make such conjectures, as it would not be in keeping with the above-stated objectives. The content of previous analyses performed by District staff indicates that the District is well aware of such possible biases.

1.2 BACKGROUND TO SURVEY

The information needs of RTD's Planning and Marketing departments dictate that data about RTD riders must be continuously and systematically collected. Most of this ridership data is acquired through ride checks, in which, on a given day, every boarding on a line is counted by location and fare category and every alighting on the line is recorded by location. These checks provide accurate statistics concerning bus stops and lines, but since they provide little data about individual passengers, on-board surveys are also necessary as a supplemental source of information.

Previous On-Board Surveys only sampled a small number of RTD system lines. For the 1983 survey, however, the District desired a survey that would provide more than general

system statistics, but would provide accurate data for all portions of the system. Therefore, a much larger sample was required, and outside assistance was necessary. For this reason the District obtained the services of Barton-Aschman and Associates as a consultant for the survey.

1.3 OUTLINE OF THE REPORT

Each of the three objectives mentioned above correspond to one chapter in this report (Chapters 2-4). Chapter two summarizes the techniques that were used in setting the survey objectives, designing the survey methodology, selecting the sample, and weighting the results. This chapter should prove to be extremely informative to the District in that there has been only sparse analysis of the survey methodology to this point in time.

Chapter Three contains a summary of the data from the survey. These results are divided into two sections. The first section presents overall District ridership statistics, as well as a breakdown of these statistics by rider characteristics such as income, race and gender. The second section crosstabulates ridership characteristics in order to profile the District's patrons. To improve the value of this report as a reference tool, more complete results are provided in tabular form in the Appendix V.

In Chapter Four, the accuracy of the survey results is evaluated. The analysis in this chapter is broken down into

three sections. In the first, the survey results for fare payment method and time period are compared to District fare survey and ride check data. In order to determine the degree to which the final weighted survey results can be disaggregated while remaining accurate, comparisons are made for both system-wide statistics and small groups of lines. Similar comparisons are made for the survey statistics which result when the weighting algorithm is only partially applied, and these comparisons are used to measure the effect of each weighting step on the accuracy of the results. The second section compares mean system weights for various groups of riders and service types in an attempt to discover if any of these groups are significantly undersampled in the survey. The third section calculates confidence intervals for this survey data.

The final chapter of this report (Chapter 5) consists of conclusions and recommendations stemming from the analysis of the survey. This chapter begins with a summary of the survey results covered in Chapter Two. A second section contains the major findings from Chapters Three (survey methodology) and Four (accuracy of results).

Based upon these findings, four recommendations are made:

- That the survey results for system-wide and service category (e.g. express, demand) be used, as the problems which exist do not appear great enough to affect these results significantly.
- That the survey results for individual lines not be used, since the weighting methodology was not intended to provide data of this type.
- That the survey results for small groups of lines be used with caution unless the reliability of these results can be supported by further study.
- That the RTD consider re-weighting the evening/night results if it ever wishes to study these results alone.

2.0 SURVEY METHODOLOGY

2.1 SELECTION OF SURVEY OBJECTIVES

The first phase in the survey process consisted of a series of meetings between Barton-Aschman personnel and RTD Planning and Marketing staff to determine the objectives for the survey. While many of the objectives were similar to those of previous surveys, this one was unique in that Planning Department staff needed data for use in calibrating origin-destination and fare policy models. For this reason, information on the location and timing of transit trips over all portions of the system was necessary. Therefore, the survey had to be designed in such a way that results could be weighted to represent system trip totals. (The actual list of objectives is shown in Appendix I).

2.2 QUESTIONNAIRE DESIGN

Questions were written that would provide the information requested in the survey objectives. Questions requiring large samples, such as those related to modeling (trip location and time, trip purpose, household demographic data) were placed on the On-Board Survey questionnaire. Lower priority questions, many of which were used in RTD's previous surveys of smaller sample size, were placed on a telephone questionnaire used to interview a portion of the On-Board Survey respondents.

2.3 SAMPLE SELECTION

The sample was chosen from a list of all bus trips, listed by day of the week, division, line, run, and trip starting time.[1] The selection procedure was as follows:

1) All trips on the list were grouped according to whether they were scheduled for weekdays, Saturdays, or Sundays. Within each of these three groups, the trips were sorted by line; then, within each line, the trips were sorted by division. In generalized form, the resulting list would appear as follows:

Weekday	Line 1	Div 1	(group of bus trips)
Weekday	Line 1	Div 2	(group of bus trips)
Weekday	Line 1	Div 3	(group of bus trips)
Weekday	Line 2	Div 2	(group of bus trips)
Weekday	Line 2	Div 3	(group of bus trips)
Weekday	Line 3	Div 1	(group of bus trips)
Saturday	Line 1	Div 2	(group of bus trips)
Saturday	Line 3	Div 1	(group of bus trips)
Sunday	Line 1	Div 1	(group of bus trips)
Sunday	Line 2	Div 1	(group of bus trips)

2) Within each of the groups produced by the previous step, the trips were grouped according to bus run. These bus run groups were then arranged randomly within each of the groups produced by the previous step.

3) Within each bus run group, the trips were sorted by start time. At the end of this step, each group of trips having the same day, line, and division would have an arrangement similar to the following list:

Run 17	9:11	trip
	10:27	trip
	11:03	trip
	11:39	trip
	12:16	trip

Run 6	6:54	trip
	7:30	trip
	8:06	trip
Run 8	14:47	trip
	15:18	trip
	15:54	trip
	16:30	trip

4) A random number was used to select a cluster of trips near the top of the list resulting from steps 1-3. The remaining clusters chosen were separated from the first by a pre-determined interval. (As an example of this method, if a survey was to have a sampling ratio of 1/12 with cluster size equal to 4, the first cluster would be randomly chosen from among the first 48 trips on the list. This cluster would be followed by 44 unsampled trips, 4 sampled trips, 44 unsampled trips, 4 sampled trips, etc.) The cluster size and sampling ratio chosen by the consultant could not be determined; however, the relative volume of survey responses indicates that the same sampling volume was used on each day of the week. The sampling ratio on weekends was therefore one-fifth of the weekday sampling ratio.

2.4 SURVEY ADMINISTRATION

The On-Board Survey was pretested on April 14 and 15, 1983, while the actual survey was in the field between April 30 and June 20, 1983. On the local and express lines, professional surveyors were employed by the consultant to conduct the survey. The surveyors were instructed to distribute questionnaires to all who boarded on each bus trip

selected in the sample, recording in a log book the number of boardings by fare payment.[2] In addition, the questionnaires contained serial numbers, and after each trip the serial number of the next questionnaire was recorded as a double-check to the boarding count. On Park and Ride and night runs, questionnaires were distributed by the driver, and no fare count was taken. Passengers were instructed to return questionnaires to receptacles at the exits of each bus; however, the survey questionnaire could also be returned through postage-paid mail.

As part of the On-Board Survey, respondents were asked to provide the addresses and purposes (i.e. work, home, school, etc.) of both origins and destinations. If one of these locations was listed as being the respondent's home, survey personnel used a reverse telephone directory to obtain the respondent's telephone number. A portion of those whose telephone numbers could be obtained in this manner were then randomly selected and interviewed over the telephone using the Telephone Survey questionnaire. (The data results and methodology of the telephone survey are not analyzed in this report).

2.5 FACTORING PROCEDURES

2.5.1 Overview

As designed by Barton-Aschman, the final factored (weighted) records contain only responses for patrons who

were on the first leg of their trip. Two factors are used to weight these responses: (1) FACTRIPS, which factors these first-leg responses to represent the total number of passenger trips in the system, and (2) FACBDS, which factors the responses to represent the total number of passenger boardings in the system. This section summarizes the methodology used in deriving these factors.

The two factors, FACTRIPS and FACBDS, were derived through a methodology which could be classified as a post-stratified weighting technique in which four strata were used. These strata are referred to as category, master group, subgroup, and line, and are defined as follows:

Categories:

1 = AM peak time period, north or east direction
2 = AM peak time period, south or west direction
3 = midday base time period
4 = PM peak time period, north or east direction
5 = PM peak time period, south or west direction
6 = evening time period
7 = night time period

Master Groups:

All lines were assigned to one of 22 different master groups, defined according to their geographical location. For example, Master Group 1 was defined to include lines 1, 2, 4, 10, 16, and 20.[3] Due to the smaller sample size on weekends, master groups for Saturdays and Sundays were often combined for weighting purposes.

Subgroups:

In most master groups the lines were divided into

smaller groups call subgroups. For weekday statistics, a total of 51 subgroups were used.

Line:

A line was defined as being inclusive of all branches. The most disaggregate level of weighting occurred at this level; no distinction was made between branches of the same line. For a given day of the week, all responses on a given bus line were defined as belonging to the same line, master group, and subgroup.

Within these strata, three seperate weights are calculated. The final weights, FACBDS and FACTRIPS, are actually composites formed from the following three weights:

- Response Factor - Weights the individual responses to control for non-response bias and estimate overall characteristics for sampled bus trips.
- Transfer Factor - Adjusts the estimates for sampled bus trips to account for the estimated number of transfers.
- Bus Factor - Expands the estimates for the sampled bus trips to estimate characteristics of the universe.

The use of these three weights is best explained by way of an example. In this example, two bus trips in a given line, subgroup, master group, and category ("cell") are sampled. According to the boarding count (no fare count was taken in this example), 200 people board the bus. Of these riders,

50 return completed and usable questionnaires. Of these 50 people, 40 had boarded the bus for the first leg of their trip. Under the survey methodology, these 40 responses would represent all the riders on the bus. In simplified form, the weighting would occur as follows:

1) The response factor would be calculated by dividing the 200 counted boardings by the 40 usable questionnaires. The resulting response factor for each respondent would be 5.

2) The transfer factor is computed according to the methodology described in Section 2.5.3 and Appendix II. This transfer factor adjusts the total number of counted boardings to approximate the total number of trips. For example, if the transfer factor for this particular cell were 0.96, then the two bus trips with 200 boardings would represent (200)(0.96) = 192 trips.

3) The bus factor would be calculated by dividing the total number of bus trips in the cell by the number of sampled bus trips in the cell. In this example, if there were 30 bus trips in the cell, with only two sampled, the bus factor would be 15. This factor might be increased to account for cells where no bus trips were sampled.

The relationship between these factors is summarized by the following formula (a detailed description of this relationship is provided in Appendix II):

- For respondents who used cash:
  FACTRIPS = (BUS FACTOR) X (RESPONSE FACTOR)
  FACBDS = (BUS FACTOR) X (RESPONSE FACTOR) X (TRANSFER FACTOR)

- For respondents who used passes (or rode on lines without fare counts):
  FACBDS = (BUS FACTOR) X (RESPONSE FACTOR)
  FACTRIPS = (BUS FACTOR) X (RESPONSE FACTOR) X (TRANSFER FACTOR)

In the above example (where there was no fare count), FACBDS would be equal to (15)(5) = 75. FACTRIPS would be equal to (15)(5)(0.96) = 72.

An important characteristic of this procedure is the method it uses to account for cells where no sample was taken. If there was no sample taken for a given line during a particular time period, heavier weights would usually be assigned to similar lines during the same time period. Because these empty cells are not accounted for through use of heavier weighting on the same line during a different time period, the weights placed upon a particular line do not necessarily represent the universe of bus trips on that line. The weighting methodology was not intended to provide line-by-line aggregate totals. Since the weighting was done according to time periods and line groups, survey results for these strata should be more meaningful.

A second important characteristic of this procedure is that no special technique exists for handling the situation where only one or two responses exist in a given "cell" (the group of all responses belonging to the same category, master group, subgroup, and line). It is therefore possible

for a single response to be weighted to account for ten lines, while a single entry in a similar cell would be weighted to account for that cell alone. Cells with only one or two responses occurred often during the evening and night periods.

2.5.2 Response Factor

The response factor for all responses belonging to the same category, master group, subgroup, and line (the same "cell") is calculated through use of the following formula, shown in simplified form:

$$\frac{U}{S},$$

where U = the total number of boardings counted in the cell, and S = the total number of responses in the cell.

On most runs, a fare count was taken as the survey was being conducted; in these cases the response factor is calculated separately for pass boardings and cash boardings. Since cash patrons who transfer must use transfer tickets, it was possible for the surveyor to determine the number of patrons who were boarding their first bus, and the universe could therefore be set to this number. In the case of passes, the universe was set equal to the total number of persons boarding with passes, since the surveyor could not differentiate between first-time boardings and transfers. As a result, on these runs the response factor for cash

boardings accounts for the total number of trips, while the response factor for passes accounts for the total number of boardings. On runs where no fare count was taken, the response factor accounts for the total number of boardings.

2.5.3 Transfer Factor

The transfer factor accounts for the propensity of patrons to transfer, and is calculated separately for respondents who use cash and respondents who use passes. For respondents who use cash, the transfer rate calculation is based upon the relative proportion of cash boardings and transfer ticket boardings counted in a given cell. For these respondents, the transfer factor is equal to or greater than one, and is multiplied by the response factor's count of total trips to provide an estimate of total boardings. For pass respondents, the transfer factor for a given cell is based upon the respondents' answers to survey question #12 (see questionnaire, Appendix X), i.e. the number of buses required for the trip. For these responses the transfer factor is never greater than one, and is multiplied by the response factor's count of boardings to estimate the total number of trips. The precise procedure for computation of these factors is provided in Appendix II.

Because the transfer factors and response factors calculated for cash patrons are based on the actual fare counts, these factors should be quite accurate in calculating the

total number of cash trips and boardings. Similarly, the survey figures for the total number of pass boardings on sampled trips should be accurate, as they are based on the fare count. The results for pass trips on a given bus trip would be less accurate, however, as they are estimated based on the number of buses per trip reported by survey respondents. It should be noted that when the FACBDS weight is used, statistics for those on the first leg of their trip are weighted to represent all boardings. This technique is only accurate to the degree that patrons on the first leg of their trip are similar to patrons not on the first leg. Therefore, the survey results should be more accurate for statistics concerning bus trips.

2.5.4 Bus Factor

The bus factor was calculated using a methodology similar to that used for response factors. Stated in simplified form, the formula used is equal to:

$$\frac{U}{S},$$

where U = the total number of bus trips in a given cell, and S = the total number of sampled bus trips in a given cell.

If no bus trips within a given cell were sampled, the weights of other cells are increased to account for the empty cell. If there was no sample for a peak period cell,

the bus trip weights for the cell in the same master group and subgroup, heading in the opposite direction during the opposite peak, are increased by a corresponding amount. In other cases, the weights for all bus trips in the same subgroup, master group, and category are increased. Appendix II describes this procedure in more detail.

FOOTNOTES

[1] A bus trip is defined as being a single journey of a bus in one direction along its route. A bus run is defined as being a complete piece of work as performed by a bus from the time it leaves the division to the time it returns.

[2] On park-and-ride and owl runs, the bus operators conducted the survey. For these runs the driver did not count the boardings by fare category, but the serial numbers on the questionnaires were used to determine the total number of boardings.

[3] As explained in section 4.0, the master group assignment for unsampled lines is unknown. Therefore, it is possible that one or more of the unsampled lines are also a part of Master Group 1.

3.0 SUMMARY OF SURVEY RESULTS

In this chapter, the major results of the On-Board survey will be reviewed. The chapter is divided into two basic sections. In the first section, the level of RTD service consumed is examined, as is the relationship between the amounts of service consumed by various rider subgroups. The second section focuses wholly on the district's ridership, providing a demographic profile of the district's patrons. Because the survey produced an overwhelming amount of data, this chapter is intended only as an executive summary of the major findings. Most of the tables pertinent to this chapter are located in Appendix V. This appendix includes survey results, by day and by time period, for each survey question. It also contains cross tabulations of results for key pairs of questions.

This chapter does not attempt to produce any analysis of the accuracy of the results. Rather, it has two purposes:

- To provide a brief summary of the major survey results.
- To provide statistics which will, in the next chapter be compared with control statistics to evaluate survey accuracy.

There are two words of caution concerning the presentation which follows. First, the survey was intended to provide data concerning the universe of linked transit

trips, which are defined as the total number of boardings minus the number of boardings which are the result of transfers between buses. For this reason the results stated in this chapter are not to be interpreted as applying to the typical transit rider; unless specified the data is presented in terms of linked passenger trips. Second, the survey results are estimated for the RTD system as it existed during April - June 1983, when the survey was taken. A number of changes may have occurred in the system since that time.

3.1 TRANSIT SERVICE CHARACTERISTICS

3.1.1 Total Transit Service Consumption

The On-Board survey estimates that the District serves slightly over 907,000 linked passenger trips each weekday, while serving 528,000 trips each Saturday and 365,000 trips each Sunday. In terms of unlinked passenger trips, or boardings, the estimates are 1,253,000 boardings per weekday, 726,000 boardings per Saturday and 495,000 boardings per Sunday. The weekday ridership is thus 70 percent higher than Saturday and 150 percent higher than Sunday. The ratio of unlinked to linked boardings for the system is roughly 1.4.

On weekdays, the highest concentration of trips served per operational hour occurs during the PM peak (3-6pm), accounting for 32 percent of all weekday trips. The peak

periods taken together (6-9 am, 3-6pm) account for 58 percent of all weekday trips, compared to 35 percent during the base period (9am-3pm). The PM peak period thus serves 60 percent more ridership than the AM peak, while the peak periods together serve 50 percent more ridership than the base period. On weekends, trips generally begin later than on weekdays, and are more dispersed throughout the day, most likely because of the smaller proportion of work and school trips occurring on weekends (see section 3.1.3 on trip purpose).

A demographic breakdown of transit use shows that nearly 70 percent of RTD riders are members of a minority group. According to the survey, the three major ethnic groups in terms of RTD trips are Whites, Blacks and Hispanics. On weekdays, the percentage of total linked ridership for these three groups is 35.5 percent, 28 percent and 26 percent respectively. On Saturday, the percentage of total ridership for the three groups remains in the same rank order, but the number of trips made by whites decreases relative to the number of trips made by Blacks. On Sunday, the highest proportion of trips (32.5%) is made by Hispanics, with Whites second (32%) and Blacks third (27%).

TABLE 3-1

TOTAL DAILY RIDERSHIP BY ANNUAL HOUSEHOLD INCOME

Percentage of Total Trips

HH INCOME	WEEKDAY	SATURDAY	SUNDAY
Under $10,000	40.2%	49.5%	56.5%
$10,000-$24,999	36.4	37.0	31.4
$25,000-$49,999	16.5	10.9	8.0
$50,000 + Over	7.0	2.5	2.0
	(100%)	(100%)	(100%)

Since service to the poor is one of public transit's most important societal functions, information on household income is helpful for determining the effectiveness of the District in providing this type of service. The survey shows that the District does indeed serve a high proportion of lower income riders; approximately 78 percent of all RTD riders have household incomes less than $10,000 per year. The survey further documented the generally held belief that weekend transit service serves a higher proportion of low income riders than does weekday service. Table 3-1 reveals that the proportion of riders with household incomes under $10,000 is significantly higher on weekends (especially Sundays) than on weekdays. The lower income associated with weekend service does coincide with a higher proportion of minority riders (see Section 3.2 for the relationship bet-

ween income and ethnicity). The survey also indicates that on weekdays the AM and PM peaks are principally the result of trips made by those in the middle and higher income groups (greater than $10,000). In the lower income brackets (less than $10,000), demand throughout the day is level, or peaked during the midday period.

In addition to household income, the survey provides alternative measures of a rider's transit dependence. For example, the majority of those making trips have no automobile available for their trip. As might be expected, the proportion of riders who have an auto available is greatest when the riders's income is also the greatest: on weekdays, especially during the AM and PM peaks. During these peak periods, 33 percent of the respondents said a car was available for their trips, compared with only 25 percent during the base period. This proportion is lowest on Sundays, when income is also lowest; only 17 percent of the riders have an auto available for their trip.

Not only do most of the District's riders fail to have an auto available for their trips, but a large proportion have no household automobiles whatsoever. Fifty-percent of all weekday trips are made by riders with no cars. With even a higher proportion on Saturday (61%) and Sunday (69%). The proportion with no cars is again highest during the time periods when income is lowest.

Finally, the results of the survey corroborate the findings in previous surveys which have found that women are more likely than men to be transit users. On weekdays, the proportion of females to males is 59 percent to 41 percent, while on Saturday it is 56 percent to 44 percent. Only on Sunday does the number of males approach the number of females; on this day the female to male proportion is 51 percent to 49 percent. The results also reveal that the proportion of females drops considerably in the evening and night time periods, with males actually outnumbering females by a 56-44 margin. Overall, the largest proportion of females occurs during the AM peak period (midday period on Sunday).

3.1.2 Method of Fare Payment

The fare payment question was likely the single most important question in the On-Board Survey. As was discussed earlier in section 2.0, this question functioned as a control against non-response bias. In addition, it provided data used by the District in determining fare policy (See Footnote, Table A V-2).

TABLE 3-2

TOTAL DAILY RIDERSHIP BY METHOD OF FARE PAYMENT

Percentage of Total Trips*

FARE TYPE	WEEKDAY	SATURDAY	SUNDAY
Cash	37.7%	40.2%	39.5%
Regular Pass	22.8	27.2	23.2
Elderly/ Handicapped Pass	9.0	9.1	11.7
Student Pass	15.7	13.5	13.0
College Pass	6.0	4.4	7.4
Express Pass	4.7	1.7	2.0
Other	4.1	3.9	3.2
	(100%)	(100%)	(100%)

* Total Fares Checked

Table 3-2 reveals that cash fare payments are the most common type of fare payment among RTD riders, followed by regular and student passes. A comparison of weekdays to Saturdays and Sundays reveals several important differences. On both weekend days, the proportion of cash use rises significantly while the proportion of express pass use falls. The proportion of student pass and college pass use also drops, but not as significantly as the use of express passes. The proportion of use of senior passes rises substantially on Sunday, while the proportion of use for regular fare passes rises on Saturday, but not on Sunday.

A comparison of fare usage between the peak and base periods on weekdays also reveals notable differences. Although the actual period of time during each peak is only half the base period, more regular passes and express passes are used during either of the peaks than during the base period. Use of the other types of fare is spread out more evenly throughout the day. College passes, senior passes, and handicapped passes have the lowest proportions of use during the peaks in relation to the base.

3.1.3 Activities at Origins and Destinations

The survey inquired of respondents as to the type of trip they were making by asking for both their trip origin and destination purpose. The survey's origin-destination data thus provides comprehensive information on the travel behavior of SCRTD patrons.

TABLE 3-3

TOTAL DAILY RIDERSHIP BY TRIP PURPOSE (ORIGIN-DESTINATION)*

Percentage of Total Trips**

TRIP_PURPOSE	WEEKDAY	SATURDAY	SUNDAY
Work	54.1%	35.7%	22.3%
School	21.1	1.3	1.1
Shopping	11.4	29.0	23.5
Visiting-Recreation	8.0	18.6	35.5
Religious	0.8	5.9	11.8
Medical-Dental	3.3	2.4	1.8
Other	10.2	10.3	9.6
	(100%)	(100%)	(100%)

* Includes origins and/or destinations

** Totals may exceed 100% due to double counting of trips which are not home based.

Table 3-3 reveals the trip to and from work (work related) to be the most common weekday trip type. School related trips also account for a significant portion of weekday trips, along with shopping and visiting recreation. As expected, work-related trips are most common during the AM and PM peak periods, while school-related trips occur most often during the AM peak and base periods. The highest proportion of shopping-errand trips also occur during the midday base period.

Table 3-3 also reveals that the proportion of work and school-related trips drops significantly on weekends, with a consequent increase in the proportion of incidental-type trips. This pattern is particularly evident on Sundays, where the work trip is supplanted as the predominant trip type by both visiting-recreation and shopping-related trips. Religious trips show an expected increase on Sundays as well. It should be noted that, while school-related trips account for only 1 percent of all weekend trips, student pass use accounts for 13 percent of total weekend ridership by fare, while college pass use accounts for 6 percent (See Section 3.1.2 on Method of Fare Payment). This indicates that school passes are being used significantly on weekends for non-school-related purposes.

A breakdown of trip purpose by annual household income reveals that the work-related trip is much more predominant among higher income transit users. The work-related trip accounts for 42 percent of all trips made by riders with household incomes less than $10,000, compared to 61 percent for incomes greater than $25,000. The remainder of the surveyed trip purposes decrease in proportion to total trips as household income rises. The increase in the proportion of work-related trips as household income increases reveals that higher income riders generally utilize the bus for a more specialized purpose, indicating a higher level of transit dependence for lower income riders.

3.1.4 Mode of Access to Bus

The overwhelming majority of RTD patrons access the bus by walking (93% on weekdays, 96% on Saturdays and Sundays), with over 75 percent of these patrons walking no more than three blocks. These access mode statistics, which are for boarding patrons, parallel those for patrons alighting the bus.

A breakdown of weekday access mode by time of day reveals a noticeable pattern. During the base, PM peak, and evening periods, the proportion who walk is approximately equal to the daily average, 93 percent. However, during the night the proportion drops to 90 percent, probably due to safety considerations, and during the AM peak it drops to 87.5 percent, apparently due to the operation of peak period park-and-ride lines (see Section 3.1.6 on type of service).

There is also a discernable pattern in the mode of access to the bus used by riders of different household incomes. Generally, as household income increases, the probability of the rider accessing the bus by walking decreases. Ninety-six percent of all riders with household incomes less than $10,000 access the bus by walking, compared to 88 percent for incomes greater than $25,000. The maximum proportion of riders who access the bus by walking have household incomes less than $2,000, while the minimum proportion is for riders with incomes greater than $50,000 (96% and 87%, respectively).

3.1.5 Transfer Patterns

Overall, a majority of the District's patrons require only one bus per trip, with Sunday being the only day where the proportion of trips falls below 50 percent (52% on weekdays, 52.5% on Saturdays, 47% on Sundays). Over 90 percent of the passenger trips require two buses or less. The mean number of buses per trip for weekdays and Saturdays is 1.5, increasing only slightly to 1.6 on Sundays.

The pattern of bus use varies considerably with respect to ethnic background, particularly with regard to White and Black riders. White riders (62%) are far more likely to require only one bus per trip than are Blacks (42%). However, with the exception of Black riders, all other surveyed ethnic groups show over 50 percent of their riders requiring only one bus per trip. Overall, Whites require the smallest number of buses per trip with a mean of approximately 1.4, while Blacks require the largest number with a mean of 1.7.

The number of buses required per trip also shows variation with respect to household income, although less variation occurs here than what was observed when analyzing the pattern of bus use by ethnicity. The major decrease in the number of buses required per trip occurs with riders whose household incomes are greater than $25,000. Sixty-one percent of all riders with household incomes above $25,000 require only one bus per trip, compared to 51 percent for riders with incomes below $25,000. Riders with household

incomes in excess of $50,000 are by far most likely to require only one bus (67%). The survey also found that the proportion of riders requiring only one bus per trip increases steadily as the number of household cars increases (this holds true for auto availability as well). These results were expected given that lower income riders are more transit dependent, and thus more likely to use the bus under less ideal circumstances.

3.1.6 Type of Bus Service

TABLE 3-4

TYPE OF BUS SERVICE BY ANNUAL HOUSEHOLD INCOME

Percentage of Total Trips

HH INCOME	LOCAL	ALL DAY EXPRESS	PEAK HOUR ONLY EXPRESS
Under $10,000	44.6%	32.8%	3.1%
$10,000-$24,999	36.1	36.9	24.5
$25,000-$49,999	13.9	21.7	38.3
$50,000 + Over	5.4	8.6	34.1
	(100%)	(100%)	(100%)

The differences which have been observed with respect to household income are perhaps most distinct when broken down by the type of service used. Table 3-4 reveals that the proportion of low income riders (under $10,000) is signifi-

cantly higher on local service lines in comparison with express service lines. These differences are particularly apparent for peak hour only express service lines, where nearly three-quarters of all riders have annual household incomes greater than $25,000. Overall, peak hour only express riders have a mean family income of roughly $34,000, compared to $19,000 for all day express riders and only $14,500 for local service riders.

There are other indicators as well of the overall greater wealth (and lessened transit dependency) of express service riders. Nearly 42 percent of all express riders, and 85 percent of all peak hour only express riders, have a car available for their trip. This statistic seems to show that express buses are indeed attracting commuters who would normally be using a car. Meanwhile, only 27 percent of all local service riders have a car available for their trip. This greater availability of a car for express riders is reflected in the access mode of express riders. Nearly 95 percent of local service riders walk to their bus, compared to 85 percent for express riders and only 62 percent for peak hour only express riders.

These differences observed in family income by type of service can be explained by the geographic areas served by the different line types and the ethnic background of their riders. Express ridership to the downtown area is served primarily in the San Fernando and San Gabriel valleys, where

both areas were observed to have higher than average household incomes (see Section 3.1.7 on planning sectors). In addition, 50 percent of all express riders are white, increasing to over 78 percent on peak hour only express service, while Whites account for only 33 percent of all riders on local service lines. The survey results show that White riders have significantly higher household incomes than any other major ethnic group (see Section 3.2 on rider demographics).

3.1.7 Planning Sectors

The survey questionnaire inquired of respondents as to the precise street address of their boarding and alighting. Allocating respondents to the 13 planning sectors (as they existed in 1983) based on their boarding location allows for a cross-sectional analysis of the survey results over the entire Los Angeles county service area. The vast differences in the demographic characteristics of the overall population between these planning sectors suggests that rider demographics will vary significantly as well.

An examination of the ethnic backgrounds of RTD riders by the planning sector in which their bus trip originates (linked boardings) shows considerable variation between the various sectors. The San Fernando Valley planning sector is characterized by the largest majority of White riders at 65 percent, with West Los Angeles ranking a somewhat distant

second at 56 percent. Conversely, the South Central Los Angeles planning sector is dominated by Black ridership, which at 73 percent is the largest proportion for any one ethnicity in any one planning sector. Only 6 percent of the South Central Los Angeles planning sector's riders are White, which is one-tenth of the San Fernando Valley's White ridership proportion. East Los Angeles is another planning sector which is distinct for its overwhelming non-White ridership. Over 70 percent of the East Los Angeles planning sector's riders are Hispanic, with White riders accounting for only 15 percent of the total.

The San Fernando Valley, which maintains the largest proportion of White riders of any planning sector in the RTD system, also exhibits the highest rider household income of any planning sector. This is consistent with findings in this study which show that White riders tend to have the highest household incomes of any ethnic group (see Section 3.2 on rider demographics). The survey estimates that about one-third of all San Fernando Valley riders have household incomes greater than $25,000, which is about twice the proportions found in the East Central Cities, South Central Los Angeles and East Los Angeles planning sectors. Overall, the San Fernando Valley planning sector has the highest mean household income at approximately $17,500, with the San Gabriel Valley planning sector near the top at $17,000.

The downtown Los Angeles planning sector, which serves as the hub for work commute trips, shows the expected overwhelming predominance of PM peak ridership. Nearly 60 percent of all linked boardings originating in the downtown planning sector occur during the 3 hour PM peak period, while only 4 percent occur for the same amount of time during the AM peak.

This distinction of the downtown Los Angeles planning sector as primarily an employment center is further borne out by the origin-destination (trip purpose) survey responses. Over 62 percent of all linked trips beginning in the downtown planning sector originate from the work place, as compared with only 10 percent which originate from a residence. West Los Angeles is another planning sector which shows up as a major employment center within the RTD system, though not to the same magnitude as downtown Los Angeles. Over one-third of all trips beginning in the West Los Angeles planning sector originate from the work place, which is about equal to the proportion originating from home. The remaining planning sectors appear to be primarily residential in nature. This is especially true for the East Central Cities, San Gabriel Valley and South Central Los Angeles planning sectors, where about two-thirds of all linked trips beginning in these planning sectors originate from a residence.

3.1.8 Frequency of Bus Use

This question provides data which is useful to the District for fare policy analysis, particularly with regard to pass fare users. This variable is also useful as an alternative measure of transit dependency.

The survey results concur with the common assumption that pass fare riders use the bus on a more frequent basis than do cash fare riders. Nearly 96 percent of all regular pass riders use the bus almost daily, compared to only 70 percent for cash fare riders. Express and student pass riders are also very likely to use the bus almost daily (both at 95%) while handicap and senior pass riders are the least likely of the pass riders to use the bus almost daily (85% and 81%, respectively).

The survey results also show that lower income riders are more likely to use the bus on an almost daily basis; although the relationship between family income and frequency of bus use does not appear to be linear. The peak frequency of ridership occurs with household incomes of around $10,000-$15,000, where roughly 87 percent of the riders use the bus almost daily. The frequency of bus use gradually decreases as incomes rise or fall above or below the $10,000-$15,000 base income figure, reaching a minimum frequency proportion for incomes in excess of $50,000 (78%). Riders with household incomes greater than $50,000 are roughly three to four times more likely to use the bus only

on an occasional basis (less than once a week) than are riders with incomes less than $10,000.

3.2 GENERAL RIDER DEMOGRAPHIC CHARACTERISTICS

This section will summarize the results of the On-Board Survey pertaining strictly to ridership characteristics. Specifically, this section will examine the interrelationships of various ridership characteristics in an attempt to provide a more precise picture of the District's patrons. Due to the disparate socio-economic characteristics of the District's riders, it is impossible to compose a "typical" rider profile which would be at all representative of the overall rider population. A comparative analysis of rider sub-populations will therefore be used.

TABLE 3-5

ANNUAL HOUSEHOLD INCOME BY ETHNIC BACKGROUND

Percentage of Total Trips

HH_INCOME	WHITE	ASIAN/PACIFIC ISLANDER	HISPANIC	BLACK
Under $10,000	32.7%	34.0%	54.5%	44.7%
$10,000-$24,999	39.6	32.9	33.1	35.8
$25,000-$49,999	19.4	25.6	8.2	14.6
$50,000 or more	8.4	7.4	4.2	4.9
	(100%)	(100%)	(100%)	(100%)

Table 3-5 presents a breakdown of family income by ethnicity and shows that Hispanics are by far the poorest of the rider ethnic groups surveyed; over half of all Hispanic riders are lower income (household incomes less than $10,000). This overwhelming predominance of lower income Hispanics is so great that, despite ranking third in total trips served, Hispanics account for a higher volume of trips by lower income riders than any other ethnic group. At the other end of the spectrum, nearly a third of all Whites and Asian/Pacific Islanders have household incomes greater than $25,000, about two to three times higher than the rate for Hispanics. Overall, White riders have the highest mean family income at approximately $17,000, followed by Asians/Pacific Islanders at $16,500, Blacks at $13,000 and Hispanics at $10,500.

TABLE 3-6

AUTO OWNERSHIP/AVAILABILITY BY ETHNIC BACKGROUND

Percentage of Total Trips

ETHNIC BACKGROUND	AUTO OWNERSHIP YES	AUTO OWNERSHIP NO	AUTO AVAILABILITY YES	AUTO AVAILABILITY NO
WHITE	48.7%	51.3%	30.2%	69.8%
ASIAN/PACIFIC ISLANDER	62.6	37.4	39.0	61.0
HISPANIC	43.1	56.9	25.5	74.5
BLACK	48.0	52.0	28.1	71.9
OTHER	55.9	44.1	35.2	64.8

Due to the high costs associated with automobile ownership and operation, it would be expected that lower income riders would have lower rates of auto ownership, thus being more transit dependent. The survey bears out these expected results by indicating that Hispanics, who have the lowest household incomes of any ethnic group surveyed, also have the fewest number of household cars and were least likely to have a car available for their trip (See Table 3-6). Conversely, Whites and Asians/Pacific Islanders, who have the highest household incomes, also have the greatest number of household cars and are most likely to have a car available for their trips. The number and availability of household cars, in addition to household income, are also a function of household size. However, even though Hispanic riders have the fewest number of household cars, they have the largest number of persons per household. The mean number of persons per household for Hispanics is 4.0, compared to only 2.6 for Whites, 3.3 for Blacks and 3.6 for Asians/Pacific Islanders. These household size figures thus tend to further substantiate the claim that Hispanics, and low income riders in general, are more transit dependent.

White riders, in addition to having the highest household incomes, generally tend to be older than their counterparts as well. The mean age for White riders is 39 years, compared to only 29 years for Blacks and Hispanics. This age differential is explained (at least in part) by the

survey results which show that Whites were the least likely of all ethnic groups to use the bus for school-related trips. Since the age of riders using the bus for school-related trips is lower (roughly 18 years) than for any other trip purpose, it would thus be expected that White riders would be generally older than other ethnic groups. Indeed, only 28 percent of all White riders are less than 25 years of age (upper range of school ages), compared to 47 percent for Hispanics and 49 percent for Blacks.

An examination of employment status by ethnicity shows that Hispanic riders (75.5%) are most likely to be employed whether full or part-time, followed in order by Asians/Pacific Islanders (71%), Blacks (69%) and Whites (68%). Although Whites rank last in terms of employment, they do have a higher proportion of riders employed full-time as compared with Blacks. The correspondingly smaller proportion of White riders employed part-time is most likely due to the lower proportion of White riders who are young and/or students. Systemwide, male riders (73%) are more likely to be employed either full or part-time as compared with females (68%), though a slightly higher proportion of females are employed part-time.

The survey also revealed that there are some noticeable differences in the ratio of male to female riders for different ethnic groups. These differences are particularly apparent for Blacks, where over 63 percent of all riders are

female. In comparison, Whites maintain the lowest proportion of female riders at 54 percent.

4.0 ACCURACY OF RESULTS

The purpose of this chapter is to evaluate, to the extent possible, the accuracy of the On-Board Survey results. Accuracy will be evaluated using three different techniques. In Section 4.1, the survey results will be compared to control data gathered from ride checks and fare surveys. Section 4.2 will compare the weights assigned to sample sub-populations in order to determine if there are any biases associated with the survey data results. Finally, Section 4.3 will examine the effect of the weighting procedures on the confidence interval size.

4.1 COMPARISON OF SURVEY WITH EXISTING CONTROL DATA

Comparison of On-Board Survey results with control data is difficult because most of the survey data can only be compared to the results of previous on-board surveys. Since all previous surveys included only a small fraction of RTD lines, those surveys are likely to be less accurate than the 1983 survey, and a comparison of survey results would therefore have little meaning in reference to survey accuracy. However, the 1983 survey results do include two pieces of information which can be compared to ride check and fare survey data:

- Type of fare payment: Comparison of fare payment data is relatively easy, since the required data is readily available in both the survey output and ride

check data. The fare payment was used as the control variable during the computation of the transfer factor and the response factor. Therefore, the weighted survey results for this variable should be more accurate than for other variables.

- Time period of boarding: This comparison is more difficult to perform, as time period data is not easily obtained from the line checks. However, estimates by time-of-day, based upon the ride checks, were obtained and used in this study. It should be noted that time periods were used to define the strata used in weighting. Therefore, the weighted survey results for this variable should be more accurate than for other variables.

In order to increase the usefulness of the comparisons, each will be made at two different levels of aggregation: for the entire system and for groups of lines. The rationale for making the comparisons in this manner is that the accuracy of the survey at the system-wide level does not necessarily imply the accuracy of the survey at lower levels of aggregation. A comparison of survey results for various levels of disaggregation should therefore provide some idea of the degree to which the survey remains accurate when results are disaggregated.

The comparisons made in this section will only involve proportions. The reason for this limitation is that the

weighting methodology used did not necessarily weight the results of a given group of lines in such a way as to represent the universe for that group of lines (see Section 2.1). In particular, twenty-one lines, representing 23,500 weekday boardings, were not included in the survey, and it is not known which other lines were weighted upward to account for these missing lines.[1] Thus, while the system-wide results are known to be weighted upward to represent system-wide boardings, it is not possible to determine, for any subset of the sample, which subset of the system that sample is weighted to represent. Therefore, little can be learned from a comparison of totals for groups of lines. However, the proportions for these same groups of lines should still be accurate. Since the groups are relatively large at this point, the weighting for any of the lines not included is unlikely to be great enough to distort the proportions within the group. For an individual line, on the other hand, the distortion could be considerable.

4.1.1 System-Wide Comparison

The system-wide comparison of survey results utilized comparable survey and control data. For fare payment, the survey's statistics are the results from the fare payment question, fare first checked.[2] The control data are derived from fare surveys conducted for 1983.

For time period, the survey statistics are the results

according to time period as defined by the survey; each bus trip was defined as belonging to a particular period, and all results for that trip were allocated to that time period. The control data is based upon the overall systemwide time distribution calculated by the District on the basis of ride checks.

TABLE 4-1

SYSTEM-WIDE COMPARISON: RIDE CHECK VS SURVEY PROPORTIONS

Fare Payment Method

	Cash/Ticket/ Transfer	Regular Pass	Elderly/ Handicap Pass	Student Pass
Ride Check	43.3	21.2	11.0	20.5
Survey (weighted)	39.1	27.5	9.0	24.7

Time Of Day

	AM Peak	Base	PM Peak	Evening/Night
Ride Check	24.9	33.2	28.1	13.8
Survey (weighted)	19.6	34.5	32.5	13.4

The results shown in these tables indicate that the survey results are quite similar to the control data accepted by the District as being accurate. The only two apparent problems are the differences in the distribution of pass vs cash users, and the low estimate for ridership during the AM peak. However, these problems do not appear to be large enough to call into question the accuracy of the survey results for the system as a whole.

4.1.2 Comparison for Groups of Lines

In this section, the type of comparison made in the previous section will be performed for groups of lines. As displayed in Table 4-2, the first ten groups represent the

lines sampled within Master Groups 1 through 10.[3] Since these ten line-groups closely correspond to the strata used in weighting, the weighting results for these groups should be most accurate. The remaining three groups in the comparison (A-C) are groups of randomly selected lines. Group A was randomly selected from among all lines, Group B was randomly selected from all local and limited lines, and Group C was randomly selected from among all express lines. The line-groups are described in Appendix VI.

In the first step, the weekday survey results for fare payment proportions were compared to the corresponding results of ride checks conducted closest to the survey dates.[4] This comparison, as shown in Table 4-2, revealed that the survey's underestimation of cash boardings and overestimation of pass boardings, already shown to exist on a system-wide level, followed a very consistent pattern in each of the line-groups. While on the system-wide level the discrepancy was not enough to call the results into question, seven of the line-groups were underestimated for cash boardings by over 6%. This comparison indicates that the survey results at the line-group level might not be reliable.

In an attempt to discover why the weighted results for fare payment are inaccurate at the line-group level, the weighting procedure was broken down so that the results could be observed after the completion of each step. The

exact procedure used in this process is described in Appendix IX. The results, summarized in Table 4-2, show the effect of each weighting step on the proportion of cash boardings. The first column in this table contains, for purpose of comparison, the ride-check data. Since the actual, unfactored survey results only contain responses for persons on the first leg of their trip, the unfactored results cannot be interpreted to have any meaning with regard to total unlinked boardings. The first step of the weighting procedure, then, used TFACT to weight the unfactored results upward to account for transfer boardings. The result of this step, shown in Column 2, approximates the unweighted data in a form which can be compared with unlinked boarding statistics. The second step (Column 3), uses the factor RFACT to weight the results to account for non-response; the results of this step should set the total survey responses equal to the total number of boardings counted on the buses surveyed. The third step weights by BFACT to account for buses not sampled. The results of this step, shown in Column 4, are the final weighted survey results.

TABLE 4-2

COMPARISON OF FARE PAYMENT DATA

Results for Percentage Who Pay Cash

Group	Ride-Check Date	(TFACT) Weighting 1st Step	(RFACT) Weighting 2nd Step	(BFACT) Final Weighted Result
1	38.2	38.0	31.0	30.4
2	45.1	37.6	41.0	39.1
3	46.2	42.3	38.7	39.5
4	48.3	53.5	43.1	45.4
5	41.5	43.0	36.4	34.5
6	43.3	43.6	39.0	39.4
7	44.1	35.4	35.3	31.2
8	45.0	45.6	38.6	37.5
9	51.3	45.5	48.5	45.5
10	52.0	45.5	44.3	48.5
A	42.5	41.2	36.8	38.5
B	46.2	41.4	39.8	42.7
C	46.2	46.0	40.0	37.2

Table 4-2 reveals that the weighting followed a surprising pattern. While, in each group, the results were slightly different, the most accurate results appear after the first step (weighting by TFACT), where weighting was minimal. Strangely, the second step (weighting by RFACT) worsened the results. According to the methodology, in the second step the survey results were forced to match the total fare counts. Since the variable shown here is fare payment, the results of the second step should represent the actual fare counts for the trips sampled. Apparently, this fare count was consistently biased in favor of pass boardings. The final weighting step, which weights the fare count results to represent the universe, did not significantly improve or reduce accuracy. Taken together, then,

the second and third weighting steps reduced the accuracy of the results.

The second comparison, shown in Table 4-3, matched the survey's weighted time-of-day breakdown to ride-check data. This ride-check data was obtained through use of 1983 Fare Policy/Service Deployment Study data which estimates the proportion of riders during each time period based on 1983 ride check data. These proportions were then multiplied by the total ridership of each line for the ride check closest to the survey data to obtain an estimate of ridership during each time period. The estimates derived using this method are accurate to the extent that (1) the distribution of trips over the length of each line remained constant throughout the day, and (2) the proportion of ridership during each time period remained stable throughout 1983.

The pattern which occurred in system-wide survey results for time-of-day distribution is repeated in each of the thirteen groups of lines (see Appendix VI). In every case, the number of AM-peak boardings was underestimated while the number of PM-peak boardings was overestimated. While the discrepancy on a system-wide level was not great enough to bring into question the reliability of system-wide survey data, the discrepancy for five of the line-groups is over 10% (see Table 4-3), indicating that the survey results at this level of disaggregation may not be reliable.[5]

TABLE 4-3

COMPARISON OF TIME-PERIOD DATA

Results for Percentage of AM Peak Boardings

Group	Ride-Check Date	(TFACT) Weighting 1st Step	(RFACT) Weighting 2nd Step	(BFACT) Final Weighted Result
1	25.4	16.7	14.9	18.5
2	26.0	24.4	18.4	19.0
3	25.0	12.7	12.1	18.9
4	27.9	15.2	13.4	15.5
5	27.0	11.6	10.4	13.4
6	29.3	23.1	16.3	25.9
7	32.9	20.4	14.2	17.1
8	29.6	21.2	18.6	21.4
9	29.1	15.0	12.8	17.3
10	23.8	25.8	13.4	12.5
A	25.8	12.2	12.5	21.0
B	25.4	16.9	15.9	20.2
C	35.7	28.6	28.4	26.2

As with fare-payment results, the second weighting step (weighting for non-response) appears to push the time-period results in the wrong direction. In this case, however, the final weighting step (weighting to represent the universe) improves upon the results of the second step. Combined, the second and third steps improve the accuracy of results for seven groups, while reducing accuracy for four groups. For this variable, the results are defined not by the passenger's response but by the bus trip in which the response occurred.[6] Because the second weighting step forces the survey results to equal bus-trip boarding counts, the time-period distribution in this column is equal to the actual boarding counts of the bus trips sampled. Thus, it

is the boarding counts which are biased against the AM-peak period. However, the damage caused by this inaccuracy is mitigated by higher response rates during the AM-peak and by the accuracy of the final weighting step.

Not enough is known at this time to determine the cause of the apparent inaccuracy of the boarding counts obtained for these two variables. The pattern appears too consistent to be caused by chance, and the methodology for selecting the bus trips to be sampled appears too random to be capable of causing a systematic bias. One possible explanation that appears plausible, however, is that the definitions used in the survey boarding counts do not correspond to definitions used in ride checks. For example, a patron who uses an ID card and pays a reduced cash fare is counted by a ride check as a cash boarding; if the surveyors counted such persons as being pass users, the definitions would not correspond to each other. Similarly, the RTD defines certain bus trips as belonging to a specific time period, and if Barton-Aschman's method of assigning bus trips to a time period was significantly different, the definitions would be inconsistent. If the definitions used in the boarding counts were also inconsistent with the definitions used in assigning each response to a stratum, the weighted survey results will be biased. However, if these two definitions are consistent, the overall survey results will be unaffected. The accuracy of the survey results cannot be

demonstrated until it is shown that the weighted survey results conform to ride-check data when consistent definitions are used.

Given that, in Tables 4-2 and 4-3, the combined second and third weighting steps reduce the accuracy of the results more often than improve it, one might be led to conclude that these two weighting steps should not be used at all. However, it should be noted that in each of these tables, the weighting process is only shown for the portion of the distribution where the weighted results in Table 4-1 appeared most in error. For example, the largest difference between the weighted and ride-check time-of-day distributions occurred during the AM peak, and so AM-peak proportions were compared in Table 4-3. Since the weighted survey proportions for AM peak were the most inaccurate, the partially weighted survey results are most likely to consistently improve the accuracy. A comparison of system-wide results for both variables revealed that the weighted results for the proportion of AM-peak and cash boardings are less accurate than results which are only weighted to account for transfer boardings. However, when the overall distributions for the two variables were examined, the accuracy of the fully-weighted and partially-weighted results was approximately equal.

The use of weighting, then, does not appear to help or hurt the survey results when measured in terms of time-

period and fare-payment accuracy. However, the weighting could be necessary to prevent underrepresentation of certain groups due to response bias. This possibility will be examined in the following section.

4.2 POTENTIAL SURVEY BIAS AGAINST RIDER GROUPS

The analysis of this section will use the final weights assigned to each response to calculate the average weight applied to various subgroups of riders. Because the final weights used indicate the number of riders represented by each response, a larger average weight for a particular subgroup may indicate that this subgroup was relatively undersampled.

It was anticipated that lower income, inner city minority riders would be relatively undersampled for a variety of reasons. In particular, these riders tend to use the bus for short, congested inner city trips. These conditions were hypothesized to be less conducive to completing a survey questionnaire. An examination of survey weights does indeed show a relative undersampling for these riders. For example, the mean weight (linked boardings) for White riders in the sample is 122, compared to 176 for Blacks and 178 for Hispanics. Also, lower income rider groups consistently have larger associated weights than do higher income riders. The mean weight for riders with annual household incomes less than $2,000 is 201, compared to only 85 for incomes

greater than $50,000. As mentioned, these differences were expected because of the types of trips these riders made. The weighting results tend to confirm our expectations. Inner city planning sectors such as East Los Angeles (212) and South Central Los Angeles (207) have higher mean weights relative to more distant suburban sectors such as the San Fernando Valley (105) and the San Gabriel Valley (80). Differences in weights are also apparent when examining service types, where local service to/from downtown (181) has a much higher mean weight than express service to/from downtown (79), particularly in comparison to peak hour only express service (26).

A breakdown of the overall (system) weights into their basic components will reveal whether the observed variation in the weights are due to a bias in the sampling technique, or merely the result of non-response bias. The overall weight assigned to each rider is composed of three elements: (1) RFACT (response factor), (2) BFACT (bus factor), and (3) TFACT (transfer factor). RFACT basically weights up the responses on a particular bus trip to the number actually counted on board. BFACT weights up members of a specific sampling strata (master group) for trips not sampled. TFACT relates to the transfer rate and is unimportant in this analysis.

The results of the weighting breakdown substantiate the hypothesis that the inner city minority riders were under-

sampled because of a lower likelihood of response to the survey. Variations were observed in the response weighting factors (RFACT) which parellel observed variations in the overall weights, while the bus weighting factors (BFACT) remain fairly constant. For example, the mean response weighting factor (weekday) for Whites is 9.8, compared to 13.1 for Hispanics and 13.5 for Blacks. Meanwhile, the mean bus weights are fairly constant; 14.7 for Whites, 16.0 for Blacks and 16.3 for Hispanics. Also as expected, lower income riders tended to have higher response weighting factors than upper income riders; 13.8 for household incomes less than $2,000, 7.8 for household incomes greater than $50,000. Perhaps the best example is for types of service, where local service to/from downtown (14.2) shows a much larger response weighting factor than express service to/from downtown (5.9), while maintaining even a larger advantage over peak hour only express service (2.8). Again, the bus weighting factors for both local and express service remain very similar; 15.0 and 15.4, respectively.

Although it does appear that lower income, inner city minority riders were relatively undersampled in the On-Board Survey (no concrete data exists to confirm an actual under-representation), it seems that this occurrence is due to response bias, and not to any systematic bias in the sampling technique. At any rate, the response factor (RFACT) definitely increases the weight placed upon responses from

groups traditionally underrepresented in ridership surveys.

4.3 CALCULATION OF CONFIDENCE INTERVALS

Statistical analysis of the survey results is difficult because of the use of the weighting technique. Because of this technique, the survey results do not form a random sample, which is a basic requirement for most statistical tests. In this case, the use of stratification is likely to reduce the size of the confidence interval, while the use of weighting is likely to increase it. In order to produce an estimate of the survey confidence interval, a formula was used which calculates the overall confidence interval for a stratified weighted estimate based on the confidence intervals for the results in individual cells. This formula and its use are described in Appendix VIII.

Two major problems in calculating the confidence intervals should be mentioned here. First, in order to calculate the standard deviation in each cell, there must be at least two responses present, and Master Group 2, excluding the evening and night periods, is the only master group where every cell fulfills this condition. Thus, confidence intervals could only be calculated for this one group. Second, the confidence interval formula assumes that the selection process within each cell was random, while in reality it was not. Since no reasonable alternative could be found, however, this method had to suffice. The confidence intervals

which resulted from this formula were compared with the confidence intervals that would exist if a simple, unweighted, random sample were assumed. Since both formulas assume a random distribution, but only one assumes a stratified weighting technique, the results of the comparison can be used to determine the effect of the weighting and stratification on the confidence interval. The results are as follows:

TABLE 4-4

95% CONFIDENCE INTERVALS: MASTER GROUP 2
EXCLUDING EVENING/NIGHT PERIOD

Example 1:

Proportion of Patrons Who Are Asian

unweighted mean = 0.0222

unweighted confidence interval = $\pm$0.0143

weighted confidence interval = $\pm$0.023

Example 2:

Proportion of Patrons With Family Income Below $10,000

unweighted mean = 0.3744

unweighted confidence interval = $\pm$0.0471

weighted confidence interval = $\pm$0.0609

This analysis reveals that the combined effect of the stratification and weighting is quite small, apparently accounting for an additional 1% on each end of the confidence interval. Most likely, the increased accuracy due to stratification was counter-balanced by the reduced accuracy due to weighting.

FOOTNOTES

[1]These lines are shown in Appendix IV. According to George Hoit, who worked with Barton-Aschman in developing the weighting methodology, the Master Groups are defined in a cross-reference computer file. This file could not be located, and therefore it is not known to which strata the twenty lines not sampled belonged.

[2]Regular pass results are the total who checked regular pass first plus the total who checked express pass first.

[3]Because certain lines were not sampled, and the master groups assignments for these lines are unknown, the master groups used do not compare exactly to the actual master groups.

[4]Since the survey results for cash boardings are weighted to represent the total of all cash boardings counting transfers, the number of transfers recorded in the ride checks was added to the number of cash boardings to insure comparability of results.

[5]The methodology used for estimating distribution by time-period from the ride checks would be expected to produce results that would vary randomly in both directions of the actual mean. The fact that the AM-peak is consistently underestimated indicates that the discrepancy results from the survey data, not from the ride check data.

[6]According to George Hoit, each bus trip was assigned to a single time period. The time period for each response was

assigned according to the time period of the first-leg bus trip for that response.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS REGARDING SURVEY DATA RESULTS

The data results of the On-Board Survey appear to conform to findings which were expected based on general assumptions and previous On-Board Surveys. As expected, the District tends to serve minority, lower income riders. Nearly 70 percent of RTD riders are members of a minority ethnic group, while 40 percent of all weekday riders have annual household incomes of less than $10,000 (nearly 60 percent on Sundays). A majority of these riders are extremely dependent upon mass transit, having no automobile available for their trip.

The ethnicity and income level of RTD riders shows considerable variation when examining geographic boarding location and type of service. The poorest riders tend to board in the South Central and East Central Los Angeles planning sectors, where annual household incomes average between $10,500 and $12,500. The most affluent riders tend to board in the San Fernando Valley and San Gabriel Valley planning sectors, where household incomes average about $17,000-$17,500. Household income also varies by type of service. Riders boarding local service lines have mean household incomes of approximately $14,500, in comparison to $19,000 on express service and $34,000 on peak hour only express service lines.

Trip purpose varies by time of day and day of week. On weekdays, the majority of the trips are either work (54%) or school (21%) related. A majority of the work trips occur during the AM and PM peak periods, while most school trips occur during the AM peak and midday base. Work and school (especially school) related trips fall dramatically on weekends, with visiting-recreation related trips (35%) becoming predominant on Sundays. The work related trip is also much more predominant among higher income riders, accounting for over 60 percent of all trips made by riders with household incomes in excess of $25,000 (40 percent for household incomes less than $10,000).

Overall, a majority of RTD riders require only one bus per trip (Sunday is the only day where the proportion of trips falls below 50 percent), and over 90 percent of the passenger trips require two buses or less. However, there is significant variation with respect to ethnicity and household income. In particular, White riders (62%) are far more likely to require only one bus per trip than are Black riders (42%). Additionally, riders with household incomes greater than $25,000 (61%) are more likely to require only one bus per trip in comparison to riders with household incomes less than $25,000 (51%). These results were expected given that lower income riders are more transit dependent (the proportion of riders requiring only one bus per trip increases steadily as the number of household cars

increases), and thus more likely to use the bus under any circumstances.

The On-Board Survey also corroborates the common assumption that pass fare riders use the bus on a more frequent basis than do cash fare riders. Over 95 percent of all require pass riders use the bus almost daily (express and student pass riders too), compared to only 70 percent for cash fare riders. The survey also shows that student pass riders use the bus frequently on weekends for non-school related trips. This information on frequency of bus use is useful to the District for fare policy analysis, particularly with regard to pass fare users.

5.2 CONCLUSIONS REGARDING SURVEY METHODOLOGY AND DATA ACCURACY

One of the most useful results of this analysis is the determination of the sampling and weighting methodology. The sampling technique followed a reasonable method which allowed some degree of randomness while cutting cost. A major problem was that it did not allow for increasing the sampling volume during weekday nights and on weekends. Since there are relatively few trips during these periods, the sample size was very small and a large variance would be expected as a result.

The weighting methodology also appears to follow a logical, reasonable pattern. As a first step in this procedure, the survey responses were broken into strata defined by time

period, groups of lines, and line. Three different weights were computed within each of the cells defined by these strata to account for transfers and non-response, and to weight the results to represent system totals. The weighting technique also included a procedure to increase the weights of non-empty cells to account for empty cells within the same group of lines and time period. This technique resulted in increased accuracy for time period statistics at the expense of individual line statistics. Thus, survey results on an individual line basis are probably not accurate, and were not intended to be.

One problem with the weighting methodology is its lack of a special way to handle cells with only one or two responses. During the evening and night time periods, it is possible for a single response to be weighted to account for ten lines, while a single entry in another cell would only be weighted to account for one line. The accuracy of the weighted results could probably be improved if the evening and night weighting was redone with the cells combined in such a way as to insure a minimum number of responses in each cell.

A more serious issue threatening the accuracy of the weighted results is the problem found in the bus trip boarding counts used as the control totals for non-response weighting. Some inaccuracy could be expected in this control total, as it represents a sample of bus trips. How-

ever, in every case checked, the boarding count totals appear to underestimate the number of AM-peak boardings and cash boardings. This finding strongly suggests that some type of systematic bias exists in the boarding counts used as control totals. Since the accuracy of the survey results depends upon the accuracy of these control totals, this problem is potentially serious, especially because the final step in the factoring process does not do enough to correct the discrepancy.

Although there is an apparent discrepancy in the boarding count totals used in the weighting process, the exact definitions used in the boarding counts are unknown, and therefore it cannot be shown that this discrepancy is a sign of survey inaccuracy. The key question which needs to be answered is whether the definitions used in the boarding counts are consistent with the definitions used in assigning survey responses to a stratum. If these definitions are consistent, and if use of these definitions causes the ride-check data to conform to survey results, then the survey results are more likely to be accurate. However, if the boarding count definitions are inconsistent with the definitions for individual responses, then the survey results are likely to be inaccurate.

5.3 RECOMMENDATIONS

Based on the findings of this study, the following four

recommendations are made:

1) That the weighted survey results on the system-wide and service category levels be utilized: The analysis indicates that the survey results are accurate at these levels of aggregation. The apparent discrepancy between survey boarding count and ride-check counts does not, by itself, provide sufficient justification for rejecting the survey results.

2) That the survey results for individual lines not be used: The weighting methodology was such that the line-by-line results were not intended to be accurate. In addition, the sample size for most of these lines is too small to allow sufficient accuracy.

3) That the weighted survey results for small groups of lines (such as the master groups defined in the Appendix) be used with caution unless their accuracy is supported by further study: As stated above, the possibility exists that the boarding counts used as control totals have biased the weighted results in a systematic fashion. This apparent problem is likely the result of the definitions used in the boarding counts. There would not be a problem at all if it were shown that (1) the definitions used in the boarding counts were consistent with those used in defining the strata to which each response belonged,

and (2) the boarding count definitions, when applied to the ride check data, provided results which conformed to the weighted survey results.

4) That the District consider re-weighting the evening/night results: As stated above, the weighting during these time periods is probably inaccurate due to the large number of cells containing only one or two responses. The reliability of the results for this time period could therefore be improved if such cells were combined for purposes of weighting. However, this procedure could result in additional District expense, and the effect of improved evening/night results on the overall survey results would be minimal. Nevertheless, re-weighting might be desirable if the District wishes to study the evening/night statistics separately.

APPENDIX

A-I: OUTLINE OF SURVEY OBJECTIVES

The objectives for the survey were summarized by the survey consultant after a series of meetings in which District staff discussed their objectives with the consultant. This summary was as follows:

1. Data Objectives -
   a. Transit trips - Information on the location and timing of transit trips was desired by the Planning Department for use in calibrating origin-destination models and determining fare policy.
   b. Data with respect to the transit passenger - Data regarding demographics and income would be useful to the Planning Department, as it would improve the demographic data base, provide additional information for use in setting fare policy, and improve the District's ability to make accurate projections.
   c. Data regarding the household of the passenger - Data such as household size would also be valuable for the Planning Department's models.
   d. Awareness of RTD - Information on the awareness of patrons to RTD activities such as Metro Rail would be useful to the District as it would aid in the understanding of the political role played by transit patrons.
   e. Data regarding passes - Information on the

availability of passes would be useful to the Marketing Department in order to determine if the distribution system for RTD passes is adequate. The Marketing Department also desired information about the market for a tourist pass.

f. Data on access to, availability, and adequacy of information on RTD services to transit riders - This information would allow the Marketing Department to evaluate the distribution of RTD information through printed pamphlets and advertising.

g. Miscellaneous data - This category included other questions of concern to the Marketing Department, including why people ride the RTD, length of time as an RTD passenger, distance to bus stop, rider evaluation of RTD services and time tables, and the use of RTD by the handicapped.

h. Attitudinal questions - Questions concerning the attitudes of the riders regarding service, comfort, security, access and cost were also considered to be valuable to the District.

i. Proposition A analysis - Data was needed to provide information to RTD and other agencies on the reasons for the ridership increase which followed the Proposition A Reduced Fare Program.

2. On-Board Survey -

The On-Board Survey was intended to collect the most

important patronage data. To this end the survey questionnaire was to be easily read and reasonably short to encourage a high response rate.

3. Follow-On Survey -

   Because of the large amount of data desired by the District, survey questions were prioritized according to the importance of obtaining reliable data at the line level. Questions which could not be included in the On-Board Survey questionnaire were placed in a Follow-On (telephone) Survey.

4. Sampling Plan -

   The sampling scheme was to be designed with the following objectives in mind:

   a. To provide data by bus line.

   b. To provide for estimates of precision based on the sample.

   c. To allow use of secondary data available to RTD.

   d. To provide data by time of day and by operating division.

   e. To be capable of being factored to represent a total population of bus riders by weekday, Saturday and Sunday.

5. Geographic Coding Precision -

   In order to be most useful, the survey design needed to allow for tabulation of data by geographic units such as census tracts.

A-II: DESCRIPTION OF FACTORING METHODOLOGY

The survey response file uses two factors, FACBDS and FACTRIPS, to weight the responses of patrons on the first leg of their trip. FACBDS, which weights the responses to represent total boardings (unlinked trips), is calculated by the following formulae:

A) If respondent used a pass, or was on a bus trip where no fare count was taken:

FACBDS = (RESPONSE FACTOR) x (BUS FACTOR)

B) Else;

FACBDS = (RESPONSE FACTOR) x (TRANSFER FACTOR) x (BUS FACTOR)

FACTRIPS weights responses to represent total passenger trips (linked boardings). The formula for FACTRIPS is as follows:

A) If respondent uses a pass, or was on a bus trip where no fare count was taken:

FACTRIPS = (RESPONSE FACTOR) x (TRANSFER FACTOR) x (BUS FACTOR)

B) Else;

FACTRIPS = (RESPONSE FACTOR) x (BUS FACTOR)

The response factor, transfer factor, and response factor, are calculated according to three strata, defined as follows:

A) Categories:

1 = AM peak time period (6-9), north or east direction
2 = AM peak time period, south or west direction
3 = midday time period (9-3)
4 = PM peak time period (3-6), north or east direction
5 = PM peak time period, south or west direction
6 = evening time period
7 = night time period

B) Master Groups:

Master Groups are groups of lines, defined geographically. The exact definition of Master Groups is provided in Appendix A-III.

C) Subgroups:

Subgroups are groups of lines, defined geographically, within one Master Group. Master Group 9 consists of 9 Subgroups. Other Master Groups contain 1 to 4 Subgroups.

COMPUTATION OF RESPONSE FACTOR

For each cell (all sampled bus trips having the same Category Master Group, Subgroup, and line) the following ratio was calculated (assuming the survey response ratio for the cell was greater than 0%):

$$\frac{U}{S}$$

where U = total number of questionnaires handed out within a cell group,

and S = total number of responses within a cell group.

For cells where a fare count was conducted, this ratio was calculated separately. For respondents who used cash, U

was set equal to the total number of cash boardings excluding transfers. For respondents who used passes, U was set equal to the total number of pass boardings.

If, for a given cell, U was greater than 0 while S was not, several steps could be taken:

A) If the cell (1) was a peak-hour cell, a check was made to determine if the cell for the same Master Group and Subgroup of the other peak and opposite direction (2) contained S greater than 0. If it did, the response factor for (2) was calculated to be:

$$\frac{U_1 + U_2}{S_2}$$

where U_1 = the universe in (1)
U_2 = the universe in (2),
and S_2 = the sample in (2)
The response factor for (1) was set equal to 0.

If the cell was not a peak hour cell, or both (1) and (2) contained a zero response rate (S=0), then step B:

B) If, for any other cells having the same Category, Master Group, and Subgroup, the S was greater than 0, the response factor for all such cells was multiplied by the ratio:

$$\frac{U_{AS}}{U_{SS}}$$

where U_{AS} = the total universe of cells having the same Category, Master Group, and Subgroup,

and U_{SS} = the total universe of such cells in which S is greater than 0.

If no cells having the same Category, Master Group, and Subgroup were sampled (i.e. $U_{SS} = 0$), step C:

C) For all empty cells which could not be accounted for using steps A or B, the response factors for all cells having the same Category and Master Group were multiplied by a ratio equal to:

$$\frac{U_{AM}}{U_{SM}}$$

where U_{AS} = the total universe of al cells having the same Category and Master Group,

and U_{SM} = the total universe of all such cells for which S is greater than 0.

COMPUTATION OF TRANSFER FACTOR

In the previous step, the total number of pass boardings and the total number of cash trips was determined. In this next step, therefore, it was necessary to find transfer rates using two different methods. For pass boardings (and boardings where no fare check was made) the transfer factor was used to determine the number of trips. For cash trips, the transfer rate was used to calculate the number of boardings given the number of trips.

o Cash transfer factor (always >= 1):

$$\frac{CB + TB}{CB}$$

where CB = total cash boardings for the bus trips within a cell group (fare check data), and

TB = total transfer boardings for the bus trips within a cell group (fare check data).

o Pass transfer factor (if > 1 then it is set to 1.00):

$$\frac{PT/RPB}{CT/RCB} \times \frac{1}{CTF}$$

where PT = total number of sampled pass trips for the Category, Master Group, and Subgroup.

RPB = total number of buses which these pass users reported using.

CT = total number of sampled cash trips for the Category, Master Group, and Subgroup.

RCB = total number of buses which these cash users reported using.

CTF = cash transfer factor (calculated above)

If a given cell group contained insufficient data to calculate a transfer factor, the transfer factor was calculated for all trips having the same Category, Master Group, and Subgroup, and applied to the cell group. If data was still insufficient the transfer factor for all bus trips in the same Category and Master Group was used. If the transfer factor still could not be calculated, it was set to 1.0.

For bus trips where no fare check was taken, the transfer factor was set at 0.96, with the exception of trips during the night period, where the transfer factor was set to 0.75. Most likely, these numbers are system-wide averages derived from the survey.

COMPUTATION OF BUS FACTOR

For each cell (all bus trips having the same Category, Master Group, Subgroup, and line) the following ratio was calculated (assuming at least one bus trip in the cell was sampled):

$$\frac{U}{S}$$

where U = total number of bus trips in the cell,

and S = the total number of sampled bus trips in the cell.

If, for a given cell, U was greater than 0 while S was not the following steps could be taken:

A) If, for any other cells having the same Category, Master Group, and Subgroup, the S was greater than 0, the bus factor for all such cells was multiplied by the ratio:

$$\frac{U_{AS}}{U_{SS}}$$

where U_{AS} = the total universe of cells having the same Category, Master Group, and Subgroup,

and U_{SS} = the total universe of such cells in which S is greater than 0.

If no cells having the same Category, Master Group, and Subgroup were sampled (i.e. $U_{SS}=0$), step B:

B) For all empty cells which could not be accounted for using steps A or B, the bus factors for all cells having the same Category and Master Group were

multiplied by a ratio equal to:

$$\frac{U_{AM}}{U_{SM}}$$

where U_{AM} = the total universe of all cells having the same Category and Master Group,

and U_{SM} = the total universe of all such cells for which S is greater than 0.

A-III: DEFINITION OF MASTER GROUPS
(Not including lines not sampled)

1: Lines 1, 2, 4, 10, 16, 18, 20

2: Lines 40, 53, 55, 56

3: Lines 81, 83, 90, 92, 94, 96, 97

4: Lines 45, 48, 51, 60, 358, 456

5: Lines 14, 28, 33, 42, 220, 232

6: Lines 30, 70, 76, 78, 170, 176, 262, 264, 268, 276

7: Lines 26, 65, 66

8: Lines 420, 423, 424, 560

9: Lines 149, 178, 185, 187, 192, 274, 280, 291, 460, 462, 470, 480, 482, 484, 486, 487, 488, 490, 493, 496

10: Lines 146, 250, 251, 255, 256, 259, 260, 266, 270

11: Lines 401, 483

12: Lines 102, 103, 105, 107, 108, 110, 115, 117, 119, 120, 124, 125, 127, 128, 130

13: Line 271

14: Lines 150, 152, 154, 158, 163, 164, 165, 168, 169, 228, 230, 234, 239, 243, 245

15: Lines 175, 177, 180, 181, 183, 188, 201

16: Lines 200, 204, 206, 207, 209

17: Lines 210, 212, 217

18: Line 602

19: Lines 126, 205, 225, 443, 444, 446, 448

20: Lines 418, 457, 489, 464, 497, 498

21: Lines 429, 431, 434

22: Lines 436, 439

A-IV: LINES NOT SURVEYED WITH ESTIMATED DAILY PATRONAGE
(Ride checks closest to survey data)

LINE	PATRONAGE	LINE	PATRONAGE
84	8,570	427	368
104	953	430	111
126	1,096	437	182
174	780	438	335
211	873	445	385
236	2,307	466	505
265	1,068	492	277
413	173	494	343
419	107	495	1,507
426	2,198	576	1,158
		605	198

		TOTAL:	23,491

A-V: SELECTED SURVEY DATA RESULTS

TABLE A V-1

WEEKDAY RIDERSHIP BY FARECLASS

Percentage of Total Trips

Fare Type	Fare First Checked	Total Fares Checked
(Missing)	1.8%	1.8%
Cash	38.3	37.7
Ticket	1.2	1.4
Regular Pass	22.9	22.8
Handicapped Pass	2.1	2.1
Senior Pass	6.9	6.9
Student Pass	15.8	15.7
College Pass	6.0	6.0
Express Pass	4.1	4.7
Tourist Pass	0.1	0.0
Other	0.8	0.7
TOTALS TRIPS*	907499 (100%)	923070 (100%)

*Totals are not equal due to riders checking multiple categories.

TABLE A V-2

TOTAL DAILY RIDERSHIP BY FARE CLASS (TOTAL FARES CHECKED)

Percentage of Total Trips*

	Weekday						Saturday	Sunday
	AM Peak	Midday	PM Peak	Evening	Night	Total	Total	Total
(Missing)	1.4%	1.6%	1.6%	4.8%	2.1%	1.8%	1.8%	0.8%
Cash	35.9	38.0	36.1	41.1	44.3	37.7	40.2	39.5
Ticket	1.6	1.5	1.5	0.7	0.4	1.4	4.3	1.1
Regular Pass	25.8	16.9	24.7	21.8	32.5	22.8	27.2	23.2
Handicapped Pass	0.9	3.0	2.0	3.8	1.2	2.1	2.4	1.8
Senior Pass	5.6	10.9	5.5	1.8	1.6	6.9	6.7	9.9
Student Pass	17.4	17.3	15.6	16.6	6.3	15.7	13.5	13.0
College Pass	5.8	7.4	4.5	6.2	6.7	6.0	4.4	7.4
Express Pass	4.9	2.2	7.5	3.0	4.9	4.7	1.7	2.0
Tourist Pass	0.1	0.1	0.0	---	---	0.0	0.0	0.5
Other	0.8	1.1	1.0	0.3	0.0	0.9	1.4	0.8
TOTAL TRIPS	179310 (100%)	318584 (100%)	297057 (100%)	40950 (100%)	87116 (100%)	923070 (100%)	530704 (100%)	373924 (100%)

*Statistics on this table are the total number of fares checked. As shown in Table A V-1, use of the total fares checked more accurately reflects the number of patrons using express passes.

TABLE A V-3

TOTAL DAILY RIDERSHIP BY PURPOSE (ORIGIN-DESTINATION)

Percentage of Total Trips*

	Weekday						Saturday	Sunday
	AM Peak	Midday	PM Peak	Evening	Night	Total	Total	Total
Work	64.3%	35.5%	61.4%	49.5%	78.1%	54.1%	35.7%	22.3%
School	24.8	35.5	16.8	12.1	9.8	21.1	1.3	1.1
Shopping Errands	2.5	20.2	10.6	11.4	0.2	11.4	29.0	23.5
Visiting-Recreation	2.8	8.9	9.0	22.2	5.3	8.0	18.6	35.5
Religious Institution	0.2	0.8	0.8	0.9	1.8	0.8	5.9	11.8
Medical-Dental	2.0	6.3	2.0	1.7	---	3.3	2.4	1.8
Other	5.5	16.7	7.7	10.2	4.2	10.2	10.3	9.6
TOTAL TRIPS*	178076 (100%)	357182 (100%)	312485 (100%)	42909 (100%)	83171 (100%)	973823 (100%)	474036 (100%)	380962 (100%)

*The entry in each cell represents the total of all trips having the stated origin purpose plus the total of all trips having the stated destination purpose. Totals are greater than the total number of trips due to double counting of trips which are not home-based.

TABLE A V-4

TRIP PURPOSE (ORIGIN-DESTINATION) BY ANNUAL HOUSEHOLD INCOME*

Percentage of Total Trips

Household Income	Work	School	Shopping	Visiting Recreation	Medical	Other	Total Weekly Trips
Under $2,000	43.5%	15.8%	15.7%	16.1%	3.4%	13.9%	671,565(Avg)
$2,000-$9,999	42.7	16.5	16.9	13.4	4.2	14.0	1,202,560
$10,000-$24,999	59.3	13.0	12.8	8.9	2.6	10.2	1,606,040
$25,000-$49,000	64.4	16.9	10.3	6.9	1.5	10.5	689,200
Over $50,000	52.1	30.7	9.0	8.1	1.6	15.7	279,610
OVERALL	52.4%	16.1%	13.6%	10.8%	3.1%	12.5%	4,448,980(Avg)

Number of missing observations = 981,000

*Table represents the total of all trips having each trip purpose as the stated origin or destination. Totals are greater than 100% due to the double counting of trips which are not home based.

TABLE A V-5

TRIP PURPOSE (ORIGIN-DESTINATION) BY ETHNIC BACKGROUND*

Ethnic Background	Work	School	Shopping	Visiting Recreation	Medical	Other	Total Weekly Trips
White	50.0%	14.1%	16.8%	9.1%	3.6%	14.2%	2,350,550(Avg)
Asian/Pacific Islander	55.4	23.3	11.7	6.2	1.4	11.1	339,060
Hispanic	55.9	17.5	12.8	10.2	3.0	7.7	1,357,640
American Indian	45.2	27.1	9.0	14.8	2.4	12.4	69,510
Black	46.1	20.9	11.9	14.3	3.0	12.9	1,446,940
Other	31.0	20.7	14.8	14.5	2.5	31.2	112,700
OVERALL	50.3%	17.9%	13.8%	10.8%	3.1%	13.3%	5,121,650(Avg)

Number of missing cases = 310,000

*Table represents the total of all trips having each trip purpose as the stated origin or destination. Totals are greater than 100% due to the double counting of trips which are not home based.

TABLE A V-6

TOTAL DAILY RIDERSHIP BY MODE OF ACCESS TO BUS

Percentage of Total Trips

	Weekday						Saturday	Sunday
	AM Peak	Midday	PM Peak	Evening	Night	Total	Total	Total
Walk	87.5%	95.6%	95.0%	93.2%	89.9%	93.2%	95.9%	95.7%
Auto (Driver)	3.2	0.9	0.5	0.4	1.9	1.3	0.6	0.8
Passenger	7.2	2.8	3.7	4.9	8.1	4.5	3.2	3.2
Other	2.1	0.7	0.8	1.5	0.0	1.0	0.4	0.4
TOTAL TRIPS	175038 (100%)	309236 (100%)	286121 (100%)	38967 (100%)	83888 (100%)	893251 (100%)	509976 (100%)	355917 (100%)

TABLE A V-7

MODE OF ACCESS TO BUS
BY ANNUAL HOUSEHOLD INCOME

Household Income	Walk	Auto-Driver	Auto-Passenger	Other	Total	Total Weekly Trips
Under $2,000	96.4%	0.6%	2.4%	0.6%	100%	656,840
$2,000-$9,999	95.7	0.5	3.4	0.4	100	1,201,210
$10,000-$24,999	93.8	1.1	3.8	1.2	100	1,603,920
$25,000-$49,999	89.0	2.8	7.2	0.8	100	690,040
Over $50,000	87.4	3.0	7.3	2.2	100	279,470
OVERALL	93.6%	1.2%	4.3%	0.9%	100%	4,431,480

*Number of missing cases = 999,040

TABLE A V-7

MODE OF ACCESS TO BUS

BY ANNUAL HOUSEHOLD INCOME

Household Income	Walk	Auto-Driver	Auto-Passenger	Other	Total	Total Weekly Trips
Under $2,000	96.4%	0.6%	2.4%	0.6%	100%	656,840
$2,000-$9,999	95.7	0.5	3.4	0.4	100	1,201,210
$10,000-$24,999	93.8	1.1	3.8	1.2	100	1,603,920
$25,000-$49,999	89.0	2.8	7.2	0.8	100	690,040
Over $50,000	87.4	3.0	7.3	2.2	100	279,470
OVERALL	93.6%	1.2%	4.3%	0.9%	100%	4,431,480

*Number of missing cases = 999,040

TABLE A V-8

MODE OF ACCESS TO BUS
BY ETHNIC BACKGROUND

Ethnic Background	Walk	Auto-Driver	Auto-Passenger	Other	Total	Total Weekly Trips
White	93.0%	1.9%	4.2%	0.9%	100%	1,790,580
Asian/Pacific Islanders	94.1	0.9	4.5	0.5	100	341,250
Hispanic	93.4	0.8	4.6	1.3	100	1,341,140
American Indian	92.1	1.4	6.5	-	100	68,320
Black	94.1	1.0	4.2	0.6	100	1,422,350
Other	94.4	0.8	4.5	0.3	100	114,420
OVERALL	93.5%	1.2%	4.4%	0.9%	100%	5,098,060

*Number of missing cases = 332,470

TABLE A V-9

TOTAL DAILY RIDERSHIP BY NUMBER OF BUSES FOR TRIP

Percentage of Total Tripa

	Weekday						Saturday	Sunday
	AM Peak	Midday	PM Peak	Evening	Night	Total	Total	Total
One	56.7%	53.9%	54.7%	51.9%	49.2%	54.1%	52.5%	47.4%
Two	39.0	37.9	38.6	40.3	46.2	39.2	41.5	43.0
Three	4.0	6.1	5.9	3.2	4.4	5.3	5.3	8.1
Four or more	0.3	2.2	0.9	4.6	0.2	1.3	0.9	1.4
TOTAL TRIPS	174037 (100%)	303793 (100%)	283855 (100%)	38871 (100%)	83782 (100%)	884337 (100%)	506735 (100%)	351950 (100%)

TABLE A V-10

NUMBER OF BUSES FOR TRIP BY VEHICLE AVAILABILITY

Vehicle Availability	One	Two	Three	Four or More	Total	Total Weekly Trips
Driver	61.8%	34.1%	3.3%	0.8%	100%	903,200
Passenger	55.6	38.9	4.0	1.5	100	572,060
No	51.2	41.3	6.1	1.4	100	268,750
OVERALL	53.6%	39.7%	5.3%	1.3%	100%	5,025,200

*Number of missing cases = 405,320

TABLE A V-11

NUMBER OF BUSES FOR TRIP BY NUMBER OF HOUSEHOLD CARS

Number of HH Cars	One	Two	Three	Four or More	Total	Total Weekly Trips
Zero	50.6%	41.5%	6.3%	1.7%	100%	2,598,290
One	55.3	39.7	4.2	0.8	100	1,436,360
Two	58.3	36.2	4.7	0.7	100	1,991,160
Three or More	63.3	31.6	4.3	0.8	100	63,280
OVERALL	53.8%	39.6%	5.3%	1.3%	100%	5,027,010

*Number of missing cases = 403,510

TABLE A V-12

NUMBER OF BUSES FOR TRIP BY ETHNIC BACKGROUND

Ethnic Background	One	Two	Three	Four or More	Total	Total Weekly Trips
White	61.7%	33.6%	3.9%	0.8%	100%	1,784,730
Asian/Pacific Islander	58.9	37.3	2.8	1.0	100	337,360
Hispanic	54.3	39.1	4.8	1.7	100	1,346,890
American Indian	56.7	39.3	1.8	2.2	100	66,800
Black	41.3	48.7	8.6	1.4	100	1,436,200
Other	61.6	34.3	2.9	1.2	100	114,620
OVERALL	53.7%	39.6%	5.4%	1.3%	100%	5,086,610

*Number of missing cases = 343,920

TABLE A V-13

NUMBER OF BUSES FOR TRIP BY ANNUAL HOUSEHOLD INCOME

Household Income	One	Two	Three	Four or More	Total	Total Weekly Trips
Under $2,000	49.4%	41.9%	6.9%	1.7%	100%	666,900
$2,000-$9,999	52.3	40.6	5.0	2.0	100	1,199,390
$10,000-$24,999	51.2	41.9	6.1	0.8	100	1,607,930
$25,000-$49,999	58.5	35.5	5.2	0.8	100	687,140
Over $50,000	66.8	29.1	3.0	1.2	100	278,930
OVERALL	53.4%	39.8%	5.6%	1.3%	100%	4,440,290

*Number of missing cases = 990,240

TABLE A V-14

TOTAL DAILY RIDERSHIP BY TYPE OF SERVICE

Percentage of Total Trips

	Weekday						Saturday	Sunday
	AM Peak	Midday	PM Peak	Evening	Night	Total	Total	Total
L.A. LOCAL (Lines 1-99)	43.1%	49.9%	48.7%	51.4%	44.2%	47.7%	45.7%	63.2%
OTHER LOCAL (Lines 100-299)	38.8	39.1	34.5	35.9	47.4	38.2	45.3	29.6
LIMITED STOPS (Lines 300-399)	0.1	----	0.2	0.6	----	0.1	0.1	----
L.A. EXPRESS (Lines 400-499)	17.0	8.7	14.7	11.0	8.4	12.3	8.7	7.2
OTHER EXPRESS (Lines 500-599)	1.0	1.3	1.3	1.0	----	1.1	----	----
SPECIAL SERVICE (Lines 600-699)	----	1.0	0.5	----	----	0.5	0.1	----
TOTAL TRIPS	174,842 (100%)	311,763 (100%)	290,442 (100%)	39,208 (100%)	85,578 (100%)	901,832 (100%)	527,688 (100%)	365,343 (100%)

TABLE A V-15

TYPE OF SERVICE BY ANNUAL HOUSEHOLD INCOME

SERVICE TYPE	UNDER $2,000	$2,000-$9,999	$10,000-$24,999	$25,000-$49,000	$50,000 OR MORE	TOTAL	TOTAL WEEKLY TRIPS
L.A. LOCAL (Lines 1-99)	16.1%	28.4%	36.6%	13.8%	5.1%	100%	2,185,490
OTHER LOCAL (Lines 100-299)	16.2	28.5	35.5	14.1	5.8	100	1,662,740
LIMITED STOPS (Lines 300-399)	20.3	23.9	45.0	9.7	1.0	100	4,290
L.A. EXPRESS** (Lines 400-499)	9.6	20.0	34.7	24.0	11.5	100	556,720
OTHER EXPRESS** (Lines 500-599)	11.5	19.7	48.0	14.2	6.5	100	41,980
SPECIAL SERVICE (Lines 600-699)	0.6	6.2	27.1	37.9	28.1	100	22,550
OVERALL	15.2%	27.2%	36.0%	15.4%	6.3%	100%	4,473,770
*Number of missing cases = 956,760							
**ADDENDUM (Express service only):							
PEAK HOUR ONLY EXPRESS	0.8	2.3	24.5	38.3	34.1	100	59,480
ALL DAY EXPRESS	10.8	22.0	36.9	21.7	8.6	100	539,220
OVERALL	9.8%	20.2%	35.7%	23.3%	11.2%	100%	598,700

TABLE A V-16

TYPE OF SERVICE BY ETHNIC BACKGROUND

SERVICE TYPE	WHITE	ORIENTAL	HISPANIC	AMERICAN INDIAN	BLACK	OTHER	TOTAL	TOTAL WEEKLY TRIPS
L.A LOCAL (Lines 1-99)	31.8%	8.1%	32.7%	1.4%	24.3%	1.7%	100%	2,500,110
OTHER LOCAL (Lines 100-299)	33.7	4.1	20.2	1.5	37.7	2.8	100	1,964,010
LIMITED STOPS (Lines 300-399)	16.1	2.4	46.6	1.4	29.5	4.1	100	4,720
L.A. EXPRESS** (Lines 400-499)	50.8	8.2	23.0	1.1	14.8	2.2	100	612,200
OTHER EXPRESS** (Lines 500-599)	49.0	4.4	16.3	----	27.5	2.9	100	47,720
SPECIAL SERVICE (Lines 600-699)	63.5	15.3	6.1	----	13.8	1.3	100	23,680
OVERALL	35.1%	6.6%	26.5%	1.4%	28.3%	2.2%	100%	5,152,450

*Number of missing cases = 278,080

**ADDENDUM (Express service only):

PEAK HOUR ONLY EXPRESS								
	78.3	7.8	6.5	----	6.2	1.2	100	63,050
ALL DAY EXPRESS	47.7	7.9	24.2	1.1	16.7	2.4	100	596,870
OVERALL	50.7%	7.9%	22.5%	1.0%	15.7%	2.3%	100%	659,920

TABLE A V-17

TYPE OF SERVICE BY AVAILABILITY OF AUTO FOR TRIP

SERVICE TYPE	DRIVER	PASSENGER	NONE AVAILABLE	TOTAL	TOTAL WEEKLY TRIPS
L.A. LOCAL (Lines 1-99)	18.4%	11.0%	70.6%	100%	2,447,990
OTHER LOCAL (Lines 100-299)	11.6	12.6	75.9	100	1,937,990
LIMITED STOPS (Lines 300-399)	17.7	4.6	77.7	100	5,050
L.A. EXPRESS** (Lines 400-499)	34.2	8.8	56.9	100	607,980
OTHER EXPRESS** (Lines 500-599)	15.8	10.5	73.7	100	48,330
SPECIAL SERVICE (Lines 600-699)	66.5	6.1	27.4	100	23,930
OVERALL	17.9%	11.3%	70.8%	100%	5,071,280
*Number of missing cases = 359,240					
**ADDENDUM (Express service only):					
PEAK HOUR ONLY EXPRESS	76.7	8.2	15.2	100	62,450
ALL DAY EXPRESS	28.3	9.0	62.7	100	593,870
OVERALL	32.9%	9.0%	58.2%	100%	656,320

TABLE A V-18

TOTAL DAILY RIDERSHIP BY PLANNING SECTOR

Percentage of Total Trips

	Weekday						Saturday	Sunday
	AM Peak	Midday	PM Peak	Evening	Night	Total	Total	Total
SAN FERNANDO VALLEY	12.4%	10.0%	9.7%	10.3%	8.9%	10.3%	5.6%	5.9%
NORTH CENTRAL AREA	4.2	4.4	3.1	4.4	4.6	4.0	3.9	3.6
SAN GABRIEL VALLEY	14.2	8.8	5.8	10.4	17.2	9.7	4.1	3.2
WEST LOS ANGELES	5.1	5.8	6.2	6.7	3.1	5.6	2.6	8.2
SOUTH CENTRAL L.A.	18.1	16.0	11.4	9.7	16.3	14.7	21.7	18.4
EAST CENTRAL CITIES	2.8	2.9	2.8	2.2	12.0	3.7	4.4	1.5
EAST LOS ANGELES	8.2	6.7	4.7	16.7	7.1	6.8	2.7	7.2
MONTEBELLO-COMMERCE	0.1	0.3	0.4	----	----	0.3	0.3	0.4
MID CITIES	2.0	2.0	1.0	0.6	0.0	1.4	1.1	1.2
SOUTH BAY	3.5	5.2	4.4	3.1	5.6	4.5	3.7	2.0
WEST CENTRAL L.A.	25.6	24.9	21.5	20.7	22.9	23.6	35.1	33.7
DOWNTOWN L.A.	3.4	12.0	28.2	14.5	2.2	14.8	14.1	14.5
LONG BEACH	0.4	0.9	0.8	0.6	----	0.7	0.7	0.2
TOTAL TRIPS	166,837 (100%)	292,769 (100%)	275,705 (100%)	36,247 (100%)	79,298 (100%)	850,856 (100%)	493,311 (100%)	341,605 (100%)

TABLE A V-19

PLANNING SECTORS BY ETHNIC BACKGROUND

PLANNING SECTOR	WHITE	ORIENTAL	HISPANIC	AMERICAN INDIAN	BLACK	OTHER	TOTAL	TOTAL WEEKLY TRIPS
SAN FERNANDO VALLEY	65.2%	5.6%	15.5%	1.4%	10.1%	2.2%	100%	465,970
NORTH CENTRAL AREA	42.6	6.7	44.1	1.0	2.7	2.9	100	191,040
SAN GABRIEL VALLEY	38.7	9.7	29.0	1.0	19.3	2.3	100	428,840
WEST L. ANGELES	56.4	5.7	14.9	1.0	20.6	1.4	100	269,860
S. CENTRAL L.A.	6.4	1.0	15.5	1.6	72.6	2.9	100	750,680
EAST CENTRAL CITIES	31.1	1.4	35.1	0.6	28.2	3.6	100	174,020
EAST L. ANGELES	14.7	5.3	70.2	2.8	5.6	1.4	100	308,180
MONTEBELLO-COMMERCE	25.0	26.4	31.7	----	13.8	3.0	100	13,790
MID CITIES	43.8	6.3	32.1	3.1	12.4	2.3	100	66,760
SOUTH BAY	25.5	3.0	12.6	1.1	56.1	1.8	100	280,590
W. CENTRAL L.A.	41.7	9.7	23.4	1.0	22.2	2.0	100	1,229,230
DOWNTOWN L.A.	33.2	9.8	32.3	0.7	22.0	1.9	100	713,210
LONG BEACH	40.5	1.5	12.6	1.8	38.6	5.0	100	33,660
OVERALL	35.0%	6.7%	26.6%	1.2%	28.3%	2.2%	100%	4,853,830

*Number of missing cases = 576,700

TABLE A V-20

PLANNING SECTORS BY ANNUAL HOUSEHOLD INCOME

PLANNING SECTOR	UNDER $2,000	$2,000-$9,999	$10,000-$24,999	$25,000-$49,000	$50,000 OR MORE	TOTAL	TOTAL WEEKLY TRIPS
SAN FERNANDO VALLEY	10.5%	23.1%	32.3%	23.9%	10.1%	100%	395,080
NORTH CENTRAL AREA	15.4	27.0	36.1	17.9	3.5	100	162,290
SAN GABRIEL VALLEY	9.5	20.7	39.0	23.5	7.2	100	371,190
WEST LOS ANGELES	10.6	24.4	36.6	19.2	9.1	100	233,600
SOUTH CENTRAL L.A.	19.5	29.9	34.8	12.2	3.6	100	646,990
EAST CENTRAL CITIES	19.7	25.7	31.8	12.2	0.7	100	132,880
EAST LOS ANGELES	20.7	30.4	28.9	8.2	10.8	100	269,570
MONTEBELLO-COMMERCE	14.2	22.2	25.7	36.1	1.7	100	12,400
MIDCITIES	9.1	28.8	43.1	13.0	6.0	100	59,940
SOUTH BAY	19.7	23.0	35.9	14.7	6.7	100	172,130
WEST CENTRAL L.A.	15.0	29.3	40.6	10.8	4.2	100	1,091,860
DOWNTOWN L.A.	13.3	24.2	34.1	19.9	8.5	100	627,800
LONG BEACH	22.4	29.1	28.8	9.2	10.5	100	30,720
OVERALL	15.0%	27.0%	36.1%	15.6%	6.3%	100%	4,206,440

*Number of missing observations = 1,224,080

TABLE A V-21

TOTAL DAILY RIDERSHIP BY FREQUENCY OF BUS USE

Percentage of Total Trips

	Weekday						Saturday	Sunday
	AM Peak	Midday	PM Peak	Evening	Night	Total	Total	Total
Almost daily	87.6%	79.1%	87.3%	86.6%	91.4%	84.9%	82.4%	76.8%
At least once per week	8.5	13.9	8.7	7.3	7.1	10.2	13.6	13.3
Less than weekly	3.9	7.0	4.1	6.0	1.5	4.9	4.0	9.9
TOTAL TRIPS	172559 (100%)	301316 (100%)	281234 (100%)	38741 (100%)	78989 (100%)	872839 (100%)	514528 (100%)	351530 (100%)

TABLE A V-22

FREQUENCY OF BUS USE BY ANNUAL HOUSEHOLD INCOME

Household Income	Almost Daily	Weekly or more	Less than Weekly	Total	Total Weekly Trips
Under $2,000	82.9%	11.8%	5.3%	100%	658,730
$2,000-$9,999	85.7	10.8	3.4	100	1,182,990
$10,000-$14,999	87.9	8.3	3.8	100	704,690
$15,000-$24,999	83.8	11.1	5.0	100	892,080
$25,000-$49,000	81.9	11.3	6.8	100	684,900
Over $50,000	77.7	10.3	12.0	100	277,340
OVERALL	84.2%	10.7%	5.2%	100%	4,400,730

*Number of missing cases = 1,029,790

TABLE A V-23

FREQUENCY OF BUS USE BY ETHNIC BACKGROUND

Ethnic Background	Almost Daily	Weekly or more	Less than Weekly	Total	Total Weekly Trips
White	81.3%	12.8%	5.8%	100%	1,762,910
Asian/Pacific Islander	85.6	9.6	4.8	100	337,580
Hispanic	87.5	9.0	3.5	100	1,338,580
American Indian	84.6	11.6	3.9	100	69,220
Black	84.2	10.2	5.6	100	1,429,280
Other	82.3	10.3	7.4	100	113,990
OVERALL	84.1%	10.8%	5.1%	100%	5,051,570

*Number of missing cases = 378,960

TABLE A V-24

FREQUENCY OF BUS USE BY FARE CLASS (TOTAL FARES CHECKED)

Fare Class	Almost Daily	Weekly or more	Less than Weekly	Total	Total Weekly Trips
CASH	70.4%	11.1%	1.9%	100%	2,024,590
TICKET	82.6	11.3	6.0	100	68,330
REGULAR PASS	95.9	3.3	0.8	100	1,242,700
HANDICAP PASS	85.0	14.3	0.8	100	113,780
SENIOR PASS	81.2	17.0	1.8	100	371,570
STUDENT PASS	95.2	4.5	0.3	100	829,650
COLLEGE PASS	94.0	5.4	0.6	100	317,740
EXPRESS PASS	95.2	3.7	1.1	100	221,270
TOURIST	45.1	37.3	17.6	100	3,180
OTHER	78.2	14.0	7.8	100	47,600
(MISSING)	82.5	11.1	6.5	100	77,420
OVERALL	84.1%	10.8%	5.1%	100%	5,313,170

*Number of missing cases = 200,270

TABLE A V-25

TOTAL DAILY RIDERSHIP BY AGE

Percentage of Total Trips

	Weekday						Saturday	Sunday
	AM Peak	Midday	PM Peak	Evening	Night	Total	Total	Total
0 - 16	8.9%	7.6%	8.4%	7.9%	3.8%	7.8%	7.0%	8.5%
16 - 25	31.6	35.6	30.8	41.2	28.5	32.9	28.1	30.8
25 - 35	28.2	21.3	24.3	30.7	31.9	25.0	30.3	23.7
35 - 45	12.1	10.5	16.3	11.5	21.1	13.7	11.6	12.2
45 - 55	7.7	6.6	9.2	4.1	10.1	7.9	9.2	8.4
55 - 65	6.2	8.3	6.7	3.6	4.3	6.8	8.7	7.1
65 +	5.3	10.1	4.4	1.0	0.2	6.0	5.1	9.3
TOTAL TRIPS	168126 (100%)	295730 (100%)	273738 (100%)	38310 (100%)	80082 (100%)	855986 (100%)	496874 (100%)	350626 (100%)

TABLE A V-26

AGE BY ETHNIC BACKGROUND

Ethnic Background	16 or Less	17-25	26-45	46-65	Over 65	Total	Total Weekly Trips
White	7.2%	20.7%	36.5%	22.0%	13.6%	100%	1,755,730
Asian/Pacific Islander	6.5	26.3	42.8	17.9	6.6	100	332,760
Hispanic	7.0	39.9	40.9	10.5	1.7	100	1,341,680
American Indian	13.0	43.9	17.9	13.7	1.3	100	69,170
Black	8.8	40.0	39.6	10.4	1.3	100	1,421,560
Other	12.0	36.4	34.5	13.9	3.0	100	108,900
OVERALL	7.7%	32.3%	38.8%	15.1%	6.1%	100%	5,029,800

*Number of missing cases = 400,730

TABLE A V-27

TOTAL DAILY RIDERSHIP BY ETHNIC BACKGROUND

Percentage of Total Trips

	Weekday						Saturday	Sunday
	AM Peak	Midday	PM Peak	Evening	Night	Total	Total	Total
White	37.1%	37.1%	35.7%	25.3%	30.7%	35.5%	32.9%	31.9%
Oriental	7.1	6.5	7.8	6.0	2.9	6.7	6.8	5.1
Hispanic	23.2	24.2	27.6	37.3	30.3	26.2	26.3	32.5
American Indian	1.5	1.3	1.3	2.4	0.9	1.3	1.1	1.7
Black	28.2	28.4	25.7	26.9	33.9	27.9	30.3	27.2
Other	2.6	2.5	1.9	2.1	1.4	2.2	2.7	1.5
TOTAL TRIPS	168804 (100%)	297736 (100%)	277528 (100%)	38947 (100%)	80071 (100%)	863086 (100%)	511021 (100%)	352661 (100%)

TABLE A V-28

TOTAL DAILY RIDERSHIP BY GENDER

Percentage of Total Trips

	Weekday						Saturday	Sunday
	AM Peak	Midday	PM Peak	Evening	Night	Total	Total	Total
MALE	34.6%	39.5%	41.0%	51.5%	58.1%	41.2%	43.8%	48.8%
FEMALE	65.4	60.5	59.0	48.5	41.9	58.8	56.2	51.2
TOTAL TRIPS	166817 (100%)	294075 (100%)	274979 (100%)	38311 (100%)	75242 (100%)	849424 (100%)	494557 (100%)	345818 (100%)

TABLE A V-29

GENDER BY ETHNIC BACKGROUND

Ethnic Background	Male	Female	Total	Total Trips
White	45.5%	54.5%	100%	1,735,210
Asian/Pacific Islander	45.1	54.9	100	333,580
Hispanic	42.3	57.7	100	1,340,920
American Indian	49.8	50.2	100	67,810
Black	36.7	63.3	100	1,410,410
Other	37.9	62.1	100	110,045
OVERALL	42.0%	58.0%	100%	4,998,380

*Number of missing cases = 432,150

TABLE A V-30

GENDER BY EMPLOYMENT STATUS

Gender	Full Time	Part Time	Not Working	Total	Total Trips
MALE	53.8%	18.8%	27.3%	100%	2,008,960
FEMALE	48.9	18.4	31.7	100	2,765,230
OVERALL	51.0%	19.2%	29.9%	100%	4,771,190

*Number of missing cases = 659,330

TABLE A V-31

TOTAL DAILY RIDERSHIP BY ANNUAL HOUSEHOLD INCOME

Percentage of Total Trips

HH INCOME	Weekday						Saturday Total	Sunday Total
	AM Peak	Midday	PM Peak	Evening	Night	Total		
Less than $2000	12.5%	16.0%	12.2%	21.2%	14.2%	14.2%	18.0%	23.3%
$2000-4999	8.2	13.4	9.5	6.8	6.7	10.2	11.9	10.8
$5000-9999	14.4	17.9	14.6	16.7	14.4	15.8	19.6	22.4
$10000-14999	15.9	13.4	16.6	14.5	23.7	16.0	18.9	12.4
$15000-19999	10.8	9.2	11.3	9.6	14.2	10.7	10.2	7.4
$20000-24999	10.7	9.4	10.7	8.7	6.2	9.7	7.9	11.6
$25000-34999	9.8	8.0	9.5	6.4	7.2	8.7	5.8	5.4
$35000-49999	10.8	6.4	8.0	7.1	6.9	7.8	5.1	2.6
$50000 & over	7.2	6.3	7.6	9.2	6.6	7.0	2.5	2.0
TOTAL TRIPS	147078 (100%)	257036 (100%)	238191 (100%)	32791 (100%)	74900 (100%)	749997 (100%)	434403 (100%)	310897 (100%)

TABLE A V-32

ANNUAL HOUSEHOLD INCOME BY ETHNIC BACKGROUND

ETHNIC BACKGROUND	UNDER $2,000	$2,000-$9,999	$10,000-$24,999	$25,000-$49,000	$50,000 OR MORE	TOTAL	TOTAL WEEKLY TRIPS
White	8.0%	24.7%	39.6%	19.4%	8.4%	100%	1,596,840
Asian/Pacific Islander	11.5	22.5	32.9	25.6	7.4	100	293,280
Hispanic	21.2	33.3	33.1	8.2	4.2	100	1,120,270
American Indian	16.4	35.3	27.3	13.6	7.4	100	60,680
Black	19.1	25.6	35.8	14.6	4.9	100	1,242,660
Other	20.3	24.8	28.8	25.9	10.3	100	90,240
OVERALL	15.1%	27.2%	36.0%	15.4%	6.3%	100%	4,403,980

*Number of missing observations = 1,026,550

TABLE A V-33

TOTAL DAILY RIDERSHIP BY YEAR BEGAN RIDING RTD

Percentage of Total Trips

	Weekday						Saturday	Sunday
	AM Peak	Midday	PM Peak	Evening	Night	Total	Total	Total
After 1-83	13.5%	11.9%	12.9%	11.9%	17.0%	13.0%	10.3%	6.1%
Between 7-82 and 1-83	15.7	13.2	14.6	16.4	8.7	13.9	14.2	12.2
Between 1-79 and 6-82	22.2	20.2	23.9	27.8	23.0	22.4	21.0	18.0
Before 1979	48.6	54.7	48.6	43.9	51.4	50.7	54.5	63.7
TOTAL TRIPS	168085 (100%)	293492 (100%)	277639 (100%)	38208 (100%)	78447 (100%)	855870 (100%)	490833 (100%)	347377 (100%)

TABLE A V-34

YEAR BEGAN RIDING RTD BY FARE CLASS

Fare Class	After 1/83	7/82 to 1/83	1/79 to 6/82	Before 1979	Total	Total Weekly Trips
Cash	16.8%	13.6%	21.1%	48.6%	100%	1,979,560
Ticket	10.7	15.5	21.3	52.5	100	57,300
Regular Pass	9.8	10.9	25.0	54.3	100	1,210,260
Handicap Pass	4.5	3.1	15.1	77.2	100	106,790
Senior Pass	1.9	4.4	12.8	80.8	100	36,136
Student Pass	11.9	23.6	23.8	41.0	100	795,170
College Pass	13.0	20.7	21.9	44.3	100	314,130
Express Pass	8.0	11.3	30.4	50.3	100	224,640
Tourist	3.4	29.3	42.8	24.5	100	3,470
Other	8.9	4.8	18.6	67.6	100	40,000
OVERALL	12.3%	13.8%	22.2%	51.6%	100%	5,155,530

*Number of missing cases = 312,970

TABLE A V-35

YEAR BEGAN RIDING RTD BY GENDER

Gender	After 1/83	7/82 to 1/83	1/79 to 6/82	Before 1979	Total	Total Weekly Trips
Male	14.4%	15.1%	23.4%	47.1%	100%	2,082,970
Female	10.5	13.2	21.3	55.0	100	2,859,080
OVERALL	12.1%	14.0%	22.2%	51.7%	100%	4,942,050

*Number of missing cases = 488,470

TABLE A V-36

YEAR BEGAN RIDING RTD BY ANNUAL HOUSEHOLD INCOME

Household Income	After 1/83	7/82 to 1/83	1/79 to 6/82	Before 1979	Total	Total Weekly Trips
Less than $2,000	15.4%	16.5%	14.9%	53.1%	100%	648,660
$2,000-$9,999	9.6	11.0	20.6	58.8	100	1,186,210
$10,000-$24,999	12.7	13.6	21.3	52.3	100	1,573,940
$25,000-$49,999	12.0	13.8	27.3	46.9	100	684,730
Over $50,000	12.7	12.9	28.5	45.9	100	277,150
OVERALL	12.1%	13.3%	21.6%	53.0%	100%	4,370,680

*Number of missing cases = 1,059,840

TABLE A V-37

YEAR BEGAN RIDING RTD BY ETHNIC BACKGROUND

Ethnic Background	After 1/83	7/82 to 1/83	1/79 to 6/82	Before 1979	Total	Total Weekly Trips
White	11.0%	12.8%	21.2%	55.0%	100%	1,767,750
Asian/Pacific Islander	13.6	20.4	29.4	36.6	100	339,550
Hispanic	13.7	14.2	22.8	49.3	100	1,332,630
American Indian	7.2	10.5	27.3	55.0	100	67,000
Black	12.5	13.7	19.5	54.3	100	1,414,930
Other	11.6	11.8	26.2	50.4	100	112,660
OVERALL	12.3%	13.9%	21.9%	51.9%	100%	5,034,540

*Number of missing cases 395,990

TABLE A V-38

TOTAL DAILY RIDERSHIP BY SCHEDULE SOURCE

Percentage of Total Trips*

	Weekday						Saturday	Sunday
	AM Peak	Midday	PM Peak	Evening	Night	Total	Total	Total
On-board bus	57.5%	53.8%	54.8%	48.8%	60.8%	55.3%	54.4%	57.5%
Does not have schedule	23.0	27.0	25.4	26.1	16.2	24.7	28.1	21.1
By mail	2.4	1.9	1.6	3.2	4.6	2.2	1.5	1.8
Customer Service Center	7.8	7.8	8.4	7.9	8.5	8.1	7.4	7.9
Pass Outlet	4.9	3.8	4.5	6.6	5.0	4.5	5.1	4.4
Library	1.1	1.2	1.1	1.5	0.5	1.1	0.8	4.1
Thrifty Drug Store	0.7	1.7	1.1	2.1	1.0	1.3	1.1	1.2
Other	2.5	2.9	3.1	3.8	3.1	2.9	1.6	2.0
TOTAL TRIPS	165062 (100%)	288694 (100%)	271142 (100%)	37422 (100%)	78279 (100%)	840599 (100%)	482196 (100%)	345747 (100%)

TABLE A V-39

TOTAL DAILY RIDERSHIP BY RESIDENCE IN LOS ANGELES AREA

Percentage of Total Trips

	Weekday						Saturday	Sunday
	AM Peak	Midday	PM Peak	Evening	Night	Total	Total	Total
Resident	96.2%	94.1%	94.0%	87.3%	96.8%	94.5%	91.9%	88.0%
Visitor	3.8	5.9	5.9	12.7	3.2	5.5	8.1	12.0
TOTAL TRIPS	165444 (100%)	284346 (100%)	265040 (100%)	35861 (100%)	74923 (100%)	825613 (100%)	484897 (100%)	342394 (100%)

TABLE A V-40

TOTAL DAILY RIDERSHIP BY NUMBER OF DRIVERS IN HOUSEHOLD

Percentage of Total Trips

	Weekday						Saturday	Sunday
	AM Peak	Midday	PM Peak	Evening	Night	Total	Total	Total
Zero	2.2%	3.8%	2.9%	2.3%	2.7%	3.0%	3.5%	3.3%
One	33.3	35.4	33.6	34.5	25.8	33.5	59.9	57.3
Two	39.2	33.1	40.7	36.7	39.6	37.6	36.8	25.6
Three	16.2	17.4	13.0	16.1	18.4	15.8	12.9	8.1
Four	6.9	6.3	7.2	5.1	7.0	6.7	5.1	4.2
Five	1.4	2.2	1.8	5.1	4.3	2.2	0.7	0.6
Six	0.2	1.2	0.4	0.1	0.2	0.6	0.0	0.9
Seven +	0.6	0.6	0.4	0.1	2.0	0.7	1.1	0.0
TOTAL TRIPS	114799 (100%)	181887 (100%)	174558 (100%)	22648 (100%)	43400 (100%)	537292 (100%)	264173 (100%)	197754 (100%)

TABLE A V-41

TOTAL DAILY RIDERSHIP BY SIZE OF HOUSEHOLD

Percentage of Total Trips

HH Size	Weekday						Saturday Total	Sunday Total
	AM Peak	Midday	PM Peak	Evening	Night	Total		
One	15.7%	21.1%	18.3%	22.5%	17.0%	18.8%	24.9%	20.8
Two	24.3	23.0	23.1	18.6	28.4	23.6	21.0	31.7
Three	18.2	17.2	18.6	19.2	19.3	18.2	19.9	16.0
Four	16.7	15.1	14.6	14.0	14.6	15.2	15.9	12.2
Five	13.1	10.4	10.4	11.5	7.6	10.7	7.8	6.4
Six	4.8	5.6	6.9	7.1	4.2	5.8	3.8	4.4
Seven	3.2	3.0	3.9	3.2	5.2	3.5	2.1	1.7
Eight	2.1	2.3	1.6	2.5	1.8	2.0	2.4	4.8
Nine	0.9	0.9	1.1	0.4	0.7	0.9	1.5	0.3
Ten +	0.9	1.2	1.4	1.1	1.1	1.2	0.6	1.5
TOTAL TRIPS	163863 (100%)	283813 (100%)	266582 (100%)	36299 (100%)	75197 (100%)	825755 (100%)	482455 (100%)	331605 (100%)

TABLE A V-42

TOTAL DAILY RIDERSHIP BY NUMBER OF WORKERS IN HOUSEHOLD

Percentage of Total Tripa

	Weekday						Saturday	Sunday
	AM Peak	Midday	PM Peak	Evening	Night	Total	Total	Total
Zero	1.2%	2.6%	1.3%	0.7%	2.1%	2.1%	2.4%	5.2
One	37.8	39.5	38.5	41.8	39.0	38.9	38.7	44.4
Two	41.0	35.1	38.3	29.8	42.6	37.8	36.7	31.4
Three	11.3	14.4	13.0	17.9	9.6	13.0	12.7	12.7
Four	6.9	5.0	5.6	7.7	1.9	5.5	5.0	2.8
Five	1.2	1.3	2.0	1.6	2.8	1.7	4.2	2.9
Six	0.4	0.9	1.1	0.2	0.3	0.8	0.2	0.6
Seven	0.1	0.2	0.0	0.3	0.3	0.1	0.0	0.0
Eight	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Nine	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Ten +	0.0	0.1	0.0	0.0	1.5	0.2	0.0	0.0
TOTAL TRIPS	111483 (100%)	171317 (100%)	179772 (100%)	25016 (100%)	44836 (100%)	532423 (100%)	268537 (100%)	180752 (100%)

TABLE A V-43

TOTAL DAILY RIDERSHIP BY EMPLOYMENT STATUS

Percentage of Total Tripa

	Weekday						Saturday	Sunday
	AM Peak	Midday	PM Peak	Evening	Night	Total	Total	Total
Full time	58.3%	32.1%	61.2%	52.7%	72.0%	51.3%	49.5%	48.5%
Part time	18.2	24.5	14.8	24.9	16.1	19.4	20.1	17.1
Not working	23.4	43.4	24.0	22.4	11.9	29.3	30.4	34.5
TOTAL TRIPS	162754 (100%)	281337 (100%)	266410 (100%)	36336 (100%)	76662 (100%)	823490 (100%)	480621 (100%)	333747 (100%)

TABLE A V-44

EMPLOYMENT STATUS BY ETHNIC BACKGROUND

Gender	Full Time	Part Time	Not Working	Total	Total Trips
White	50.5%	17.2%	32.4%	100%	1,734,890
Asian/Pacific Islander	51.4	20.0	28.6	100	332,640
Hispanic	56.4	19.1	24.5	100	1,297,160
American Indian	48.6	18.4	33.0	100	58,360
Black	47.0	21.6	31.5	100	1,328,330
Other	36.9	24.5	38.6	100	104,080
OVERALL	50.8%	19.2%	29.9%	100%	4,855,470

*Number of missing cases = 575,060

TABLE A V-45

TOTAL DAILY RIDERSHIP BY NUMBER OF AUTOMOBILES IN HOUSEHOLD

Percentage of Total Tripa

	Weekday						Saturday	Sunday
	AM Peak	Midday	PM Peak	Evening	Night	Total	Total	Total
Zero	46.4%	51.0%	46.5%	50.4%	59.5%	49.5%	61.1%	68.7%
One	30.6	28.8	31.4	28.6	23.3	29.5	23.5	22.8
Two	14.8	13.3	15.0	12.4	9.7	13.8	9.5	5.5
Three +	8.2	6.8	7.1	8.6	7.5	7.3	5.9	3.1
TOTAL TRIPS	168993 (100%)	291442 (100%)	273624 (100%)	36668 (100%)	81079 (100%)	851806 (100%)	492017 (100%)	337522 (100%)

TABLE A V-46

NUMBER OF HOUSEHOLD CARS OF ETHNIC BACKGROUND

Ethnic Background	Zero	One	Two	Three or More	Total	Total Weekly Trips
White	51.3%	27.9%	13.7%	7.1%	100%	1,744,150
Asian/Pacific Islander	37.4	30.0	18.6	14.1	100	333,860
Hispanic	56.9	25.8	11.0	6.2	100	1,253,720
American Indian	52.3	29.1	12.2	6.4	100	68,120
Black	52.0	30.7	11.7	5.5	100	1,430,910
Other	39.1	35.7	14.9	10.4	100	110,330
OVERALL	51.7%	28.5%	12.8%	6.9%	100%	4,941,100

*Number of missing observations = 489,430

TABLE A V-47

TOTAL DAILY RIDERSHIP BY AVAILABILITY OF VEHICLE FOR TRIP

Percentage of Total Trips

	Weekday						Saturday	Sunday
	AM Peak	Midday	PM Peak	Evening	Night	Total	Total	Total
Yes, as driver	20.9%	14.8%	21.7%	10.9%	25.1%	19.0%	13.3%	9.6%
Yes, as passenger	12.8	10.7	12.1	15.0	6.9	11.4	13.1	7.8
No	66.3	74.5	66.2	74.1	68.0	69.6	73.7	82.7
TOTAL TRIPS	169054 (100%)	293129 (100%)	273341 (100%)	37598 (100%)	79682 (100%)	852804 (100%)	488613 (100%)	344936 (100%)

TABLE A V-48

VEHICLE AVAILABILITY FOR TRIP BY ETHNIC BACKGROUND

ETHNIC BACKGROUND	AUTO-DRIVER	AUTO-PASSENGER	NO	TOTAL	TOTAL WEEKLY TRIPS
White	21.2%	9.0%	69.8%	100%	1,731,260
Asian/Pacific Islander	20.1	18.9	61.0	100	323,440
Hispanic	13.8	11.7	74.5	100	1,318,310
American Indian	19.4	12.6	68.0	100	67,020
Black	16.4	11.7	71.9	100	1,410,640
Other	22.3	14.8	62.9	100	109,990
OVERALL	17.8%	11.3%	70.9%	100%	4,960,650

*Number of missing cases = 499,870

TABLE A V-49

TOTAL DAILY RIDERSHIP KNOWLEDGE OF METRO RAIL

Percentage of Total Tripa*

	Weekday						Saturday Total	Sunday Total
	AM Peak	Midday	PM Peak	Evening	Night	Total		
LA-LV train	2.1%	2.7%	3.5%	2.7%	1.4%	2.7%	1.4%	3.1%
LA-SD train	4.5	4.1	4.4	2.5	5.2	4.3	4.8	3.8
LA-LB trolley	5.3	6.0	5.7	7.5	8.4	6.1	7.3	7.1
LA-SFV subway	35.3	37.3	39.4	33.5	40.0	37.7	40.1	45.3
Do not know	52.9	49.9	47.0	53.8	45.1	49.3	46.4	40.8
TOTAL TRIPS	161975 (100%)	282122 (100%)	264225 (100%)	36991 (100%)	75974 (100%)	821287 (100%)	478251 (100%)	337283 (100%)

A-VI: COMPARISON OF LINE-GROUPS

TABLE A VI-1

DEFINITION OF LINE GROUPS COMPARED

GROUPS	LINES INCLUDED (WEEKDAY ONLY)
1	1, 2, 4, 10, 16, 18, 20
2	40, 53, 55, 56
3	81, 83, 90, 92, 94, 96, 97
4	45, 48, 51, 60, 358, 456
5	14, 28, 33, 42, 220, 232
6	30, 70, 76, 78, 170, 176, 262, 264, 268, 276
7	26, 65, 66
8	420, 423, 424, 560
9	149, 178, 185, 187, 192, 274, 280, 291, 460, 462, 470, 480, 482, 484, 486, 487, 488, 490, 493, 496
10	146, 250, 251, 255, 256, 259, 260, 266, 270
A	45, 70, 76, 105, 128, 175, 207, 209, 217, 228, 251, 271, 401, 418
B	30, 55, 126, 201, 206, 232, 234, 262, 264
C	401, 418, 424, 439, 448, 460, 464, 482, 484, 486

TABLE A VI-2

TIME PERIOD PERCENTAGES: SURVEY VS RIDE CHECK

Group	AM-Peak	Base	PM-Peak	Evening/Night	Chi-square
1 ride check	25.4%	33.2%	24.7%	16.7%	102.5%
survey	18.5	37.5	32.9	11.1	
2 ride check	26.0	30.0	28.6	15.4	37.1
survey	19.0	36.2	36.1	8.7	
3 ride check	25.0	31.3	29.5	14.2	9.6
survey	18.9	34.7	31.3	15.1	
4 ride check	27.9	28.2	28.7	15.3	57.1
survey	15.5	37.6	31.1	15.7	
5 ride check	27.0	32.2	27.1	13.7	116.0
survey	13.4	34.0	42.3	10.3	
6 ride check	29.3	37.5	22.3	10.9	27.8
survey	25.9	31.7	27.8	14.5	
7 ride check	32.9	26.9	26.4	13.8	28.8
survey	17.1	31.5	33.0	18.5	
8 ride check	29.6	29.4	26.1	14.8	47.8
survey	21.4	32.1	38.8	7.6	
9 ride check	29.1	27.5	28.6	14.8	91.6
survey	17.3	30.8	38.3	13.5	
10 ride check	23.8	35.5	27.2	13.4	70.8
survey	12.5	31.2	25.8	30.6	
A ride check	25.8	32.6	26.5	15.1	----
survey	21.0	34.7	30.5	13.8	
B ride check	25.4	32.3	28.1	14.2	----
survey	20.2	28.0	31.7	20.1	
C ride check	35.7	21.5	28.9	13.9	----
survey	26.2	23.9	34.4	15.5	

Critical value of Chi-square at 95% confidence level is 7.82.

TABLE A VI-3

FARE PAYMENT PERCENTAGES: SURVEY VS RIDECHECK

Group	Cash/ Transfer/Ticket	Regular Pass	Elderly/ Handicap Pass	Student Pass	Chi-square
1 ride check	38.2%	30.7%	14.6%	16.6%	53.5%
survey	30.4	35.6	13.1	20.9	
2 ride check	45.1	24.8	6.2	24.0	8.8
survey	39.1	27.8	6.9	26.3	
3 ride check	46.2	27.3	11.1	15.4	18.2
survey	39.5	33.9	8.4	18.2	
4 ride check	48.3	27.7	7.5	16.5	31.1
survey	45.4	26.4	4.0	24.2	
5 ride check	41.5	27.5	10.2	20.7	39.4
survey	34.5	38.0	9.6	17.9	
6 ride check	43.3	27.7	11.0	18.0	18.1
survey	39.4	28.8	8.5	23.3	
7 ride check	44.1	31.3	10.9	13.7	23.3
survey	31.2	40.3	9.1	19.5	
8 ride check	45.0	25.7	10.2	19.1	26.6
survey	37.5	26.5	7.2	28.8	
9 ride check	51.3	25.5	7.5	15.7	24.7
survey	45.5	26.2	7.5	20.8	
10 ride check	52.0	20.1	9.1	18.8	2.6
survey	48.5	20.7	10.0	20.8	
A ride check	42.5	25.2	9.1	23.2	----
survey	38.5	29.6	6.0	25.9	
B ride check	46.2	25.2	9.2	19.4	----
survey	42.7	37.8	7.3	12.2	
C ride check	46.2	30.9	7.7	15.2	----
survey	37.2	31.5	8.8	22.4	

Excludes "other" and "tourist"
Critical value of Chi-square at 95% confidence level is 7.82.

A-VII: DISCUSSION AND EXPLANATION OF CHI-SQUARE TEST USED IN SURVEY VS RIDECHECK COMPARISON:

In order to make the comparisons of survey data more meaningful, a statistical test was desired which could be used to determine if discrepancies between the survey data and ride-check data were significant. The following tests were researched as possibilities for use:

- o Mann-Whitney test: This test uses a ranking method to compare the distribution of two independent samples. It was inappropriate for use in this case, however, because it does not allow for the comparison of data pairs.
- o Kruskal-Wallis test: This test, similar to the Mann-Whitney test, compares the distribution of a independent samples. Like the Mann-Whitney test, it does not compare data pairs.
- o Sign test: The sign test involves a comparison of data pairs. However, the comparison made within each group at lines does not contain enough pairs to make the test meaningful.
- o Chi-square goodness-of-fit test: This test was selected because it measures the fit of an actual sample distribution, such as the distribution between fare categories, to a theoretically correct distribution such as the ride check data.

The assumptions of the Chi-square goodness-of-fit model are as follows:

- The sample is a random sample.
- Each observation in the sampled distribution actually represents one observation.*

Because the actual survey distribution is a weighted distribution, both of these assumptions are violated. However, the violation of the second assumption could be minimized through using the proportional distribution in the weighted sample and multiplying this result by the actual size of the sample. For example, Master Group #2, with 600 responses in the sample, had a weighted time period distribution of 19.0% AM peak, 36.2% base, 36.1% PM peak, and 8.7% evening/night. The distribution of riders used or the Chi-square analysis would then be 114, 217, 217 and 52. The theoretical distribution used for comparision purposes would be the proportions derived from the 1983 ride checks (Service Deployment Study calculations), also multiplied by the sample size, 600.

* W. J. Conover, Practical Nonparametric Statistics, John Wiley & Sons, New York, 1980. p. 190

A-VIII: CALCULATION OF CONFIDENCE INTERVALS
(weighted and unweighted)

A. Background:

The 95% confidence interval for a large, unweighted random sample is estimated by the formula:

$$P \pm 1.96 \sqrt{\frac{P(1-P)}{n}}$$

where n = the size of the sample
and p = the sample proportion

The 95% confidence interval for a weighted, stratified sample is estimated by:

$$Wh^2 (1-f_h) \frac{P_h(1-P_h)}{r_h - 1} *$$

where r_h = the size of the sample in stratum h.

p_h = the sample proportion in stratum h.

f_h = the sampling ratio in stratum h.

W_h = the estimated proportion of the total universe formed by stratum h.

in this case $W_h = \frac{(FACBD_h)(n_h)}{54781}$

where $FACBD_h$ = the boarding weight used for the cell h

54781 = the survey estimate for total boardings in Master Group 2, time periods 1-3.

B. Computation for unweighted statistics, Master Group #2, time periods 1-3.

For Asians:

unweighted proportion = 0.0222

standard deviation = $\sqrt{\frac{(0.0222)(1-0.0222)}{466}}$ = 0.00731

confidence interval = $\pm(0.0073)(1.96) = \pm 0.0143$

For Poverty:

unweighted proportion = 0.3744

standard deviation = $\sqrt{\quad}$ = 0.240

confidence interval = $\pm$(0.240)(1.96) = $\pm$0.0471

(Weighted statistics calculated by computer)

*Leslie Kish, Survey Sampling, John Wiley & Sons, New York, 1965. p. 82

A-IX: METHODOLOGY FOR TABLES 4-2, 4-3)

The procedure was conducted using the programs LONGSYS3, LONGSYS4, and LONGSYS5, found in MRPDGM. OBSJCL. CNTL. These programs read MRPDGM. OBS. FINAL. SURVEY. RECORDS.

Column 1: The control data, obtained from ride check data, followed the methodology described in the text.

Column 2: For cash boardings on trips where a fare count was taken (where FCLASS = 1, 2, 4 or 6 and DATATYPE=1), the results were weighted by TFACT (columns 312-320). For pass boardings and boardings on trips with no fare count (FCLASS=3, 5, 7, 8, 9 or 11 or DATATYPE=0), the results were weighted by 1/TFACT.

Column 3: For cash boardings on trips where a fare count was taken (when FCLASS=1, 2, 4 or 6 and DATATYPE=1), the results were weighted by (RFACT) x (TFACT). For pass boardings and boardings on trips with no fare count (FCLASS=3, 5, 7, 9 or 11 or DATATYPE=0), the results were weighted by RFACT.

Column 4: The results in Column 3 were the column 2 results weighted by BFACT. Equivalently, the boardings on trips where a fare count was taken were weighted by:

(TFACT) x (RFACT) x (BFACT)

while the pass boardings and the boardings on trips where no fare count was taken were weighted by: (RFACT) x (BFACT).

A-X: SURVEY QUESTIONNAIRE

ENGLISH

1. If you just TRANSFERRED FROM ANOTHER BUS TO THIS BUS, please write in the NUMBER OF THAT BUS LINE here _____

2. Where did you COME FROM before you got on this bus? *(Check one only)*
   1 ☐ Home 2 ☐ Work 3 ☐ School 4 ☐ Shopping/Errands 5 ☐ Visiting/Recreation 6 ☐ Religious Institution 7 ☐ Doctor/Dentist 8 ☐ Other

3. What is the ADDRESS of that place?
   _____ Number Street *(If address is not known, intersection or place name)* City Zip Code

4. At what time did you leave that place? _____ *(Time)* 1 ☐ A.M. 2 ☐ P.M. *(Check one)*

5. WHERE did you get ON THIS BUS?
   Corner of _____ *(First Street Name)* AND _____ *(Second Street Name)* WHICH IS IN: _____ City

6. I got TO THIS BUS by: *(Check one only)*
   1 ☐ Walking—I walked _____ blocks.
   2 ☐ Automobile—I drove and paid $_____ for parking.
   3 ☐ Automobile—I was dropped off.
   4 ☐ Bus—I transferred from Bus Line _____ *(Number)*
   5 ☐ Other

7. What type of FARE did you use to get on this bus? *(Check all that apply)*
   1 ☐ Cash fare of $_____
   2 ☐ Ticket fare of $_____
   3 ☐ Used a transfer
   4 ☐ $20 Regular Monthly Pass
   5 ☐ $4 Handicapped Pass
   6 ☐ $4 Senior Citizen Pass
   7 ☐ $4 Student Pass
   8 ☐ $4 College/Vocational Pass
   9 ☐ $_____ Express Pass
   10 ☐ $_____ Tourist Pass
   11 ☐ Other _____

8. Where will you get OFF THIS BUS?
   Corner of _____ *(First Street Name)* and _____ *(Second Street Name)* WHICH IS IN: _____ City

9. Where are you GOING TO now? *(Check one only)*
   1 ☐ Home 2 ☐ Work 3 ☐ School 4 ☐ Shopping/Errands 5 ☐ Visiting/Recreation 6 ☐ Religious Institution 7 ☐ Doctor/Dentist 8 ☐ Other

10. What is the ADDRESS of that place?
    _____ Number Street *(If address is not known, intersection or place name)* City Zip Code

11. How will you get TO THAT PLACE after you get OFF THE LAST BUS you ride to get there? *(Check one only)*
    1 ☐ Walking—I will have to walk _____ blocks.
    2 ☐ Automobile—I will drive. My parking costs were $_____
    3 ☐ Automobile—I will be picked up.
    4 ☐ Other _____

12. How MANY BUSES will you ride to get from where you started (Question 2) to where you are going to now (Question 9)?
    1 ☐ 1, only this bus 2 ☐ 2, including this bus 3 ☐ 3, including this bus 4 ☐ 4 or more, including this bus

13. I USUALLY RIDE RTD buses:
    1 ☐ Almost every day 2 ☐ Not every day, but at least once a week 3 ☐ Less than once a week

14. The following number of MOTOR VEHICLES (cars, trucks, vans) are in running condition at my home: *(Check one only)*
    1 ☐ 0 (none) 2 ☐ one 3 ☐ two 4 ☐ three or more

15. Was a VEHICLE AVAILABLE today for you to use to make this trip?
    1 ☐ Yes, as a driver 2 ☐ Yes, as a passenger 3 ☐ No

16. The combined TOTAL ANNUAL INCOME of all members of my household is:
    1 ☐ Less than $2,000
    2 ☐ $2,000-$4,999
    3 ☐ $5,000-$9,999
    4 ☐ $10,000-$14,999
    5 ☐ $15,000-$19,999
    6 ☐ $20,000-$24,999
    7 ☐ $25,000-$34,999
    8 ☐ $35,000-$49,999
    9 ☐ $50,000 & Over

17. Write in the following for the persons living in YOUR HOUSEHOLD:
    _____ Number of Persons _____ Number of Licensed Drivers
    _____ Number of Employed Persons Living There

18. My age is _____ *(Years)* I am 1 ☐ Male, 2 ☐ Female.

19. I consider myself to be: 1 ☐ White/Caucasian 2 ☐ Oriental/Asian/Pacific Islander 3 ☐ Hispanic/Latino 4 ☐ American Indian 5 ☐ Black 6 ☐ Other

20. I: ☐ Work full time 2 ☐ Work part time 3 ☐ Am not working outside home (retired, student, homemaker, disabled)

21. I am 1 ☐ a Resident, or 2 ☐ a Visitor to the Los Angeles area. *(Check one)*

22. I STARTED RIDING RTD buses:
    1 ☐ After January 1983
    2 ☐ Between July 1982 and January 1983
    3 ☐ Between January 1979 and July 1982
    4 ☐ Before January 1979

23. I obtained the PRINTED SCHEDULE for this bus line from:
    1 ☐ On-Board this bus
    2 ☐ I don't have one.
    3 ☐ By Mail
    4 ☐ RTD Customer Service Center
    5 ☐ RTD Pass Outlet
    6 ☐ Library
    7 ☐ Thrifty Drug Store
    8 ☐ Other _____

24. As you understand it, Metro Rail will be which of the following:
    1 ☐ A train between Los Angeles and Las Vegas.
    2 ☐ A train between Los Angeles and San Diego.
    3 ☐ A light rail line between Los Angeles and Long Beach.
    4 ☐ A subway line between downtown Los Angeles and the San Fernando Valley.
    5 ☐ I don't know.

PLEASE PLACE IN RETURN BOXES ON BUS