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GENERAL PLANNING CONSULTANT:

TECHNICAL MEMORANDUM 1.1.1

DEVELOPMENT OF 30-YEAR PROJECTIONS OF ZONAL DATA FOR TRAVEL PROJECTIONS

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Prepared for:

Southern California Rapid Transit District

Prepared by:

Schimpeler-Corradino Associates

in association with
Barton-Aschman Associates, Inc.
Cordoba Corporation
Myra L. Frank & Associates
Robert J. Harmon & Associates
Manuel Padron
The Planning Group, Inc.

July 1984

1. SUMMARY

Based on discussions with SCAG, it appears that TAZ-level data on Population, Households, Employment, and Land Use (PHEL) for 2010 are scheduled to be ready for travel forecasting by late February, 1985. Preliminary values for 2010 may be available as early as October, 1984. If added to SCAG's current work program, SCAG would probably be able to provide preliminary 2020 values by late October or early November. These values would be at the level of the Traffic Analysis Zone and GPC or District staff could presumably run the trip-generation and trip-distribution models in the late fall.

It is recommended that

- the District pursue the necessary steps to have 2020 forecasts added to SCAG's work program for this year, with production of preliminary data set for delivery by the end of October; ?

- the District obtain the agreement of SCAG to run preliminary estimates of trip generation and distribution for the year 2020, or agree that the District will run these models; and ✓

- the GPC proceeds to develop travel forecasts, a transit network, and a SCRTD-specific highway network for 2020. ✓

even if this was added to the work program, there is no guarantee that it will be ready by Oct

2. BACKGROUND AND ISSUES

2.1 Basic Inputs

There are four necessary input components to a future-year forecast by SCRTD of future transit patronage:

market segmentation data -- CALTRANS?

- o Projections of population, households, employment, and land use for use both as input to trip generation and distribution, and for use as trip-end data in mode choice and mode of arrival;

- o Projections of trip tables for the region, or models of trip generation and distribution that will allow these projections to be made;

- o A highway network for the forecast year for producing the highway skims needed to run the distribution model and to run mode choice; and

- o A transit network for the forecast year to complete the transit patronage estimates.

Typically, the production of the first two items has been an assignment of SCAG, while the third -- the highway network -- is CALTRANS' responsibility. The transit network is typically considered to be a District responsibility, together with the model runs that result in patronage estimates and an assigned transit network.

The first concern of this memo must be the plans of the various agencies to produce each of these components. These are discussed in the next section. In addition, it is important to note that year 2000 forecasts in current use are the so-called "adopted SCAG '82" forecasts, which are available at the TAZ level and which have been used to produce trip tables for modal-split modeling. SCAG is now developing both a 1984 base year and a "SCAG '82 modified" forecast for the year 2000. Regional adoption of the SCAG 82 modified forecasts for the year 2010 is targeted for February, 1985, with model runs to produce trip tables following within about 2 to 3 weeks of adoption of these forecasts. The schedule for producing forecasts to a further horizon year will necessarily follow the adoption of these modified year 2010 forecasts.

2.2 Agency Schedule for New Forecasts

SCAG has, in their current work program, the development of forecasts to the year 2010. Forecasts to 2015 or 2020 are not currently part of their work program, but 2020 could be added at SCRTD request, and with whatever agency "quid pro quo" might be required. The schedule for the new forecasts is as follows:

- 1984 Highway network: in progress and to be completed this summer. It involves, primarily, improving the detail in the network in outlying areas.

It would be better for RTD to do this

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- 2000 Highway and Transit Networks: add projects currently funded in the five-year TIP. Scheduled for completion before December 31, 1984.

- 2010 Highway and Transit Networks: no plans to do anything with these currently. Transit networks are considered to be at the District's discretion, and SCAG would be willing to work with the District and GPC to agree on projects to be added into a highway network.

Wishful thinking

- 1984 PHEL forecasts: scheduled to be ready at the TAZ level by September.

- 2000 PHEL forecasts (82 modified): scheduled to be ready for adoption by February 1985. Probably available in early October.

- 2010 PHEL forecasts: scheduled to be available at the TAZ level by October. Adoption also set for February or later.

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- 2010 Travel Forecasts: assuming adoption of the 2010 forecasts by February 7, 1985, forecasts are scheduled to be completed by March 21, 1985.

SCAG has indicated that they could add a 2020 forecast into their schedule, with the probable production of preliminary TAZ-level PHEL data by the end of October. In the meantime, it will be necessary for the District and GPC to develop some type of list of new projects that should be included in a 2020 highway network, and to decide on the coding of such a network. If this is to be coded from scratch, it will represent a significantly larger piece of work than is envisaged in the GPC Work Program. In addition, the GPC will develop a 2020 transit network, and will need to seek District guidance on the facilities to be included and any modifications to the bus network that are to be implemented. In relation to all of the above, it must also be established if the aim is to produce forecasts to 2020, or whether a closer approximation to a 30-year horizon (i.e., 2015) is desired. In the case of the latter, it seems likely that the GPC should utilize data produced by SCAG, under an amended work program, for 2020 and interpolate 2015 from the 2010 and 2020 forecasts. This would then require the District or the GPC to run trip generation and trip distribution. Running these two models may be necessary in any event, because it would not appear that we could expect SCAG to run them before April 1985.

Given this recommended approach, it does not appear that the GPC will need to run the SLAM to produce the forecasts, although we understand that SCAG may be interested in the model. Obtaining the inputs on RSA, zonal, or tract holding capacities and subjective attractiveness ratings for these units for various types of development seems likely to overburden SCAG's current staff.

3. RECOMMENDATIONS

It is recommended that SCAG be asked to add 2020 forecasts to their current work program, with TAZ-level data to be provided to the District by the end of October. It is recommended that a decision be made on whether the horizon year for GPC forecasts should be 2015 or 2020. Further, it is recommended that SCAG be asked to provide inputs to the District and the GPC on those highway improvements and changes that should be incorporated in a 2020 (2015?) highway network, and that agreement be reached on who is to build the future highway network and in what technology it is to be built (e.g., HNET, UROAD, California State Highway package, etc.). If 2015 is defined as the forecast year, agreement will be needed on the interpolation rule between 2010 and 2020. It is also recommended that agreement be reached between SCAG and the District on who will make the forecasts of trip tables, with the understanding that it is necessary to the District's schedule that these forecasts be made by the middle of December, 1984. Finally, it should be noted that the District will be asked to provide details of the transit system changes and new projects that should be encoded into the future-year transit network.

Under these recommendations, the schedule of completion of the work should be as follows:

- Future-Year Highway Network: completion of coding by December 31, 1984.
- Future-Year Transit Network: completion of coding by December 31, 1984.
- SCAG-generated PHEL data at TAZ level for use in forecasting by December 15, 1984.
- Development of fares, and other financial inputs for the future year modeling by January 30, 1984. 5?
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This represents a substantial rescheduling of the milestones and deliverables contained in the Work Program and Management Plan for the GPC, reflecting the time schedule on which information is expected to be obtained from SCAG.

Schimpeler·Corradino Associates

Engineering & Planning Consultants P O Box 8156 1429 South Third Street Louisville Kentucky 40208 502/636-3555

Mr. Gary S. Spivack, Director
Department of Planning
Southern California Rapid Transit District
425 South Main Street
Los Angeles, CA 90013

Re: General Planning Consultant
Project 1000 - Technical Memorandum 1.1.1
July, 1984.

July 9, 1984

Dear Gary:

Please find attached Technical Memorandum 1.1.1 -- Development of 30-Year Projections of Zonal Data for Travel Projections. This document represents the basis for a Milestone decision on the procedures for the 30-Year Projections. Our recommendations on this are contained in the document, which was prepared by myself with input from Bill Davidson. We need now to look for your concurrence with the decision recommended, or your suggestions on an alternative procedure to follow.

I look forward to your reply on this.

Sincerely,

Peter R. Stopher, Ph.D.
Vice President

cc: Project File 1000(2)
Keith Killough
Charlie Schimpeler
Subconsultants (6)

cc Keith please review

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RECEIVED
JUL 09 1984
GARY S. SPIVACK
DIRECTOR OF PLANNING

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GENERAL PLANNING CONSULTANT:

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GENERAL PLANNING CONSULTANT:
TECHNICAL MEMORANDUM 1.2.1
BUS/RAIL INTERFACE AND TRAFFIC ACCESS
ANALYTICAL METHODOLOGY

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Prepared for:

Southern California Rapid Transit District

Prepared by:

Schimpeler.Corradino Associates
and
Barton-Aschman Associates, Inc.

in association with

Cordoba Corporation
Deloitte Haskins & Sells
Myra L. Frank & Associates
Robert J. Harmon & Associates
Manuel Padron
The Planning Group, Inc.

December, 1984

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1. SUMMARY

Many locations in the vicinity of proposed Metro Rail stations currently experience heavy pedestrian activity. This activity is generated by adjacent land uses, modal transfers or pass-through walk trips with origins and destinations outside the immediate station area. Additional pedestrian traffic will be generated by future development in the area and by attractions to the Metro Rail stations. The purpose of this analysis is to define current and forecasted pedestrian activity and evaluate impacts of that activity on the design of the access elements of the pedestrian circulation system. Results of this task identify capacity deficiencies in the pedestrian and mode-of-arrival systems and recommend improvements or modifications to meet access criteria.

Since the Final EIS in December, 1983, the forecasts and mode-of-arrival model outputs have been outdated. New computer programs have been developed to define pedestrian arrival modes and volumes at stations including bus-to-rail and bus-to-bus transfers plus local walk access trips. The analyses of pedestrian and mode-of-arrival data and impacts will be documented in four technical memoranda, one for each of the four following station areas:

1. Union Station
2. Universal City
3. Hollywood Cahuenga
4. Wilshire/Fairfax

A description of the general study approach and the analytical methodology being used in the evaluation of these station areas is presented in this technical memorandum.

2. OVERVIEW

Many locations in the vicinity of proposed Metro Rail stations currently experience heavy pedestrian activity. This activity is generated by adjacent land uses, modal transfers or pass-through walk trips with origins and destinations outside the immediate station area. Additional pedestrian traffic will be generated by future development in the area and by attractions to the Metro Rail stations. The purpose of this analysis is to define current and forecasted pedestrian activity and evaluate impacts of that activity on the design of the access elements of the pedestrian circulation system. Results of this task will identify capacity deficiencies in the pedestrian and mode-of-arrival systems and recommend improvements or modifications to meet access criteria.

A substantial amount of work was accomplished by the Los Angeles Department of Transportation (LADOT) during preparation of the Environmental Impact Statement (EIS) to define regional and station traffic impacts resulting from implementation of the Metro Rail system. Several alternatives and variations were studied, including the 18.6 mile, eighteen station locally preferred alternative. Although vehicular traffic and parking was analyzed in detail during this process, at this early stage little effort was expended on identifying pedestrian activity and its requirements. Progress has been made in two areas since the EIS. First, the forecasts and mode-of-arrival model outputs have been updated; secondly, new computer programs have been developed to define pedestrian arrival modes and volumes at stations including bus-to-rail and bus-to-bus transfers plus local walk access trips.

Analyses of pedestrian and mode-of-arrival data and impacts will be documented in four technical memoranda, one for each of the four following station areas:

1. Union Station
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3. Hollywood Cahuenga
4. Wilshire/Fairfax

A description of the general study approach and the analytical methodology being used in the evaluation of these station areas is presented in this technical memorandum.

3. GENERAL STUDY APPROACH

3.1 DATA BASE

For this analysis, current station site plans are being provided for each of the four stations by the Metro Rail Transit Consultants (MRTC) as approved and accepted by the Southern California Rapid Transit District (SCRTD). These site plans will include a definition of the bus pick-up/drop-off areas, the number of buses each station site is able to serve (including layover space), and the number of parking spaces to be provided. Ingress/egress points and on-site traffic circulation plans will also be provided. The site plan also indicates pedestrian circulation elements and access ways between station entrance portals and the surface street/walkway system.

Bus route information--including routes, service levels, area served, and type of route (local/express)--will be obtained from a publication entitled "Milestone 9 - Supporting Services Plan" (as revised) and from SCRTD staff. This bus route information will include the direction and time of day. The LADOT will provide traffic control signing and pavement marking plans which include locations of bus stops, traffic circulation such as one-way streets, parking/stopping restrictions, and layout of walkway elements including sidewalks and crosswalks.

Existing addition and as-built plans will be provided by LADOT for signalized intersections within the station area. These plans define signal operation, phasing, and signal timing for both vehicles and pedestrians.

3.2. PEDESTRIAN ANALYSIS

Anticipated pedestrian flows within the station areas are composed of three elements: existing pedestrian activity, future pedestrian activity resulting from growth in new or redeveloped land uses within the station areas future walk trips generated by the Metro Rail station and new bus-rail transfers. Current pedestrian counts during the a.m. and p.m. peak periods with hourly breakdowns will be furnished by LADOT for all intersections adjacent to the stations. Growth in pedestrian activity around each station will be based upon the amount of committed and expected development within the area. Sources for this information include information provided by the Community Redevelopment Agency (CRA), and development allowances and projections as specified by the Los Angeles Department of Planning. Calculation of pedestrian trips will be accomplished by first applying ITE vehicle trip generation rates to the future land uses, and then applying a vehicle occupancy factor to the number of vehicle trips.

Transit-related pedestrian activity will be generated using the enhanced software packages and updated forecasts for the transit system. This program provides forecasts of bus-to-rail transfers by bus line, bus-to-bus transfers, and walk trips attracted to bus or rail transit from traffic analysis zones (TAZ's) in the vicinity of the station. The network to be used to develop the transit trips assumed the locally preferred rail alternative (LPA), (i.e., the 18.6 mile Metro Rail Line) and its associated feeder bus system, the Long Beach Light Rail Line, the Century Freeway transit facility, and the Harbor Freeway Express Bus facility.

3.3 VEHICULAR ANALYSIS

The auto/rail interface for the rail stations was previously analyzed in detail by LADOT. The analysis evaluated traffic impacts for several alternatives, including the locally preferred alternative. The traffic data and forecasting methodology used by LADOT to define background traffic for year 2000 was reviewed. A review of the technical reports, working papers, and the final report (1) concluded that background traffic volumes used in the station area impact analyses generally remain valid for purposes of this study.

Enhancements to the travel demand model and revised forecasts, however, have resulted in changes to the mode-of-arrival (MOA) data. For most stations, some re-evaluation of ingress/egress will be required. Therefore, new auto/rail interface analyses will have to be conducted to determine the interactive impacts of auto, bus and pedestrian activity within the station area and on the site.

3.4 RECOMMENDED IMPROVEMENTS

Improvements to mitigate capacity, safety, and environmental deficiencies will be identified for the four stations. Recommended improvements to pedestrian traffic operations could potentially include design changes to enhance access and circulation in the station areas. The technical memoranda for each station will highlight the need for specific improvements.

3.5 FUNDING ALTERNATIVES

(Documentation will be provided after further investigation. General discussion will be included here. Station specific proposals will be addressed in each station technical memorandum.)

4. ANALYTICAL METHOOOLOGY - STATION AREA PEDESTRIAN ACTIVITY

This section describes the technical approach and analytical techniques used to evaluate pedestrian movements anticipated in the station areas. The basic principles of pedestrian traffic flow theory and operational experience have shown that capacity and level of service analyses of pedestrian activity are similar in nature to principles of vehicular traffic flow. Therefore, the method described in "Interim Materials on Highway Capacity"(2) will be used in this analysis.

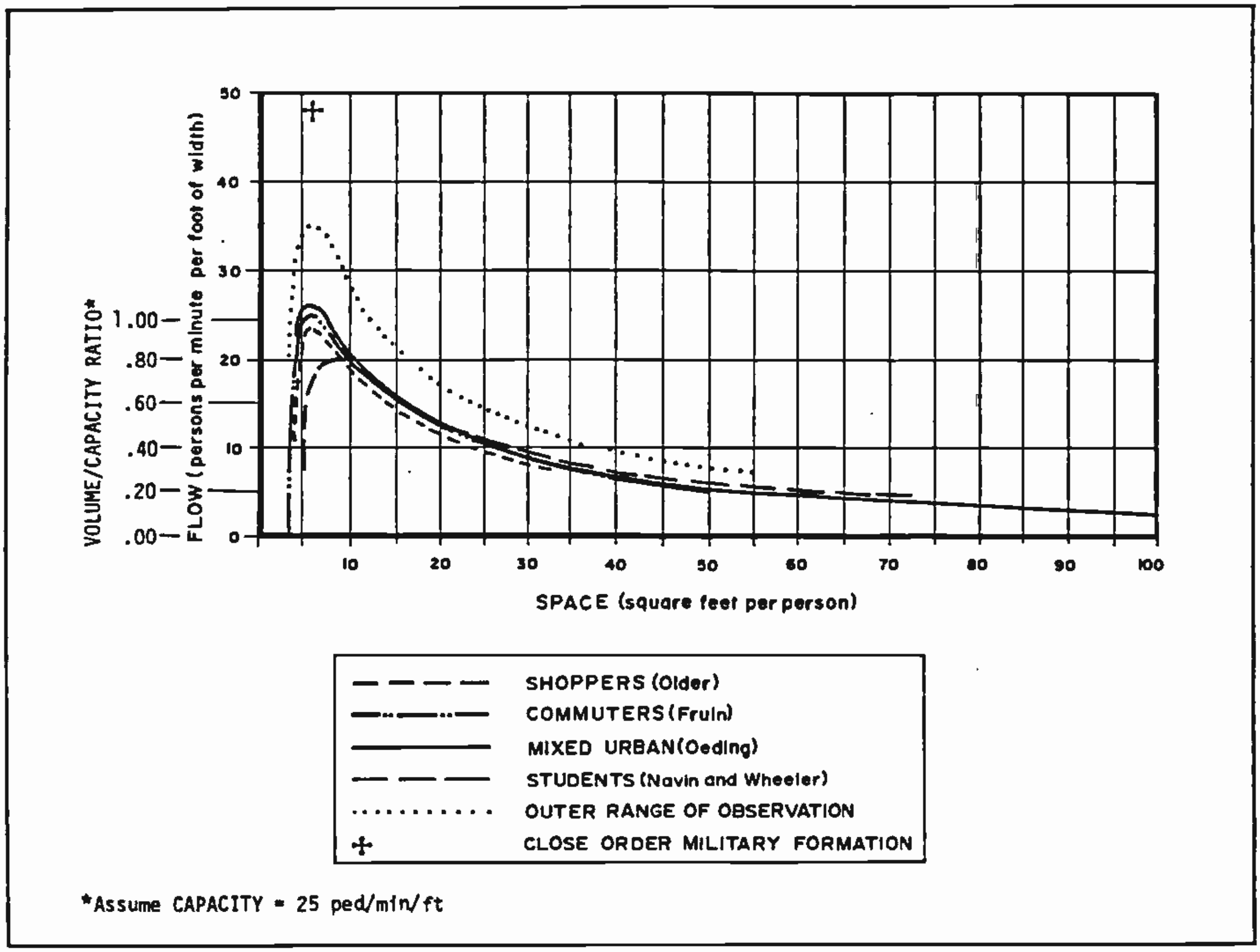
4.1 PEDESTRIAN ACCESS

The scope of the pedestrian analysis performed for the four stations, will be documented in the technical memoranda, and is limited to the sidewalks, crosswalks, station approach walkways and queue space such as reservoir areas at intersections and station portals. This specific analysis will not address, nor will the techniques used, apply to elements of vertical circulation such as stairs, escalators, elevators, and moving sidewalks, or to queueing at fare gates and on the platform areas.

As indicated above, the principles of the pedestrian flow and operation are similar to the principles of vehicular traffic flow. The basic relationship among speed, volume, and density for pedestrian flow is analogous to the vehicular flow relationship. As volume and density of a pedestrian stream increase from free-flow to near-capacity levels, speed decreases. Likewise, as density increases beyond the capacity level, both the flow volume and speed decrease rapidly (Figures 1 and 2).

Pedestrians

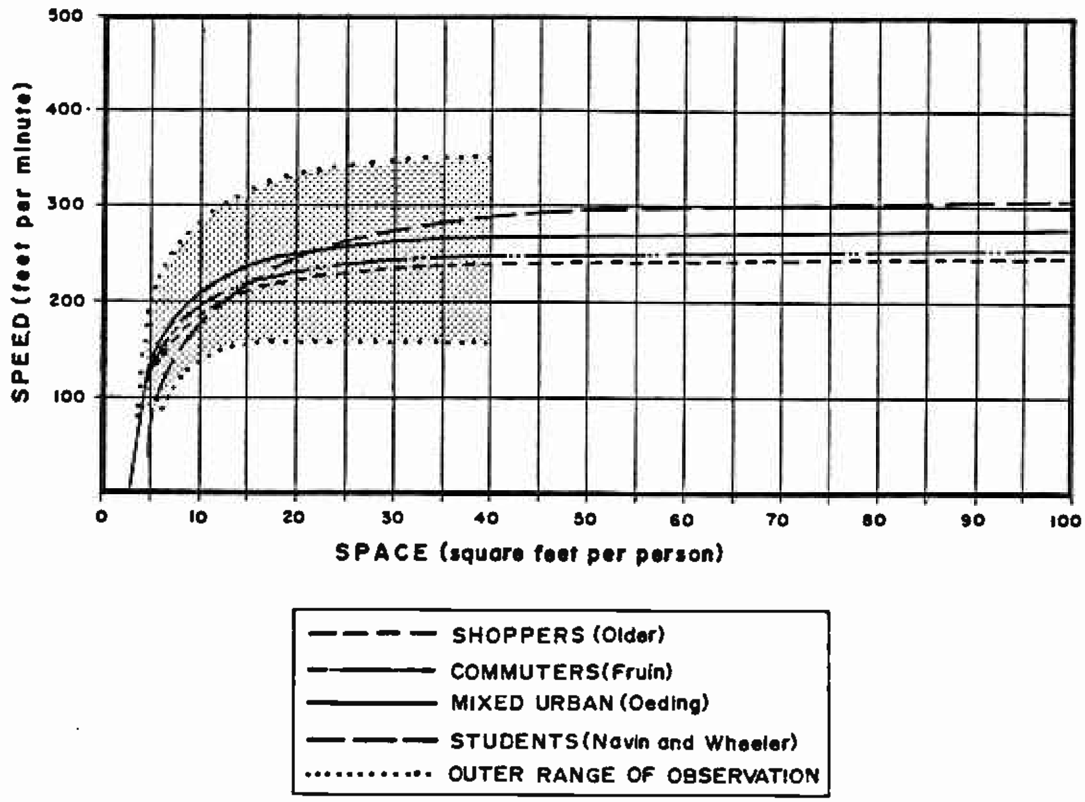
Figure 1. Flow - Space Relationship



(1 foot = .305 meter)

Source: Transportation Research Circular No. 212, TRB.

Figure 2. Speed - Space Relationship



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Source: Transportation Research Circular No. 212, TRB.

As with vehicular flow, there are several indicators relating to the degree of mobility within pedestrian facilities, including free choice of speed, the ability to pass slower pedestrians, ability to walk perpendicular to traffic, and the general ability to maneuver without abrupt changes in speed, direction or gait. Other characteristics of pedestrian movement are inherently different such as comfort, convenience, safety, security, and economy (relate to travel delay).

The basic relationship between density (space) and pedestrian flow can be developed using the fundamental flow formula:

$$\text{Flow} = \text{Speed} \times \text{Density}.$$

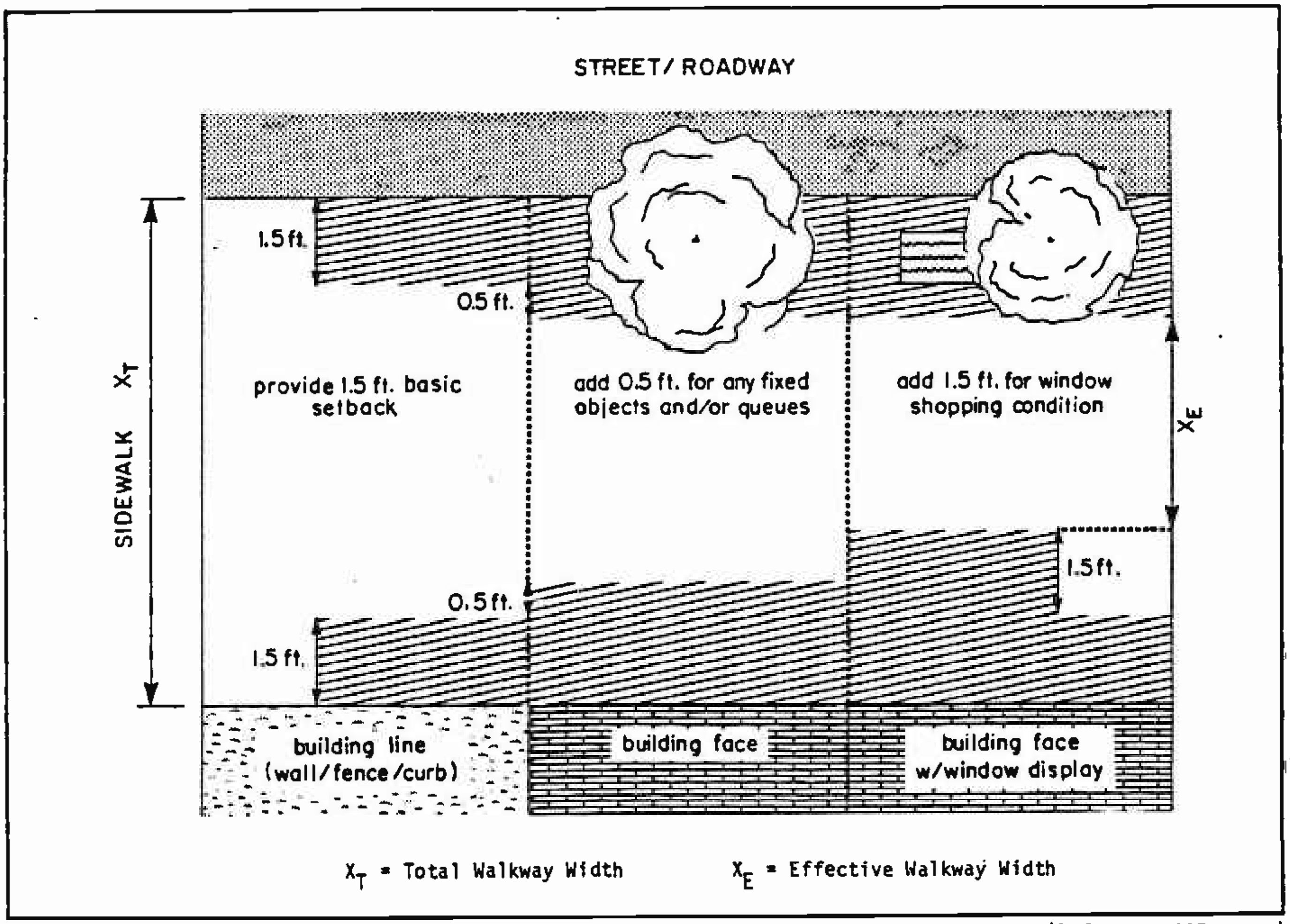
Where Flow is expressed in pedestrians/minute/foot (of walkway width), Speed is given as feet/minute and Density is expressed as pedestrians/square foot (see Figure 1). A review of this figure indicates that the maximum practical flow rate (capacity) is about 25 persons/minute/foot of walkway width, based on empirical data from four major pedestrian studies. Further, maximum flow for all observations fell within a very narrow range of space per pedestrian of from 5 to 9 square feet each. It is then obvious from this flow-density relationship that pedestrian traffic operating characteristics can be evaluated quantitatively using quality of flow and level of service concepts akin to vehicular traffic analysis. Given the above results it is strongly recommended that no walkway facility be designed for less than 5 to 9 square feet per pedestrian throughout its operable length.

The variation in speed with space availability was shown in Figure 2, along with the outer range of observations. This graphic confirms that speed declines rapidly to zero at space allocations less than the 5 to 9 square feet per pedestrian indicated above. Also the outer ranges of observation depicted in Figure 2 show that for the low range (with walkers traveling at about 150 feet per minute), the desired walking speed is not attained until a space allocation of about fifteen square feet per person is available. For the high range (with walking speeds at about 350 feet per minute), desired walking speed is not attained until about forty square feet per pedestrian is available. These threshold values (15 square ft./person and 40 square ft./person) therefore suggest definitions of service level ranges.

Two other important considerations are the "effective walkway width" and the "minimum walkway width." The effective or usable walkway width is reduced by curbs, walls, trees, poles, fire hydrants, window displays and various other obstructions appearing within the total walkway limits (Figure 3). Therefore, when developing a sidewalk design, effective, not total, walkway width must be considered in order to satisfy pedestrian demand.

A second consideration in the empirical data (References 3, 4, 5, 6) have shown that two pedestrians meeting each other or passing require, on the average, at least 2.5 feet of walkway each to avoid interference. Although Figure 3 would indicate a need for three additional feet for a walkway with a curb on one side and a building on the other, Pushkarev (3) indicates that a "buffer" of 2.5 feet is sufficient when combining both building and curb effects. Therefore, a walkway with these characteristics should have a minimum width of 7.5 feet. A walkway with no obstructions and no edge interference should be at least five feet in width.

Figure 3. Buffer Space Width



(1 foot = .305 meter)

Source: Transportation Research Circular No. 212, TRB.

Figure 3 also shows other typical walkway obstructions and impedances which affect capacity and gives specific dimensions for use in decreasing total width to arrive at effective width.

Pedestrian speeds are affected by pedestrian types, age, trip purpose, and other factors. Pedestrians going to and from work typically walk at slightly higher speeds than shoppers for example. An older or very young pedestrian tends to walk at a slower speed than other age groups. However, the analyses contained herein and the capacity calculation procedures used are based on the mean walking speed for groups of pedestrians. Given the expected age distribution, trip purpose and walkway facilities provided, this assumption would appear valid for the peak periods since walkway demand is at its highest levels. This reflects the characteristics of people going to and from work.

Research accomplished by Pushkarev, Fruin, and others (see References 3, 4, 5, 6) on pedestrian capacity has provided sufficient results to establish levels of service using average space allocation per person. Table 1 presents the adopted level of service standards, using A-F levels consistent with vehicular capacity terminology. Although space allocation is the primary criterion for level of service, speed and flow rate data may also be used as supplemental criteria. Descriptive and graphic illustrations of pedestrian levels of service are presented in Figure 4. Level of Service is also presented graphically and quantitatively in Figure 5.

Another important factor to consider is design of walkway facilities for the platoon flow effect. For the condition studied herein, platooning is assumed to occur at all stations. Since buses and rail vehicles discharge passengers

TABLE 1

Pedestrian Levels of Service on Walkways:
Based on Average Flow
(Recommended for Application)

Level of Service	Space (ft^2/ped)	Average Flow Rate[a] (ped/min/ft)	Mean Speed[b] (ft/min)	Volume/Capacity[c] Ratio
A	over 40	under 6	over 250	< 0.24
B	24-40	10-6	240-250	0.24 - 0.40
C	16-24	14-10	224-240	0.40 - 0.56
D	11-16	18-14	198-224	0.56 - 0.72
E	6-11	25-18	150-198	0.72 - 1.00
F	under 6	0-25	0-150	0.00 - 1.00

[a] Flow Rate relative to effective walkway width

[b] Speeds are calculated based on Space and Flow variables, using Equation (2)

[c] Assumed Capacity = 25 ped/min/ft

(1 foot = .305 meter)

Source: Transportation Research Circular No. 212, Interim Materials on Highway Capacity, Pedestrians, Jan. 1980.

Figure 4. Levels of Service on Walkways

LEVEL OF SERVICE A

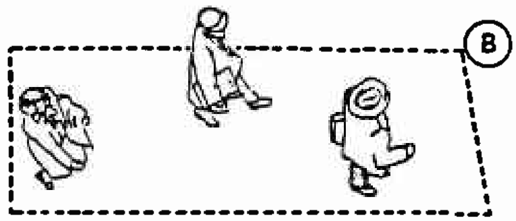
Average Pedestrian Space Allocation:
At least 40 square feet per pedestrian
Average Flow Rate:
6 pedestrians per minute per foot of effective walkway width

At walkway level of service A, sufficient area is provided for pedestrians to freely select their own walking speed, to bypass slower pedestrians, and to avoid crossing conflicts with others.

LEVEL OF SERVICE B

Average Pedestrian Space Allocation:
24 - 40 ft.^{2}/ped.
Average Flow Rate:
6 - 10 ped./min./ft. effective walkway width

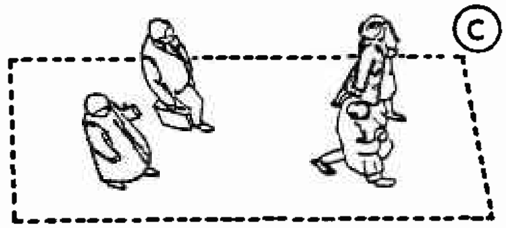
At walkway level of service B, sufficient space is available to select normal walking speed, and to bypass other pedestrians in primarily one-directional flows. Where reverse-direction or pedestrian crossing movements exist, minor conflicts will occur, slightly lowering mean pedestrian speeds and potential volume.



LEVEL OF SERVICE C

Average Pedestrian Space Allocation:
16 - 24 ft.^{2}/ped.
Average Flow Rate:
10 - 14 ped./min./ft. effective walkway width

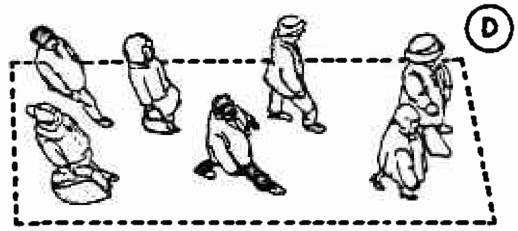
At walkway level of service C, freedom to select individual walking speed and freely pass other pedestrians is restricted. Where pedestrians cross movements reverse flows exist, there is a high probability of conflict requiring frequent adjustment of speed and direction to avoid contact. Designs consistent with this level of service would represent reasonably fluid flow; however, considerable friction and interaction between pedestrians is likely to occur, particularly in multi-directional flow situations.



LEVEL OF SERVICE D

Average Pedestrian Space Allocation:
11 - 16 ft.^{2}/ped.
Average Flow Rate:
14 - 18 ped./min./ft. effective walkway width

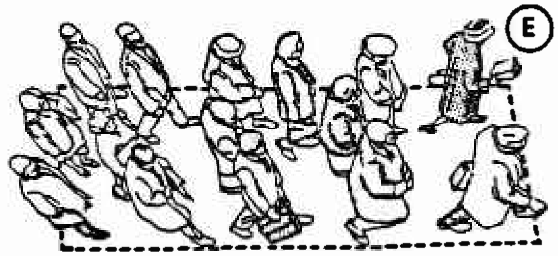
At walkway level of service D, the majority of persons would have their normal walking speeds restricted and reduced, due to difficulties in bypassing slower-moving pedestrians and avoiding conflicts. Pedestrians involved in reverse-flow and crossing movements would be severely restricted, with the occurrence of multiple conflicts with others. Designs at this level of service would be representative of the most crowded public areas, where it is necessary to continually alter walking stride and direction to maintain reasonable forward progress. At this level-of-service there is some probability of intermittently reaching critical density, causing momentary stoppages of flow.



LEVEL OF SERVICE E

Average Pedestrian Space Allocation:
6 - 11 ft.^{2}/ped.
Average Flow Rate:
18 - 25 ped./min./ft. effective walkway width

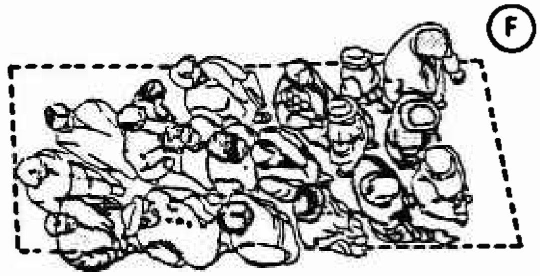
At walkway level of service E, virtually all pedestrians would have their normal walking speeds restricted, requiring frequent adjustments of gait. At the lower end of the range, forward progress would only be made by shuffling. Insufficient area would be available to bypass slower-moving pedestrians. Extreme difficulties would be experienced by pedestrians attempting reverse-flow and cross-flow movements. The design volume approaches the maximum attainable capacity of the walkway, with resulting frequent stoppages and interruptions of flow.



LEVEL OF SERVICE F

Average Pedestrian Space Allocation:
Less than 6 ft.^{2}/ped.
Average Flow Rate:
Variable, less than 25 ped./min./ft. effective walkway width

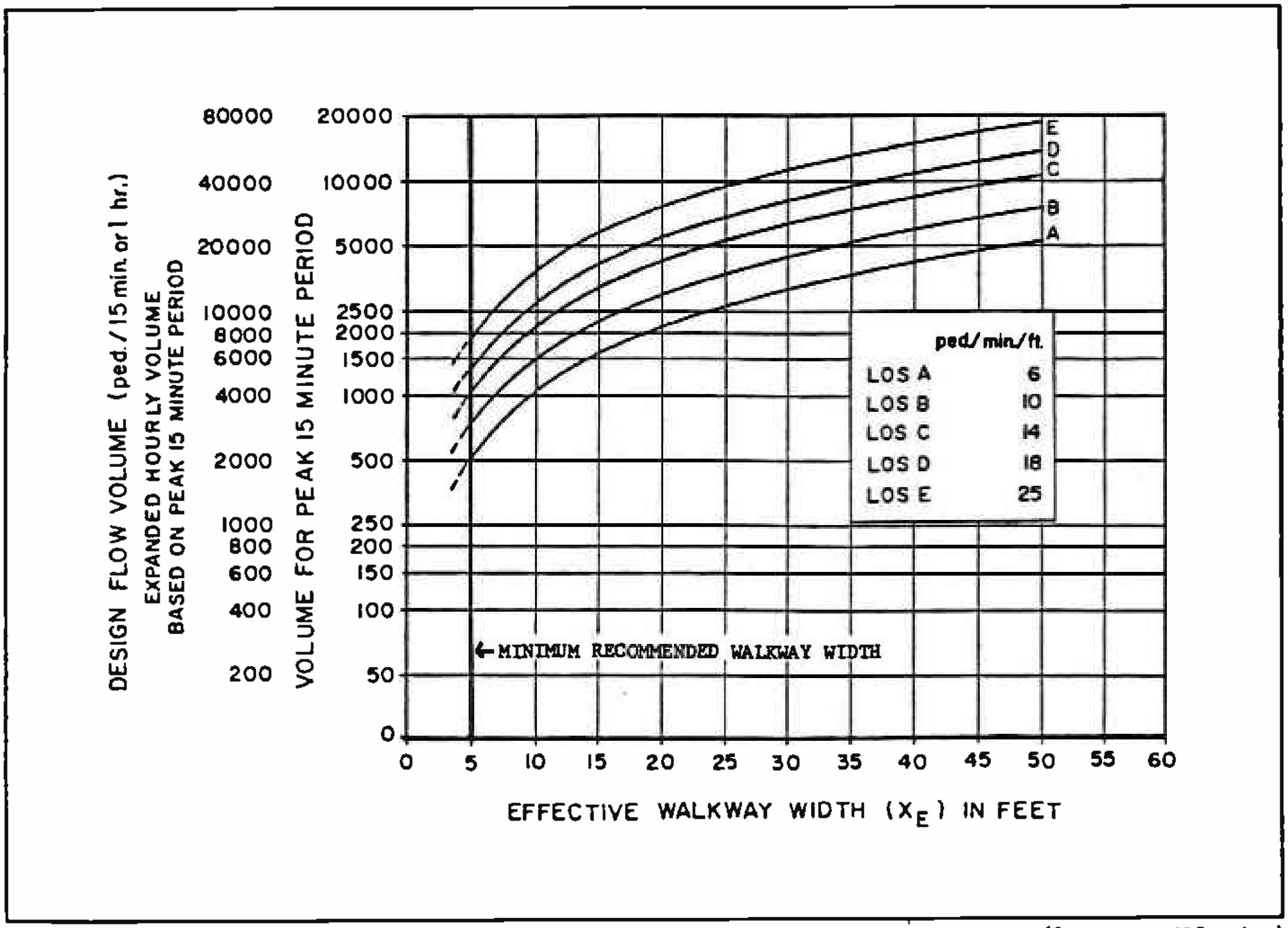
At walkway level of service F, all pedestrian walking speeds are extremely restricted, and forward progress can only be made by shuffling. There would be frequent, unavoidable contact with other pedestrians, and reverse or crossing movements would be virtually impossible. Traffic flow would be sporadic, with forward progress based on the movement of those in front. This level of service is representative of a loss of control, and a complete breakdown in traffic flow. Pedestrian areas below 5 square feet are more representative of queuing, rather than a traffic-flow situation, and this level of service is not recommended for walkway design.



(1 foot = .305 meter)

Source: Transportation Research Circular No. 212, TRB.

Figure 5. Effective Walkway Width - Design Considerations



(1 foot = .305 meter)

Source: Transportation Research Circular No. 212, TRB.

in large groups, platooning occurs frequently--particularly during the peak periods.

Pedestrian flow rates tend to fluctuate greatly--even during the peak hours. In fact, design of pedestrian facilities is often based on a peak fifteen minute period. Research data for two locations in lower Manhattan, which are generally characteristic of many concentrated CBD locations in other cities, was used as a basis for analyzing peak hour versus peak fifteen minute pedestrian activity. This data showed that flow during one minute can be as much as twice as high for the previous minute. Even during the peak fifteen minute period variations of fifty to one-hundred percent are not uncommon from one minute to the next.

An analysis of the data presented for the two lower Manhattan locations as shown in Circular 212 (Table 2) indicates that for one location in the a.m. peak, the peak fifteen minute flow rate is 1.63 times the hourly flow rate during the same time. At the second location during the a.m. peak, the peak fifteen minutes is 1.59 times the average hourly rate. A review of the midday peak period showed generally higher pedestrian flow volumes, but less variation from one minute to the next. Further, the peak fifteen minute period was only 1.12 times the average hourly rate. A review of the peak five minutes as compared to the peak fifteen minutes indicates that for the locations and times studied, the factor varied from 1.07 to 1.17. As a result of these analyses it is suggested that (pending other more relevant data that might be available through the Wilbur Smith study) peak hour pedestrian data be converted to peak fifteen minute data using a 1.60 factor and that peak fifteen minutes be converted to peak five

TABLE 2

Average Peak Hour vs. Peak 15 Minute
and Peak 5 Minute Flow Rates

	Average Peak Hour Flow/Min.	Peak 15 Min. Flow/Min.	Factor* (15)	Peak 5 Min. Flow/Min.	Factor** (5)
Lower Manhattan					
Location #1					
AM Peak Hour	46	75	1.63	88	1.17
Mid Day Peak	90	101	1.12	108	1.07
Location #2					
AM Peak Hour	72	93	1.59	100	1.08

* To convert Average Hourly to Peak 15 Minute.

** To convert Peak 15 Minute to Peak 5 Minute.

Source: Transportation Research Circular No. 212, TRB.

minutes using a 1.10 factor. Note that these factors only account for randomly arriving pedestrians and therefore, does not yet account for the platoon effect.

The diagram presented in Figure 6 shows the platoon flow rate as compared to the average flow rate for 58 observation periods. The upper limit of platoon flow observations is represented by the dashed line in the diagram. Expressed mathematically, this dashed line relating platoon flow to average flow can be stated as follows:

$$\text{Platoon Flow} = \text{Average Flow} + 4,$$

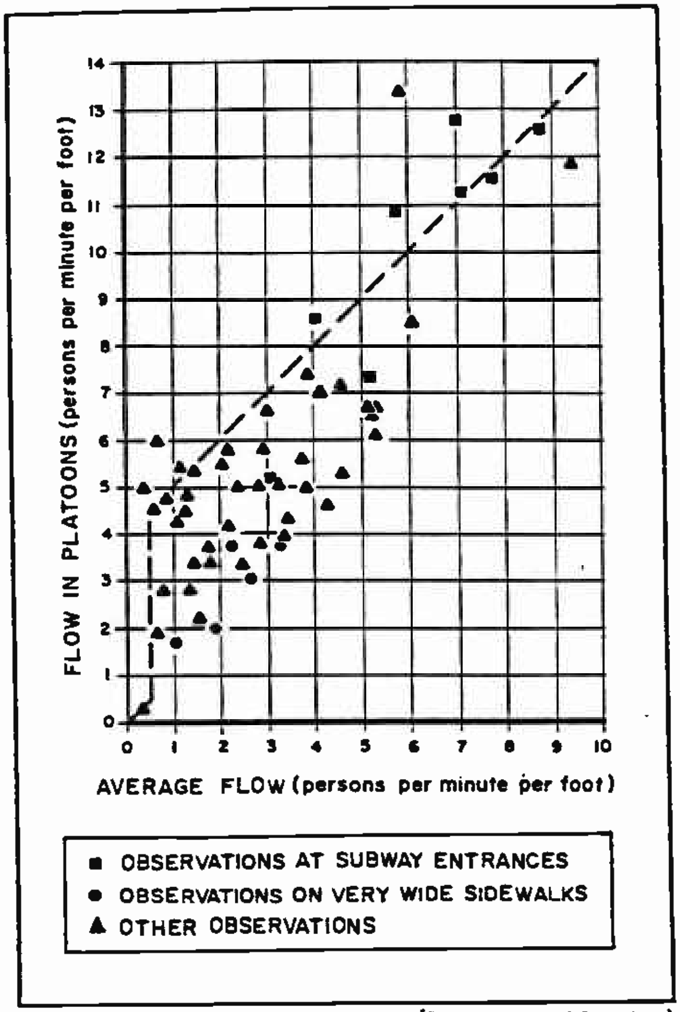
Where flow is expressed as pedestrians per minute per foot of walkway width.

The ratio of platoon flow to average flow is called the platoon factor (Figure 7). A review of this figure indicates that the platoon factor at level of service D is approximately 1.25 and this is the factor recommended for use for conversion of peak fifteen minute flow rates to a platoon flow rate. Therefore, for design of walkway facilities approaching subway entrances--where platoon conditions occur frequently--it is recommended that a platoon factor 1.25 be applied to the average fifteen minute peak flow rates as developed from pedestrian generation and average hourly rates.

4.2 DESIGN CRITERIA

An appropriate design objective would be to accommodate either average flow or platoon flow at a particular target level of service. In reviewing the various considerations for pedestrian flow around transit stations and based on observations at subway entrances, it is recommended that platoon flow be used

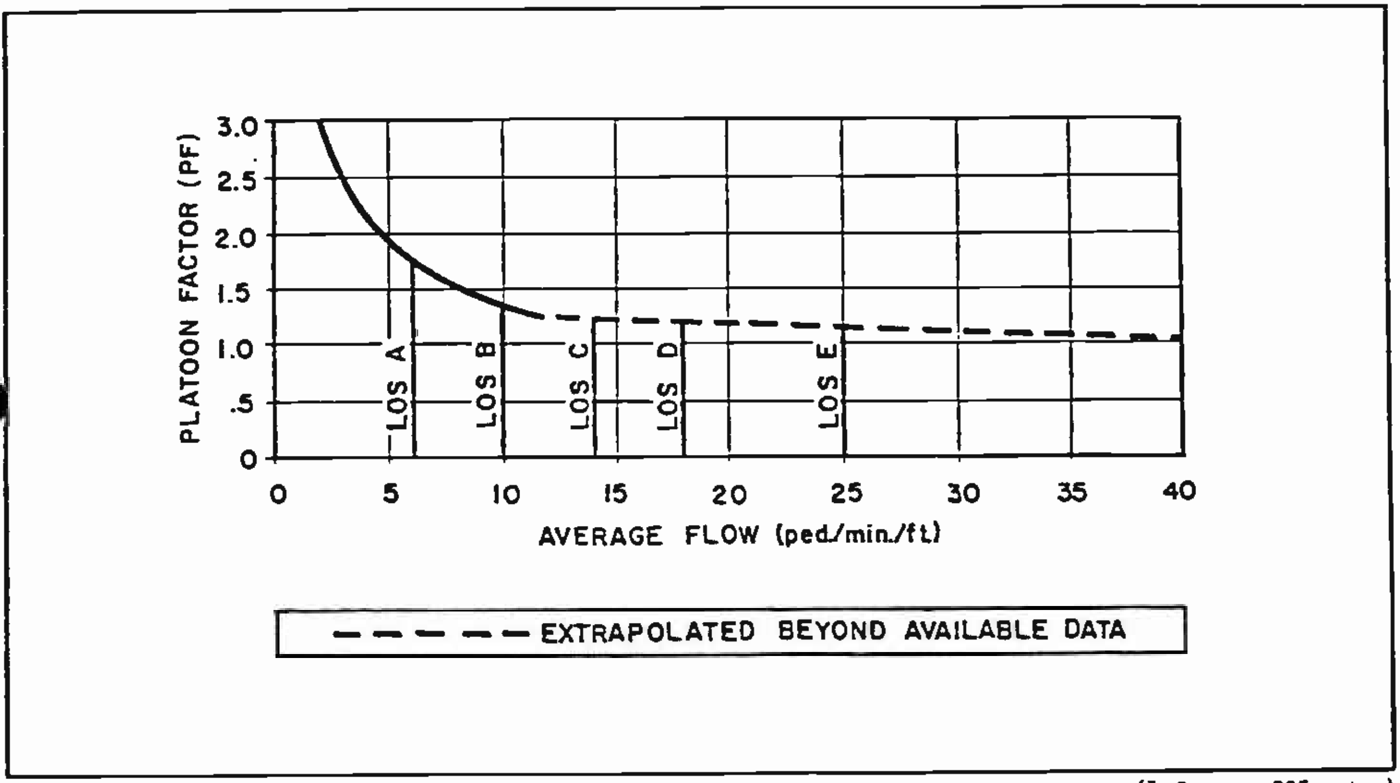
Figure 6. Relationship of Platoon Flow to Average Flow



(1 foot = .305 meter)

Source: Transportation Research Circular No. 212, TRB.

Figure 7. Relationship of Platoon Factor to Average Flow



(1 foot = .305 meter)

Source: Transportation Research Circular No. 212, TRB.

as a design criteria for this project. It is further recommended that a level of service C be used as the target for design purposes. Platoon flow conditions for this level of service would require a range of 16 to 24 square feet per pedestrian in platoons (Table 3). The platoon flow rate at this level of service would be in the range of ten to fourteen pedestrians per minute per foot of walkway width. The corresponding average flow characteristics would typically yield a level of service B for these space allocations. Given the density of the Metro Rail corridor, the development which is expected to occur within the specific station areas, and the platooning characteristic of bus/rail interface, it is appropriate to consider the above criteria for platooning conditions.

TABLE 3

Pedestrian Levels of Service on Walkways:
Related to Platoon Flow

	Platoon Flow Conditions	
Level of Service	Space, in $ft.^2$/ped.	Platoon Flow Rate, in ped./ft./min.
A	40 +[a]	< 6
B	24 - 40	6 - 10
C	16 - 24	10 - 14
D	11 - 16	14 - 18
E	6 - 11	18 - 25
F	< 6	0 - 25
F	< 6	0 - 25

[a] On wide walkways, involuntary platoons occur infrequently at this low pedestrian flow level.
(1 foot = .305 meter)

Source: Transportation Research Circular No. 212, TRB.

5. STATION AREA VEHICULAR ACCESS

5.1 OVERVIEW

The LADOT developed a comprehensive analysis of the surface traffic impacts of Metro Rail and documented the results in a series of working papers, technical memoranda and reports published during 1982 and 1983. These documents included analyses of: 1.) Base 1980 Traffic (March, 1982); 2.) Base 1995 traffic, with 1978 forecasts (July, 1982); 3.) Base 2000 with SCAG 82 B Forecasts (September, 1982), and 4.) Base 2000-Null (October, 1982). Traffic analyses of Year 2000 volumes with the SCAG 82B Forecasts, including Metro Rail facilities in the network, were also developed (April, 1983) and a Final Project Report (Traffic Analysis) was published in June, 1983.

The Technical Report entitled "2000 With Project Condition V/C Ratios and Impacts" (Task 18BAH1243, January, 1983) documents LADOT's evaluation of traffic impacts for selected intersections at each of the seventeen stations along the 18.6 Metro Rail line. The "With Project" condition V/C ratios were compared with the "Base" condition V/C ratios to establish the traffic impact expected to result from construction of the Metro Rail project. Over 250 intersections were analyzed for the 1980 Existing Condition, 2000 Base condition and the 2000 With Project condition. All committed improvements plus any TSM projects normally implemented by LADOT were identified and assumed to exist for purposes of calculating V/C ratios and Critical Movement Analyses (CMA).

The 2000 "With Project" traffic volumes were developed from vehicle trip tables based on the SCAG 82B Growth Forecasts as provided by SCRTD/LARTS for the highway system background assignments. The station mode-of-arrival data available at that time, including park-and-ride and kiss-and-ride, were added to the background assignments to produce the 2000 With Project traffic volumes used in the analysis.

The land use data developed by SCAG in a concurrent planning process and subsequently used for trip generation in the transportation planning process was not the 82B Forecasts used by LADOT, but a less intensive (countywide) level of development. However, LADOT traffic analysis, based on knowledge of proposed or anticipated development within the station areas along the Metro Rail line, should remain valid even though the SCAG 82B Forecasts were used. The analysis of station area traffic using 82B Forecasts remains valid because development in the Metro Rail corridor is expected to approximate that level even though less intensive development may occur throughout the remainder of the region. Therefore, the updated station area vehicular access and traffic impact analysis continues to use the year 2000 traffic assignments developed by LADOT as background data with the revised mode-of-arrival forecasts superimposed.

Several factors have contributed to the need for updated analyses of vehicular access. First, the patronage forecasts have been revised through the software enhancements developed by the General Planning Consultant. Secondly, the station site design and layouts have been refined and should be verified for sufficiency of vehicular access with revised arrival data prior to finalizing the designs. Finally, the transit networks used for assignment and distribution of trips in the modeling process have also been modified somewhat from those used to produce mode-of-arrival data for the LADOT studies.

5.2 REVISED MODE-OF-ARRIVAL (MOA) DATA

The revised mode-of-arrival data, when developed and available, will be tabulated by station. This information, presenting both kiss-and-ride and park-and-ride, as well as patrons by other modes of arrival, will be compared to the previous assignments on a station-by-station basis. Where significant differentials exist between the original MOA data used by LADOT and that produced by the enhanced software, a re-analysis of station area traffic impacts will be accomplished.

5.3 PERFORM TRAFFIC IMPACT ANALYSIS

The new vehicular MOA data will be assigned to the street network within the station area using zone of origin and the latest available station site plans to define points of access. Assignments will be made for both the a.m. and p.m. peak hours. Critically impacted intersections will be determined and critical movement analysis (CMA) performed using procedures defined in "Transportation Research Circular 212, Interim Materials on Highway Capacity," (TRB, January, 1980). The operations and design approach (Figure 8) will be used since verification of site design is an objective. Also, pedestrian volumes at the intersections as developed by the previously described pedestrian analyses will be considered and can be evaluated for impacts on vehicular movements using the operations and design procedure.

Analyses of vehicular capacity at intersections, critical vehicular-pedestrian conflicts, and vehicular ingress/egress at station sites, including both bus and auto operations impacts, will be conducted. All locations which are deficient in capacity, safety, or operations will be identified.

Critical Movement Analysis: OPERATIONS AND DESIGN
Calculation Form 2

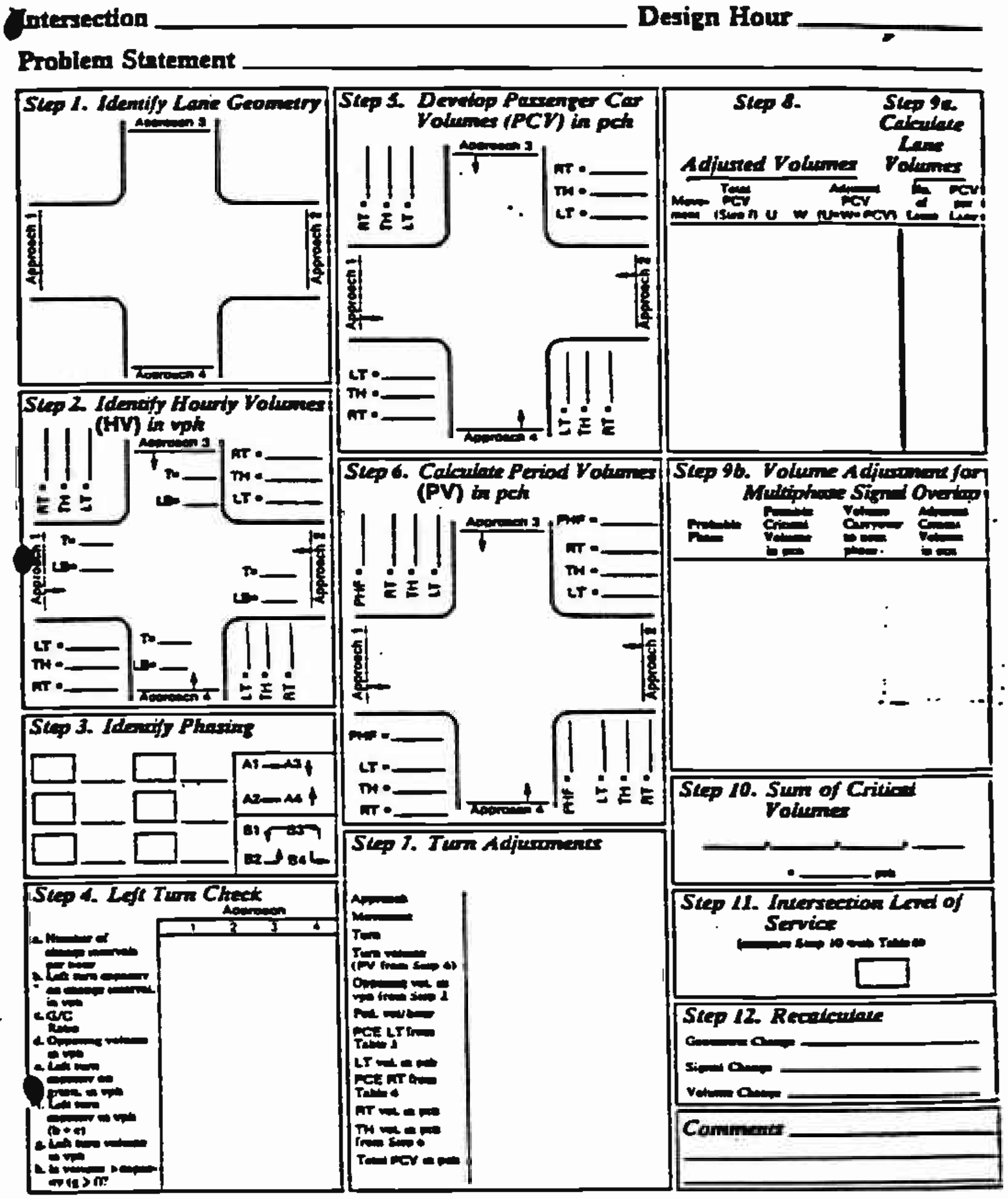


Figure 8

CRITICAL MOVEMENT ANALYSIS
OPERATIONS AND DESIGN

5.4 DETERMINE NEEDED TRAFFIC OPERATIONS IMPROVEMENTS

Traffic operations improvements recommended by the LADOT studies will be reviewed and re-evaluated in light of the revised forecasts and analyses. A revised program of improvements will be defined where needed. A notation will be made of those locations where improvements have been identified but may be considered a "betterment" and thus are not eligible for funding under UMTA guidelines.

5.5 IMPLEMENTATION

Recommendations for improving bus/rail interface and auto/rail interface and recommendations for mitigating environmental impacts will require improvement to streets and traffic signal control. Order-of-magnitude cost estimates will be determined for these improvements. Although these items are eligible for funding with transit monies, they may also be eligible for funding under traditional street improvement and traffic engineering sources. Such sources may include the City, the State, and the Federal (FHWA) governments. The GPC will develop a program of street improvement projects. Each will be assessed to determine if it may qualify for non-transit funding sources.

The potential for receiving non-transit funding will be determined along with the magnitude of such funding needs, and the probability of obtaining such funds. From this assessment a program of projects will be established with strategies for implementation using non-transit funds.

REFERENCE

1. SCRTD Metro Rail Project, Task 18CAA21, Final Project Report Traffic Analysis, LADOT, June, 1983.

2. Transportation Research Circular No. 212, Interim Materials on Highway Capacity, TRB, Washington, D.C., January, 1980.

3. Pushkarev, B., and Zupan, J.M., Urban Space for Pedestrians, Cambridge, Massachusetts, MIT Press, 1975, 212 pp.

4. Fruin, J.J., Pedestrian Planning and Design, New York Metropolitan Association of Urban Designers and Environmental Planners, 1971, 206 pp.

5. RTKL Associates, Inc., Feasibility Analysis and Design Concepts and Criteria for Communitywide Separated Pedestrian Networks, Phase III, Draft Pedestrian Planning Procedures Manual, Vols. I-III, Maryland, 1977.

6. Hall, E.T., The Hidden Dimension, New York, Doubleday and Company, Inc., 1966, 216 pp.

SCHIMPELER-CORRADINO ASSOCIATES
GENERAL PLANNING CONSULTANT to the Southern California Rapid Transit District

425 South Main Street Los Angeles, California 90013 213/972-3239

Associate Consultants:
Barton-Aschman Associates
Deloitte, Haskins & Sells
Robert J. Harmon & Associates, Inc.
The Planning Group, Inc.
Cordoba Corporation
Myra L. Frank & Associates
Manuel Padron

K.L.K.
JAN 18 1985

January 10, 1985

Mr. Gary S. Spivack
Director of Planning
Southern California Rapid Transit District
425 South Main Street
Los Angeles, CA 90013

Re: General Planning Consultant
Project 1000
Technical Memorandum 1.1.1 -
Network and Forecast Checking
Procedures
January, 1985

Dear Gary:

Attached you will find Technical Memorandum 1.1.1 - Network and Forecast Checking Procedures. These procedures were developed by Dick Pratt, Norm Steinman, and Bob Schulte to increase the reliability of forecasts for both existing and new networks.

Please contact us if you should have any questions.

Sincerely,

Peter R. Stopher
Vice President

PRS:jh

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GENERAL PLANNING CONSULTANT
TECHNICAL MEMORANDUM 1.1.1
NETWORK AND FORECAST CHECKING
PROCEDURES

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

Prepared for:

Southern California Rapid Transit District

Prepared by:

Barton-Aschman Associates, Inc.

in association with

Schimpeler Corradino Associates

January 1985

1.0 INTRODUCTION

In response to problems that have occurred over the past several months in producing accurate forecasts for existing networks, two checking procedures have been developed to be used at various steps of the forecasting process. The first procedure is computer-based and is applied during the network/skim building phase. The second procedure is manual (1) and is applied primarily during the forecasting phases of the process.

2.0 CHECKING PROCEDURES

In the first procedure, checks are made at three points in the network/skim building phase. Immediately after a network has been built, a program is run using the link and line files of the new network and the line file of the "base" network from which the new network has been created. The program produces the following reports:

- Station report for each rail station and/or park-and-ride/kiss-and-ride lot. The station node number and station type (walk, P/R, or K/R) is shown. For stations having auto access, a frequency distribution of auto link distances is printed, followed by a listing of links exceeding the maximum allowable distance. For rail stations, the dummy node number and the number of mini-walk network links are also indicated.

- UMATCH report for each rail station and/or park-and-ride/kiss-and-ride lot showing routes accessing the facility.

- Report indicating route and headway differences between the new network and the base network.

- Walk link report summarizing walk access information for each zone, including a link count and the (uniform) link distance. Zones having incorrect walk access coding are flagged.(2)

Following path building, walk access paths from a CBD zone to roughly 20 zones throughout the modeling area are traced and checked for reasonableness. For critical networks, more extensive path checking (for roughly 800 CBD interchanges) is done.

Once the skims have been created, the travel time frequency distributions for the new and base networks are compared to determine if the expected travel time differences have occurred. For selected zones near new facilities, total travel time to all other zones may be compared between the two networks to determine if the addition of the facilities has had the desired effect(s).

---

(1) This procedure could be facilitated, though, with a spreadsheet program that could, for example, compute percentage differences.

(2) That is, zones having: 1) a uniform walk link distance greater than one-half mile; 2) non-uniform walk link distances; and/or 3) walk link speeds not equal to 3 mph.

The second procedure involves the review of outputs produced during the intermediate steps of the forecasting process. Two different lists of outputs have been prepared based on the amount of time available to conduct the review. The first and longer list is the one which should be used as a regular part of the travel forecasting process. The second and shorter list is the one which should be used if, during a crisis situation, sufficient time is not available to produce and evaluate all the outputs in the longer list.

There are two types of reasonableness checks which should be performed using the outputs listed in this memo. The first type of check would be an internal one in which the outputs are compared for the same network alternative. Questions of internal consistency such as why did the express bus boardings increase by X when the express bus miles decreased by Y should be asked here. The second type of check would be a lateral one in which the outputs are compared across network alternatives. Questions of lateral consistency such as why did the express bus productivity (passengers per vehicle service mile) increase by X in Alternative 1 while it increased by Y in Alternative 2 would be asked here.

The outputs to be reviewed in the second checking procedure are shown below:

FUNCTION	REGULAR	SHORTENED
Network Building	By mode, by time period	By mode, by time period
	1. Number of routes (UNET Reports 5 & 6)	1. Number
	2. Headways of routes	2. Vehicles required
	3. Vehicles required	3. Vehicle miles
	4. Vehicle miles	4. Vehicle hours
	5. Vehicle hours	
	6. Terminals	
	7. Access links (UMATCH program)	
	8. Vehicle miles/vehicle hours	
Through Mode Split	1. Person trips by purpose and grand total	1. Person trips by purpose and grand total
	2. Transit person trips by purpose and total	2. Transit person trips by purpose and total
	3. Percent transit person trips by purpose and total	
	4. Percent transit (HBW, HBNW) for RSAs: a. attractions: 13,17,18, 20,21,23 b. productions: 13,16,17, 18,20,21	
	5. Percent walk (HBW) overall and for RSAs: a. attractions: none b. productions: 13,16,17,	

18,20,21

Mode of Arrival	1. Comparison of station loadings (a.m., unconstrained)	
	2. Comparison of mode of arrival/ mode split (a.m., unconstrained)	
Assignment	By mode and RTD total:	By mode and RTD total:
	1. Number of routes (URAP)	1. Number of routes (URAP)
	2. Vehicles required	2. Vehicles required
	3. Vehicle miles	3. Vehicle miles
	4. Vehicle hours	4. Vehicle hours
	5. Vehicle miles/vehicle	5. Passengers
	6. Vehicle hours/vehicle	6. Passengers/vehicle mile
	7. Vehicle miles/vehicle hour	7. Operating cost
	8. Passengers	8 Work transit travel time
	9. Passengers/vehicle mile	9. Non-work transit travel time
	10. Passengers/vehicle hour	
	11. Passengers/vehicle	
	12. Passenger boardings/linked trips	
	13. Operating cost	
	14. Work transit travel time	
	15. Non-work transit travel time	
Iteration	By mode and RTD total:	By mode and RTD total:
	1. Number of routes (URAP)	1. Number of routes (URAP)
	2. Vehicles required	2. Vehicles required
	3. Vehicle miles	3. Vehicle miles
	4. Vehicle hours	4. Vehicle hours
	5. Vehicle miles/vehicle	5. Vehicle miles/ vehicle
	6. Vehicle hours/vehicle	6. Passengers/ vehicle mile
	7. Vehicle mile/vehicle	7. Operating cost
	8. Vehicle mile/vehicle hour	8. Work transit travel time
	9. Passengers	9. Non-work transit travel time
	10. Passengers/vehicle mile	
	11. Passengers/vehicle hour	
	12. Passengers/vehicle	
	13. Passenger boardings/linked trips	
	14. Operating cost	
	15. Work transit travel time	

16. Non-work transit travel time
17. Farebox revenue/passenger
18. Operating cost/passenger

3.0 SUMMARY

Two checking procedures have been developed to increase the reliability of the forecasts produced in the travel demand forecasting process. The first procedure is used to determine if intended network changes have been accurately reflected in the coded network and if established coding conventions have been followed. The second procedure identifies whether the forecasts produced in each step of the process are consistent with the alternative being tested and with forecasts produced for other alternatives.

SCHIMPELER CORRADINO ASSOCIATES
GENERAL PLANNING CONSULTANT to the Southern California Rapid Transit District

425 South Main Street | Los Angeles, California 90013 | 213/972-3239

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Deloitte Haskins & Sells
Robert J. Harmon & Associates, Inc.
The Planning Group, Inc.
Cordoba Corporation
Myra L. Frank & Associates
Manuel Padron

December 19, 1985

Mr. Gary S. Spivack, Director
Department of Planning
Southern California Rapid Transit District
425 South Main Street
Los Angeles, California 90013

Re: General Planning Consultant
Project 1000 -
Technical Memorandum 86.1.1--
Documentation for 30 Year
Financial Plan Networks
December 19, 1985

Dear Gary:

Attached you will find Technical Memorandum 86.1.1--Documentation for 30 Year Financial Plan Networks. The text was prepared by Peter Bromley and covers the changes made to existing networks by Bob Schulte and Peter Bromley in order to create the networks related to the 1985 GPC work program.

If you should have any questions, please do not hesitate to contact us. Thank you for your time and consideration in this matter.

Sincerely,

PETER R. STOPHER, Ph.D.
Vice President

PRS:pb

ccs: Project File 1000 (2)
Charles C. Schimpeler
Subconsultants (5)

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

GENERAL PLANNING CONSULTANT

TECHNICAL MEMORANDUM 86.1.1

DOCUMENTATION FOR 30 YEAR

FINANCIAL PLAN NETWORKS

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Prepared for:

Southern California Rapid Transit District

Prepared by:

Barton-Aschman Associates, Inc.

in association with

Schimpeler Corradino Associates
Cordoba Corporation
Myra L. Frank & Associates
Manuel Padron
The Planning Group, Inc.

December, 1985

TABLE OF CONTENTS

1. INTRODUCTION

The purpose of this technical memorandum is to document the changes made to existing networks in order to create the 30 year financial plan networks associated with the FY 1985 GPC work program. As initially defined these were:

- Fiscal Year 1985 - containing only Phase V Sector Improvements to the existing all-bus network,

- Fiscal Year 1990 - embodying the MOS-1 alignment of Metro Rail (from Union Station to Wilshire Bl. and Alvarado St.) and Long Beach Light Rail,

- Fiscal Year 1991 - containing the MOS-3 alignment of Metro Rail (from Union Station to Beverly Bl. and Fairfax Av.) and Long Beach Light Rail,

- Fiscal Year 1993 - which includes the full MOS-5 or LPA alignment of Metro Rail (from Union Station to North Hollywood), Long Beach Light Rail, Century light rail (only from Studebaker Road to Douglas and El Segundo Blvds.) and San Fernando Valley Light Rail, and

- Fiscal Year 1995 - which embodies the full LPA alignment of Metro Rail, Long Beach Light Rail, all of Century Light Rail, San Fernando Valley Light Rail, Coastal Light Rail and Harbor Freeway Busway.

Since the time at which these simulation years were originally chosen, different scenario years and network names have been assigned to these and other networks yet to be built. The above fiscal year designations have been used throughout this memo because 1) they were the years assigned to these networks as we actually began to build them, 2) they are the names most commonly used by both GPC and District Planning staff and 3) the new network designations developed for use in the FY 1986 GPC work program (i.e. NW1, NW2, etc.) do not neatly encompass all of the networks built under the GPC FY 1985 work program discussed in this memo.

Finally, a distinction is made in this memo between the word "correction," associated with errors in the networks which were set straight, and "changes," which in this memo is always meant to mean coding alterations which were initiated in order to reflect bus line routing differences as the result of the operation of future capital-intensive facilities.

2. THE NETWORK BUILDING PROCESS

2.1 LINE CODING

In building networks associated with the FY 1985 work program, the GPC staff began by building the most capital-intensive of the networks, Fiscal Year 1995, from the existing FAR00.MRLTR network which contained the LPA alignment and Long Beach Light Rail but which was judged by District staff to include insufficient background bus changes associated with the operation of the light rail line. In addition, the Long Beach Light Rail alignment and the inclusion of Hollywood Bowl as a Metro Rail station were considered to be obsolete. Detailed background bus changes were supplied by District Planning staff and were coded into the network.

Definition for background bus changes related to the Long Beach Light Rail line was provided with the explicit understanding that rail alignments in both the Los Angeles and Long Beach Central Business Districts (CBDs) were not final. Indeed, some evolution may have occurred already in the preferred alignment for the Long Beach line since the last set of alignment definitions were provided to GPC staff. Working from the set of bus and rail routing changes supplied by District staff, these updates were incorporated into the new network. Approximately 65 corrections in line coding were made as errors were discovered. Usually these errors were the result of mistakes in the way headways or route configurations were coded. In some cases lines were not correctly coded into the park-and-ride or kiss-and-ride locations they should serve. In all cases errors were detected only as a by-product of background bus changes associated with the capital-intensive facilities mentioned earlier; no attempt was made to conduct a comprehensive route-by-route check of bus line coding. Together with the remaining link coding concerns mentioned later, this remains one of three areas in which the team conducted no thorough analysis. Nonetheless, careful records were kept, node-by-node, of all corrections and changes that were made and the fixed facilities with which these changes were associated.

Because background bus changes associated with specific fixed facilities had been carefully documented, it was possible to "build down" to the 1993 network from the 1995 network by removing the coding of both the capital-intensive facilities themselves and their associated background bus changes. These were facilities and changes which had been incorporated into the 1995 network but which had no place in the 1993 network. Thus, the 1993 network was built from the 1995 network. This process also allowed corrections already made in building the 1995 network to be maintained in the 1993 network.

Unfortunately, this process could not be used directly to build the earlier three networks. This was because no detailed and reliable single source could be found to document the background bus changes which had already been incorporated into the true base network (FAR0D.MRLTR) as a result of the inclusion of the full LPA alignment. Because it was uncertain what had been added to this network with respect to the LPA when it was first built, there was no way to be certain which were the proper elements to be removed in creating a network in which Metro Rail did not extend as far. Therefore it was decided to return to one of the existing cost-effectiveness networks (FY85A.BASE) as a base network upon which to build.

What is known about FAR85A.BASE is that it was built from the FAR82 network, although probably indirectly. The most current thinking is that one of the networks containing part of the Metro Rail alignment constituted the base network for FAR85.BASE. FAR85.BASE had been intended to replicate a "null" hypothesis in which Metro Rail would not be built and only incremental improvements in all-bus service would be made. Thus, in originally building the network, Sector V improvements were applied to the existing FAR82 network coding. Since this process was undertaken sometime in 1982, it is hardly surprising that the existing, real-world 1985 bus network looks somewhat different. This is true despite the fact that most of the sector improvements planned earlier have by now been implemented. In building the "new" 1985 UNET network, the team reviewed FY85A.BASE for consistency with existing bus routing and corrected any discrepancies. This practice unintentionally neglected the fact that current route coding was not necessarily interchangeable with 1982 bus route coding plus Sector V improvements. In general, this oversight was not judged to be very significant, in view of the fact that most of the Sector V improvements are by now reflected in current bus routings. Nonetheless, since these "corrections" were carried through to all of the new networks, it does raise the fact that line coding for the 30 Year Financial Plan networks are consistent between each other but not necessarily with their base networks. In addition, for the 1985 network, the team adopted most of the auto-connect links associated with bus-only kiss-and-ride and park-and-ride lots which had been reviewed earlier.

The 1990 network, containing the MOS-1 alignment of Metro Rail and the Long Beach Light Rail line, was then built upon a clean 1985 "base." Again, no single source of truly detailed background bus changes associated with MOS-1 could be found, but changes mentioned in the environmental assessment for MOS-1 were fleshed out through discussions with District staff and reference to prior work for the cost-effectiveness forecasts. Background bus network definition related to the Long Beach Light Rail line had been previously supplied by District Planning staff.

Work then commenced on the 1991 network, comprising both the MOS-3 alignment of Metro Rail and the Long Beach Light Rail line. The only documentation found for the background bus network related to MOS-3 was the Milestone 9 Report which was chiefly intended as a general design for the bus network for the full LPA. Careful study of this document and detailed discussion with Joe Lyle of the District's Planning staff helped to update the Milestone 9 report and uncover changes specifically related to the MOS-3 alignment. These changes were then incorporated into the network.

2.2 LINK CODING

2.2.1 General Concerns

With few exceptions the team used or extrapolated from existing links as a base for future networks. District staff had identified problems with facility-type coding for certain freeway links and these were fully reviewed. Corrections in facility-types and link speeds were made where necessary.

In addition, freeway dummy nodes were checked for the existence of walk connections. Freeway dummy nodes are a necessary concession to UNET coding rules in order to replicate the fact that express buses generally travel long distances on freeways without making any stops. UNET coding rules do not allow links longer than 25.5 miles or links which take longer than 25.5 minutes to traverse. Freeway dummy nodes provide a way of simulating a longer link, on which the bus does not make a stop, without violating UNET rules. This is true, however, only as long as no access links are connected to the node and no other transit mode shares the node (which would permit transferring). Partly to end confusion of these nodes with normal transit nodes, the team renumbered all existing freeway dummy nodes to fall within the range 7900-7949.

One further note should be made with respect to freeway link coding. In the course of path tracing on the FAR85.BASE network it was discovered that use of the link speed table distorted actual bus travel times on specific high-speed facilities. This is partially the result of congestion on certain freeways which in the real world makes bus travel slower on those facilities. However, use of a facility type/area type speed table simplifies network link speed coding by assuming that the same speed can be attained by buses on similar facilities, in similar areas, at the same time of day. With UNET networks, this is generally considered to be a necessary simplification in order to estimate acceptable speeds for so many links. Bus speeds on freeways are clearly not the only example of distortion resulting from the use of this technique, but the magnitude of the discrepancy is probably greatest in the case of these links. The team briefly considered reviewing coded versus actual bus speeds on all freeway facilities but decided against it for three reasons. One was simply the time required to complete such a study. A second reason hinged on the fact that the networks were intended to replicate future year conditions. While some freeways are clearly more congested than others today, no one knows how congested these facilities will be in the future. Finally, the intention in the future is to move to INET networks which can represent bus speed on the basis of a congested highway network. The team did, however, alter speeds on the San Bernardino Busway to more accurately reflect existing conditions. In addition, projected speeds on the future Harbor Busway were assumed to be similar to current speeds on the El Monte Busway.

The team also made changes to the existing coding of express bus links in the CBD. This change reflected a decision to alter the standard speed table by ceasing to distinguish between express and local bus speeds in the Los Angeles CBD. The rationale behind this move is the realization that, in the downtown, buses must operate in platoons with little, if any, opportunity to pass one another. This fact, coupled with the reality that, for a given route, express buses generally operate on the same stop patterns as local buses in the downtown, argues against differentiating between their speeds in these areas.

The team developed a method for calculating travel times between stations on both new and realigned light rail lines. For the purposes of estimating rail link times, maximum acceleration and deceleration rates of 3.9 ft/s/s were assumed. Maximum speeds on rail lines are a factor of the degree to which rail vehicles are separated from other traffic, the type of safety control (both on rail and non-rail vehicles), the congestion on the line as a result of other rail traffic, and the number and severity of grades and curves on the alignment.

Metro Rail, of course, is completely separated from other traffic throughout its alignment. The same is true of the Century Light Rail line where it runs in the freeway median. The Long Beach, Coastal and Century Light Rail lines (outside the freeway portion of Century's route) will not be fully separated from automobile traffic but will probably operate in exclusive right-of-ways for a large portion of their routes, with crossing gates located at major intersections. San Fernando Valley Light Rail, while enjoying an exclusive right-of-way, will probably not have crossing gate protection along its route.

For light rail routes, two and sometimes three different typical "speed regimes" were used: one for straight sections, another for curves and a third for downtown running. Furthermore, because each rail line differs slightly in the degree of separation it enjoys from other traffic and the land use it passes through, the speeds assumed in these "regimes" are dependent on the line in question. In the case of Century Light Rail, within the freeway median a speed of 55 mph was assumed in straight sections and 35 mph in curves. Calculation of rail travel times outside of the freeway median used 35 mph in straight sections and 25 mph in the curves. Since much of Coastal Light Rail parallels the Century Light Rail line outside the freeway median, it was assumed to share this last set of speeds. For the Long Beach Light Rail line, the team used the travel times already in the base network. Where these were not applicable, additional work was performed to estimate rail travel time, assuming speeds of 45 mph and 35 mph mid-corridor and 30 mph/25 mph downtown. The San Fernando Valley Light Rail line, operating without crossing gates, was assumed to operate at typical maximum speeds of 35 mph in straight sections and 25 mph in curves. In the case of San Fernando Valley Light Rail, an additional penalty was imposed on link travel times due to the absence of crossing gates. This delay was assumed to be approximately equal to 20 seconds/mile. Finally, some distinction needed to be made for all rail links between peak and off-peak dwell times, as the result of greater passenger loads in the off-peak periods. This was accomplished by assuming a dwell time of 20 seconds off-peak and a full minute in peak periods.

ASSUMED LIGHT RAIL "SPEED REGIMES"
FOR TRAVEL TIME CALCULATIONS

FACILITY	TYPICAL TOP SPEED	SPEED IN CURVES	DOWNTOWN SPEEDS Straight Sections	DOWNTOWN SPEEDS Curves
Century Light Rail (in freeway median)	55mph	35mph	--	--
Coastal Light Rail & Century Light Rail (outside freeway median)	35mph	25mph	--	--
Long Beach Light Rail	45mph	35mph	30mph(1)	25mph(1)
San Fernando Valley Light Rail	35mph(2)	25mph(2)	--	--

Acceleration and deceleration rates assumed to be uniform at 3.9 ft/s/s

(1) - In tunnel
(2) - Additional penalty of 20 seconds/mile imposed.

In running alternatives with networks similar to those developed for the 30 year financial plan, the team discovered rail patronage to be unexpectedly sensitive to relatively small variations in travel time. With this in mind, it would probably be prudent sometime in the future to conduct a more thorough investigation of all coded rail travel times. Ultimately, it would be helpful to arrive at an acceptable and universally agreed-upon methodology for estimating rail travel times of all descriptions.

There remain only two link-related concerns that have not been investigated by the team. The first is that the downtown walk network and walk connectors originally supplied in the base networks continues to be used. Despite discussion of possible problems, neither the sidewalk network nor downtown walk connectors have been analyzed or altered in the new networks. The only other item related to the link files which has not been addressed by the team is the overall integrity of the link speed table. In theory, the table should insure consistency between link speeds for links in different networks with the same facility type and area type coding. There is some suspicion as to whether this is, in fact, the case but the team made no effort to conduct a review of link speeds between different base networks.

2.2.2 Individual Network Concerns

As each new network's line and transit link coding was completed, both park-and-ride and kiss-and-ride connectors were reviewed in the areas of new fixed facilities. This was intended to insure that the connectors already in place from the base network remained logical and to add auto connectors related to park-and-ride and kiss-and ride locations directly adjacent to the fixed facilities being added to the network.

In the course of checking paths for the 1995 network, it was apparent that several walk connectors, particularly in the Wilshire Corridor, appeared on the plots as being longer than one-half mile but were coded as 0.5 miles or less. Documentation for coding guidelines for the calibration network had inferred that a ten-minute walk was the maximum length permissible for any walk connector. At three miles per hour (standard walk speed), this represents one-half mile. In evaluating this problem, reference was made to documentation for the program BLDCON, which had initially built all of the walk connectors in the networks. At that point it was discovered through the documentation that in building the walk connectors for each zone, the program calculated the zone to transit-node distance for each walk link built and chose the minimum distance to apply to all of the walk links for that zone. This, too, was contrary to calibration network coding guidelines which dictated that an average distance for all walk connectors built from a given zone be applied to each of the connectors. There seemed to be no explanation for the overlength connectors; these appeared to have been added manually.

It was decided to correct the problem of overlength connectors by means of a new BLDCON run which would rebuild all of the walk connectors in the network. Because the team was already aware of several bugs with the existing program, it decided to conduct a thorough review of BLDCON to determine the extent of the problems with simply running the program and to verify that the program was, in fact, building walk connectors based on minimum distances. Having discovered that this was indeed the case, the decision was made to write a new BLDCON program.

Bob Schulte undertook this task and decided to write a program which would optimize walk connectors by building the shortest link possible to every transit line within one-half mile of a zone. Freeway dummy nodes (through their 7900-7949 numbering) were specifically exempted. Likewise, rail nodes, by virtue of their special 8000 numbering convention, could be converted by means of an equivalence table so that walk connectors would be built into the local (dummy) node and not the rail node. Mini-walk connectors were left intact as was walk coding in the CBD (accomplished through user specification of the appropriate zones). The new BLDCON program, BLDCON2, was run on all of the new networks.

The first simulation run using a network with walk connectors built by BLDCON2 uncovered the fact that the new BLDCON nearly doubled the number of unconnected zones by the strict imposition of the half-mile rule. Analysis revealed that many of these zones were supposed to be 100 percent accessible by transit, according to the modal choice input data sets. Two questions were raised by this discovery. One was whether the location of zone centroids appeared to be acceptable or not, and the other was whether figures for the percentage of zones within walking distance of transit were reasonable. Further investigations revealed specific, isolated problems but pointed to the overall integrity of both zone centroid location and the percent walk to transit file, at least in the aggregate. It was decided, then, to alter BLDCON2 by relaxing its half-mile maximum walk connector rule in the case of zones left unconnected by its rigid imposition, allowing the program to build walk connectors of up to one mile long to connect zones with greater than zero percent walk accessibility. For zones having zero percent of the zone accessible to transit service, no connectors of any length were built. In order to present transit as a viable choice for those zones with walk connectors which were calculated, in fact, to be longer than one-half mile, it was necessary to represent these connectors as only .5 mile long.

2.3 NETWORK CHECKING

As each network was finished, two programs were used as a final check of the true network coding in place. The program UMATCH was run against a station list for fixed facilities and auto connect locations in the network. UMATCH identifies the mode and UNET line number of every transit line running through a selected node. This then allows a manual check for errors and omissions with regard to route coding into stations and auto connect locations. The second program which assists with network checking is the program UCHEK. This program identifies all park-and-ride and kiss-and-ride locations and rail stations, the number and length of auto connect links into these locations and any auto links which violate the auto link length rules. In addition, in the case of rail stations, the program also states the number of mini-walk links around the station and the local (dummy) node number. In a second report, the program performs an analysis of walk connectors. In this report, the program highlights any zones with walk connectors which are either coded to be over length, or which have non-uniform distances. UCHEK also identifies zones with walk connectors which have non-uniform walk speeds or walk speeds not equal to three miles per hour. The final report compares, line-by-line, the coding of "new" and base network line files, including headways, and determines whether routes are coded as one-way or two-way routes. This last report is particularly helpful in insuring that only the intended lines have been edited and that the specific changes made are correct.

3. THE NETWORKS

Because the 1985 network is intended to replicate a base or "null" case, it is not documented here. However, the other four networks are included. The 1990 and 1991 networks build upon the 1985 base network, and changes are documented from this perspective. The 1993 and 1995 networks build upon a base with the full LPA in place. Therefore, changes related to the operation of the full LPA are not mentioned here, but may be found in the Milestone 9 report.

1990 NETWORK

1990 NETWORK
METRO RAIL STATIONS (MOS-1)

Union Station
First and Hill Streets (Civic Center)
Fifth and Hill Streets
Seventh and Flower Streets
Wilshire Boulevard and Alvarado Street

1990 NETWORK
LONG BEACH LIGHT RAIL

Flower and Seventh Streets
Flower Street and Pico Boulevard
Flower Street and Washington Boulevard
Broadway and Washington Boulevard
Washington Boulevard and San Pedro Street
Washington Boulevard and Long Beach Avenue
Right-of-Way and Vernon Avenue
Right-of-Way and Slauson Avenue
Right-of-Way and Florence Avenue
Right-of-Way and Firestone Boulevard
Right-of-Way and 103rd Street
Right-of-Way and Imperial Highway
Right-of-Way and Compton Boulevard
Right-of-Way and Artesia Boulevard
Right-of-Way and Del Amo Boulevard
Right-of-Way and Wardlow Road
Right-of-Way and 28th Street ("Willow")
Atlantic and Hill Streets
Atlantic Street and Pacific Coast Highway
Atlantic and Anaheim Street
Long Beach Boulevard and Sixth Street
Long Beach Boulevard and Third Street
First Street and Pacific Avenue
Pacific Avenue and Sixth Street

1990 NETWORK
PARK-AND-RIDE LOCATIONS

Union Station
Long Beach Light Rail Right-of-Way and 103rd Street
Long Beach Light Rail Right-of-Way and Imperial Highway
Long Beach Light Rail Right-of-Way and Compton Boulevard
Long Beach Light Rail Right-of-Way and Artesia Boulevard
Long Beach Light Rail Right-of-Way and Del Amo Boulevard
Long Beach Light Rail Right-of-Way and Wardlow Road
Long Beach Light Rail Right-of-Way and 28th Street ("Willow")
Ventura Boulevard and Riverton Avenue
Fallbrook Avenue and Criswell Street
Shirley Avenue and Plummer Street
Roscoe Boulevard and Noble Avenue
Battery and Gaffey Streets
Hamilton Avenue and Torrance Boulevard
La Mirada Boulevard and Ocaso Avenue
Santa Ana Freeway and Alondra Boulevard
Orangethorpe Avenue and Magnolia Avenue
Citrus Street and Foothill Boulevard
Barranca Street and Workman Avenue
Diamond Bar and Pomona Boulevards
Albatross Road and Castleton Street
Monte Vista and San Jose Avenues
Mc Kinley and White Avenues
Mc Kinley and Garey Avenues
Santa Anita Avenue and Ramona Boulevard
4665 Lampson Street
Colorado Boulevard and St. John Avenue
Lakewood Boulevard and Wardlow Road (Long Beach Airport)

1990 NETWORK
KISS-AND-RIDE LOCATIONS

Wilshire Boulevard and Alvarado Street (Metro Rail)
Hawthorne Boulevard and Silver Spur Road
(Peninsula Shopping Center)
Long Beach Boulevard and Willow Street
Artesia and Hawthorne Boulevards
Rosecrans Avenue and Avalon Boulevard
San Antonio and Firestone Boulevards
Harbor Freeway and Manchester Avenue
Harbor Freeway and Slauson Avenue
Santa Monica Freeway and Fairfax Avenue
LA Co./USC Medical Center
Cal State LA San Bernadino Busway Station
Hollywood Freeway and Hollywood Boulevard
Mulholland Drive/Valley Circle Boulevard and
Calabasas Road/Avenue San Luis
Ventura and Sepulveda Boulevards
Riverside Drive (west) and Coldwater Canyon Avenue
Vineland Avenue and Riverside Drive (east)
Ventura Freeway and Golden State Freeway
Garfield Avenue and Whittier Boulevard
Puente Avenue and San Bernadino Freeway
West Covina Fashion Park
Asuza Avenue and San Bernadino Freeway
Mariposa Street and Lake Avenue

1990 NETWORK
BACKGROUND BUS CHANGES FROM BASE NETWORK

SCRTD ROUTES

Routes 20,21,22
- -Serve Metro Rail Wilshire Boulevard and Alvarado Street station
- -No route change

Route 27
- -Re-route to Metro Rail Union Station and terminate

Route 28
- -Re-route to Metro Rail Union Station and terminate

Route 33
- -Serves Metro Rail Union Station

Route 38
- -Serves Metro Rail Union Station

Route 40
- -Serves Metro Rail Union Station
- -Serves Long Beach Light Rail Washington and Broadway station
- -No route change

Route 42
- -Serves Metro Rail Union Station

Route 45
- -Serves Long Beach Light Rail Washington and Broadway station
- -No route change

Route 51
- -Serves Long Beach Light Rail Compton station
- -No route change

Route 55
- -Serves Metro Rail Union Station
- -Serves Long Beach Light Rail Compton station
- -Re-routed to serve Long Beach Light Rail Imperial station
- -Headway reduced to 15 minutes in peaks, 20 minutes off-peak

Route 56
- -Serves Metro Rail Union Station
- -Serves Long Beach Light Rail Washington and Long Beach, Vernon, Florence, and Firestone stations
- -Re-routed to serve Long Beach Light Rail Imperial station
- -Headway reduced to 20 minutes in peaks, 30 minutes mid-day

Route 60
- -Serves Long Beach Light Rail "Willow" station
- -No Route change

1990 NETWORK
BACKGROUND BUS CHANGES (CONT.)

Route 65
- -Serves Long Beach Light Rail Washington Street stations (Flower, Broadway, San Pedro, and Long Beach)
- -No route change

Route 68
- -Serves Long Beach Light Rail Washington and Flower Streets, and Washington and Broadway station
- -No route change

Route S-101 (New Route)
- -Operates through Metro Rail Wilshire Boulevard and Alvarado Street station

Route 105
- -Serves Long Beach Light Rail Vernon station
- -No route change

Route 107
- -Re-routed to serve Long Beach Light Rail Slauson station

Route 108
- -Serves Long Beach Light Rail Slauson station
- -No route change

Route 110
- -Re-routed to serve Long Beach Light Rail Slauson station

Routes 111, 112
- -Serve Long Beach Light Rail Florence station
- -No route change

Route 115
- -Serves Long Beach Light Rail Firestone station
- -No route change

Route 117
- -Serves Long Beach Light Rail 103rd Street station
- -No route change

Route 119
- -Re-routed to serve Long Beach Light Rail 103rd Street station
- -Extended in peaks to serve corridor formerly served by Route 358 (deleted)

Route 120
- -Serves Long Beach Light Rail at Imperial station
- -No route change

Route 124
- -Serves (terminates at) Long Beach Light Rail Compton station
- -Re-routed to serve Long Beach Light Rail Imperial Highway station

1990 NETWORK
BACKGROUND BUS CHANGES (CONT.)

Route 125
- Re-routed to serve Long Beach Light Rail Compton station

Route 127
- Serves Long Beach Light Rail Compton station
- No route change

Route 128
- Serves Long Beach Light Rail Compton station
- No route change

Route 130
- Serves Long Beach Light Rail Artesia station
- No route change

Route 200
- Serves Metro Rail Wilshire Boulevard and Alvarado Street station
- No route change

Route 254
- Re-routed to serve Long Beach Light Rail Imperial station

Route 260
- Serves Long Beach Light Rail "Willow" station
- No route change

Route 320,322
Terminated at Metro Rail Wilshire Boulevard and Alvarado Street station

Route 345
- Serves Long Beach Light Rail Washington and Broadway station
- No route change

Route 351
- Serves Long Beach Light Rail Compton station
- No route change

Route 358
- Line cancelled as a result of Long Beach Light Rail service

Route 360
- Line cancelled as a result of Long Beach Light Rail service

Route 400 (New Line - El Monte Shuttle)
- Operates to Metro Rail Union Station
- Operates in loop around downtown to El Monte station with stops at LA/USC Medical Center and Cal State, LA San Bernadino Busway stations

Route 426
- Terminated at Metro Rail Wilshire Boulevard and Alvarado Street station

1990 NETWORK
BACKGROUND BUS CHANGES (CONT.)

Route 456
-Line cancelled as a result of Long Beach Light Rail service

Route 457
-Re-routed to terminate at Long Beach Light Rail Del Amo Station

Route 483
-Terminated at Metro Rail Union Station

Route 485
-Terminated at Metro Rail Union Station

Route 487
-Terminated at Metro Rail Union Station

Route 489
-Terminated at Metro Rail Union Station

Route 576
-Serves Long Beach Light Rail Firestone station
-Re-routed to serve Long Beach Light Rail Imperial station

MUNICIPAL BUS LINES

Gardena Line 3
-Serves Long Beach Light Rail Compton Boulevard station
-No route change

Long Beach Line 4
-Serves Long Beach Light Rail Wardlow, and Atlantic and Anaheim stations
-No route change

Long Beach Line 5
-Serves Long Beach Light Rail "Willow" station
-No route change

Long Beach Line 6
-Serves Long Beach Light Rail Atlantic and Pacific Coast Highway, and Atlantic and Anaheim stations
-No route change

Long Beach Line 7
-Serves Long Beach Light Rail Atlantic and Anaheim station
-No route change

Long Beach Line 15
-Serves Long Beach Light Rail Del Amo station
-No route change

1990 NETWORK
BACKGROUND BUS CHANGES (CONT.)

Long Beach Line 16
-Re-routed to terminate at Long Beach Light Rail Del Amo station

Long Beach Line 17
-Serves Long Beach Light Rail Atlantic and Anaheim station
-No route change

1991 NETWORK

1991 NETWORK
METRO RAIL STATIONS (MOS-3)

Union Station
First and Hill Streets (Civic Center)
Fifth and Hill Streets
Seventh and Flower Streets
Wilshire Boulevard and Alvarado Street
Wilshire Boulevard and Vermont Avenue
Wilshire Boulevard and Normandie Avenue
Wilshire Boulevard and Western Avenue
Wilshire and Crenshaw Boulevards
Wilshire Boulevard and La Brea Avenue
Wilshire Boulevard and Fairfax Avenue
Beverly Boulevard and Fairfax Avenue

1991 NETWORK
NEW PARK-AND-RIDE LOCATIONS

Wilshire Boulevard and Fairfax Avenue (Metro Rail)
Beverly Boulevard and Fairfax Avenue (Metro Rail)

1991 NETWORK
NEW KISS-AND-RIDE LOCATIONS

Wilshire Boulevard and Vermont Avenue (Metro Rail)
Wilshire Boulevard and Normandie Avenue (Metro Rail)
Wilshire Boulevard and Western Avenue (Metro Rail)
Wilshire and Crenshaw Boulevards (Metro Rail)
Wilshire Boulevard and La Brea Avenue (Metro Rail)

1991 NETWORK
BACKGROUND BUS CHANGES FROM BASE NETWORK

SCRTD ROUTES

Route 14/37 (coded together)
- Serves Metro Rail Beverly and Fairfax station

Route 18
- Re-routed half of the peak hour buses to Metro Rail Wilshire and Vermont station to terminate there

Route 20
- Serves Metro Rail Wilshire and Fairfax, La Brea, Crenshaw, Western, Normandie, Vermont, and Alvarado stations

Route 21
- Terminated eastbound at Metro Rail Wilshire and Fairfax station

Route 22
- Terminated eastbound at Metro Rail Wilshire and Fairfax station

Route 51
- Terminated at Metro Rail Wilshire and Vermont station

Routes 66 and 67
- Re-routed to Metro Rail Wilshire and Western station and terminated there

Route 201
- Terminated at Metro Rail Wilshire and Vermont station

Route 204
- Serves Metro Rail Wilshire and Vermont station

Route 206
- Serves Metro Rail Wilshire and Normandie station

Route 207
- Serves Metro Rail Wilshire and Normandie station

Route 209
- Extended to Metro Rail Wilshire and Western station to terminate there

Route 210
- Serves Metro Rail Wilshire and Crenshaw station
- Extended half of the peak hour buses to Metro Rail Wilshire and Western station to terminate there

Route 212
- Serves Metro Rail Wilshire and La Brea station

Route S-216 (New Route and number - old S-215 - Park La Brea Shuttle)
-Operates between Metro Rail Wilshire and La Brea station and Metro Rail Beverly and Fairfax station with a stop at Metro Rail Wilshire and Fairfax station

Route 217
-Serves Metro Rail Beverly and Fairfax station

Route 320, 322
-Line cancelled as a result of Metro Rail MOS-3 service

Route 426
-Serves Metro Rail Wilshire and Crenshaw station
-Terminated eastbound at Metro Rail Wilshire and Western station

Route 430
-Re-routed to terminate at Metro Rail Wilshire and Fairfax station

Route 431
-Re-routed to terminate at Metro Rail Wilshire and Fairfax station

Route 434
-Re-routed to terminate at Metro Rail Wilshire and Fairfax station

Route 436
-Re-routed to terminate at Metro Rail Wilshire and Fairfax station

Route 437
-Re-routed to terminate at Metro Rail Wilshire and Fairfax station

Route 438
-Re-routed to terminate at Metro Rail Wilshire and Fairfax station

Route 439
-Re-routed to terminate at Metro Rail Wilshire and Fairfax station

THE 1993 NETWORK

1993 NETWORK

CENTURY LIGHT RAIL

Douglas Street and El Segundo Boulevard
Century Freeway Right-of-Way and Aviation Boulevard
Century Freeway Right-of-Way and Hawthorne Boulevard
Century Freeway Right-of-Way and Crenshaw Boulevard
Century Freeway Right-of-Way and Vermont Avenue
Century Freeway Right-of-Way and Harbor Busway Busway
Century Freeway Right-of-Way and Avalon Boulevard
Century Freeway Right-of-Way and Wilmington Avenue ("Willowbrook")
Century Freeway Right-of-Way and Long Beach Boulevard
Century Freeway Right-of-Way and Lakewood Boulevard
Century Freeway Right-of-Way and Studebaker Road (Norwalk Transit Center)

1993 NETWORK

SAN FERNANDO VALLEY LIGHT RAIL

Canoga Avenue and Nordhoff Street
Canoga Avenue and Roscoe Boulevard
Canoga Avenue and Saticoy Street
Canoga Avenue and Sherman Way
Canoga Avenue and Vanowen Street
De Soto Avenue and Victory Boulevard
Victory Boulevard and Winnetka Avenue
Tampa Avenue and Topham Street
Reseda Boulevard and Oxnard Street
Oxnard Street and White Oak Avenue
Balboa and Victory Boulevards
Victory Boulevard and Woodley Avenue
Southern Pacific Right-of-Way and Sepulveda Boulevard
Van Nuys Boulevard and Bessmer Street
Oxnard Street and Woodman Avenue
Burbank Boulevard and Coldwater Canyon Avenue
Burbank Boulevard and Laurel Canyon Avenue
Lankershim and Chandler Boulevard

1993 NETWORK
NEW PARK-AND-RIDE LOCATIONS

Universal City (Metro Rail)
North Hollywood - Lankershim and Chandler Boulevards (Metro Rail)
96th Street near LAX lot "C" (Century Light Rail)
Century Freeway Right-of-Way and Aviation Boulevard
Century Freeway Right-of-Way and Hawthorne Boulevard
Century Freeway Right-of-Way and Crenshaw Boulevard
Century Freeway Right-of-Way and Vermont Avenue
Century Freeway Right-of-Way and Avalon Boulevard
Century Freeway Right-of-Way and Wilmington Avenue
Century Freeway Right-of-Way and Long Beach Boulevard
Century Freeway Right-of-Way and Lakewood Boulevard
Century Freeway Right-of-Way and Studebaker Road
Canoga Avenue and Nordhoff Street (San Fernando Valley Light Rail)
Canoga Avenue and Roscoe Boulevard (San Fernando Valley Light Rail)
Canoga Avenue and Vanowen Street (San Fernando Valley Light Rail)
De Soto Avenue and Victory Boulevard (San Fernando Valley Light Rail)
Victory Boulevard and Winnetka Avenue (San Fernando Valley Light Rail)
Tampa Avenue and Topham Street (San Fernando Valley Light Rail)
Oxnard Street and White Oak Avenue (San Fernando Valley Light Rail)
Balboa and Victory Boulevards (San Fernando Valley Light Rail)
Victory Boulevard and Woodley Avenue (San Fernando Valley Light Rail)
Oxnard Street and Woodman Avenue (San Fernando Valley Light Rail)

DELETIONS:

Ventura Boulevard and Riverton Avenue
(Moved To Metro Rail Universal City station)

1993 NETWORK
NEW KISS-AND-RIDE LOCATIONS

Santa Monica Boulevard and Fairfax Avenue (Metro Rail)
Sunset Boulevard and La Brea Avenue (Metro Rail)
Hollywood and Caheunga Boulevards (Metro Rail)
Canoga Avenue and Saticoy Street
(San Fernando Valley Light Rail)
Canoga Avenue and Sherman Way
(San Fernando Valley Light Rail)
Reseda Boulevard and Oxnard Street
(San Fernando Valley Light Rail)
Southern Pacific Right-of-Way and Sepulveda Boulevard
(San Fernando Valley Light Rail)
Van Nuys Boulevard and Bessmer Street
(San Fernando Valley Light Rail)
Burbank Boulevard and Coldwater Canyon Avenue
(San Fernando Valley Light Rail)
Burbank Boulevard and Laurel Canyon Avenue
(San Fernando Valley Light Rail)

1993 NETWORK
BACKGROUND BUS CHANGES FROM BASE NETWORK

SCRTD ROUTES

Route 40
- -Serves Century Light Rail Hawthorne station
- -No route change

Route 51
- -Serves Century Light Rail Avalon station
- -No route change

Route 55
- -Re-routed to serve Century Light Rail "Willowbrook" station and Long Beach Light Rail Imperial station

Route 56
- -Re-routed to serve Century Light Rail "Willowbrook" station and Long Beach Light Rail Imperial station

Route 60
- -Serves Century Light Rail Long Beach Boulevard Station
- -No Route change

Route 97
- -Serves San Fernando Valley Light Rail Lankershim and Chandler Boulevards station
- -No route change

Route 117
- -Re-routed to serve Century Light Rail Aviation station

Route 119
- -Serves Century Light Rail Long Beach Boulevard station and Hawthorne station
- -New western terminus at Century Light Rail Hawthorne station

Route 120
- -Serves Century Light Rail at "Willowbrook", Hawthorne, Vermont and Aviation stations
- -Re-routed to serve Century Light Rail line at Studebaker Road station

Route 124
- -Re-routed to serve Century Light Rail "Willowbrook" station and Long Beach Light Rail Imperial Highway station

Route 125
- -Re-routed to serve Century Light Rail Studebaker Road station

Route 126
- -Extended to serve Century Light Rail Hawthorne station

1993 NETWORK
BACKGROUND BUS CHANGES (Cont.)

Route 152
- Serves San Fernando Valley Light Rail Canoga and Roscoe station
- No route change

Route 154
- Serves San Fernando Valley Light Rail stations at Tampa and Topham, Burbank and Coldwater Canyon, Burbank and Laurel Canyon and Lankershim and Chandler
- No route change

Route 158
- Serves San Fernando Valley Light Rail Oxnard and Woodman station
- No route change

Route 161
- Extended to terminate at San Fernando Valley Light Rail Canoga and Vanowen station

Route S-162 (Study route)
- Serves San Fernando Valley Light Rail Reseda Boulevard and Oxnard Street station
- No route change

Route 163
- Serves San Fernando Valley Light Rail Canoga and Sherman Way station
- No route change

Route 164
- Serves San Fernando Valley Light Rail stations at De Soto and Victory, Victory and Winnetka, Balboa and Victory, and Victory and Woodley
- No route change

Route 165
- Serves San Fernando Valley Light Rail Canoga and Vanowen station
- No route change

Route 166/168 (Coded together)
- Serves San Fernando Valley Light Rail Canoga and Nordhoff station
- No route change

Route S-167 (Study Route)
- Serves San Fernando Valley Light Rail stations at Van Nuys and Bessmer, Oxnard and Woodman, and Lankershim and Chandler
- No route change

Route 169
- Serves San Fernando Valley Light Rail Canoga and Saticoy station
- No route change

1993 NETWORK
BACKGROUND BUS CHANGES (Cont.)

Route S-172 (Study route: Old S-170)
- Serves San Fernando Valley Light Rail Lankershim and Chandler station
- No route change

Route 183
- Serves San Fernando Valley Light Rail Lankershim and Chandler station
- No route change

Route 204
- Serves Century Light Rail Vermont station
- No route change

Route 207
- Extended to serve Century Light Rail Crenshaw station

Route 210
- Serves Century Light Rail Line Crenshaw station
- No route change

Route 225 - 226
- Serves Century Light Rail Douglas and El Segundo station
- Routed to serve Century Light Rail Aviation station

Route 228
- Serves San Fernando Valley Light Rail stations at Burbank and Coldwater Canyon, Burbank and Laurel Canyon and Lankershim and Chandler
- No route change

Route 230/239 (coded together)
- Serves San Fernando Valley Light Rail stations at Oxnard and White Oak, and Burbank and Laurel Canyon
- No route change

Route 234
- Serves San Fernando Valley Light Rail Southern Pacific Railroad Right-of-Way and Sepulveda
- No route change

Route 236
- Serves San Fernando Valley Light Rail stations at Balboa and Victory, and Victory and Woodley
- No route change

Route 243
- Serves San Fernando Valley Light Rail stations at De Soto and Victory, and Victory and Winnetka
- No route change

1993 NETWORK
BACKGROUND BUS CHANGES (Cont.)

Route 254
- -Serves Century Light Rail Avalon station
- -Re-routed to serve Century Light Rail "Willowbrook" and Long Beach Light Rail Imperial station

Route 266
- -Serves Century Light Rail Lakewood station
- -No route change

Route 270
- -Re-routed to serve Century Light Rail Studebaker Road

Route 351
- -Serves Century Light Rail Avalon station
- -No route change

Route 442
- -Serves Century Light Rail Hawthorne station
- -No Route change

Route 540 (New route)
- -Operates between Fullerton park-and-ride lot and Century Light Rail Studebaker Road (Norwalk Transit Center) station. Only local stop is at Pioneer Boulevard and Rosecrans Avenue

Route 560
- -Serves San Fernando Valley Light Rail Van Nuys and Bessmer station
- -No route change

Route 576
- -Re-routed to serve Century Light Rail "Willowbrook" station and Long Beach Light Rail Imperial station

Route L-1 (Study line)
- -Re-routed in peaks to serve San Fernando Valley Light Rail Van Nuys and Bessmer station

Route L-2 (Study line)
- -Serves San Fernando Valley Light Rail Canoga and Roscoe, and Lankershim and Chandler stations
- -No route change

Route L-3 (Study line)
- -Serves San Fernando Valley Light Rail Canoga and Sherman Way station and terminates at Lankershim and Chandler station
- -No route change

1993 NETWORK
BACKGROUND BUS CHANGES (Cont.)

MUNICIPAL BUS LINES

Gardena Line 2
- -Serves Century Light Rail Vermont station
- -No route change

Norwalk Blue Line (Line 2)
- -Serves Century Light Rail Studebaker Road station
- -No route change

Simi Valley "C" Line
- -Re-routed to serve San Fernando Valley Light Rail Canoga and Nordhoff station

THE 1995 NETWORK

1995 NETWORK
HARBOR FREEWAY BUSWAY
(Operated with RTD lines 440 & 441)

	Union Station
	Alameda and Macy Streets
	Los Angeles and Temple Streets
	First and Main Streets
	First and Spring Streets
	First Street and Broadway
	First and Hill Streets
	First and Olive Streets
	Olive and Fifth Streets
	Olive and Sixth Streets
	Olive and Seventh Streets
	Olive and Eighth Streets
	Olive and Ninth Streets
	Olive Street and Olympic Boulevard
	Olive and 11th Streets
	Olive and 12th Streets
	12th Street and Grand Avenue
	Figueroa and 12th Streets
	Figueroa Street and Pico Boulevard
	Figueroa and 16th Streets
	Figueroa Street and Washington Boulevard
	Figueroa and 23rd Streets
	Harbor Busway and Martin Luther King Boulevard
	Harbor Freway and Slauson Avenue
	Harbor Busway and Manchester Avenue
	Harbor Busway and Century Freeway (I-105) *
	Harbor Busway and Rosecrans Ave
LINE 440	Artesia Boulevard and Vermont Avenue (Southbay Transit Center)
LINE 441	Harbor Busway and Carson Street
	Harbor Busway and Pacific Coast Highway
	Channel and Gaffey Streets (San Pedro Transit Center)
	Gaffey and O'Farrell Streets
	Gaffey and First Streets
	Gaffey and Seventh Streets
	Seventh Street and Pacific Avenue

* - Transfer location to Century Light Rail only

1995 NETWORK
CENTURY LIGHT RAIL

NORTH BRANCH	96th Street near LAX lot "C"
	Century Boulevard between Airport and Aviation Boulevards
SOUTH BRANCH	Douglas Street and El Segundo Boulevard
TRUNK	Century Freeway Right-of-Way and Aviation Boulevard
	Century Freeway Right-of-Way and Hawthorne Boulevard
	Century Freeway Right-of-Way and Crenshaw Boulevard
	Century Freeway Right-of-Way and Vermont Avenue
	Century Freeway Right-of-Way and Harbor Busway Busway *
	Century Freeway Right-of-Way and Avalon Boulevard
	Century Freeway Right-of-Way and Wilmington Avenue ("Willowbrook")
	Century Freeway Right-of-Way and Long Beach Boulevard
	Century Freeway Right-of-Way and Lakewood Boulevard
	Century Freeway Right-of-Way and Studebaker Road (Norwalk Transit Center)

* - Transfer location to Harbor Busway Busway only

1995 NETWORK
COASTAL LIGHT RAIL

Culver and Lincoln Boulevards
Lincoln and Jefferson Boulevards
Lincoln Boulevard and Liberator Street
96th Street near LAX lot "C"
Century Boulevard between Airport and Aviation Boulevards
Douglas Street and El Segundo Boulevard
Rosecrans Avenue and Aviation Boulevards

1995 NETWORK
NEW PARK-AND-RIDE LOCATIONS

Harbor Busway and Martin Luther King Boulevard
Harbor Busway and Slauson Avenue
Harbor Busway and Manchester Avenue
Harbor Busway and Rosecrans Avenue
Artesia Boulevard and Vermont Avenue-Southbay Transit Center (Harbor Freeway Busway)
Harbor Busway and Carson Street
Harbor Busway and Pacific Coast Highway
Channel and Gaffey Streets - San Pedro Transit Center
96th Street near LAX lot "C" (Century/Coastal Light Rail)
Culver and Lincoln Boulevards (Coastal Light Rail)
Lincoln and Jefferson Boulevards (Coastal Light Rail)
Rosecrans Avenue and Aviation Boulevard (Coastal Light Rail)

DELETIONS:

Hamilton Avenue and Torrance Boulevard
(As a result of Harbor Busway service)

1995 NETWORK
CHANGES IN KISS-AND-RIDE LOCATIONS

DELETIONS:

Harbor Busway and Manchester Avenue
Harbor Busway and Slauson Avenue

(Both are Park-and Ride locations in the 1995 Network)

1995 NETWORK
BACKGROUND BUS CHANGES FROM BASE NETWORK

SCRTD ROUTES

Route 42
- Serves Coastal Light Rail Line 96th Street station
- No route change

Route 51
- Extended to serve Southbay Transit Center (Harbor Busway Busway)

Route 81
- Serves Harbor Freeway Busway at Rosecrans

Route 108
- Serves Harbor Busway Busway Slauson station
- Re-routed to serves Coast Light Rail Culver and Lincoln Boulevards station

Route 110
- Extended westbound to serve Coastal Light Rail Lincoln and Jefferson Boulevards station

Routes 111, 112
- Serve Coastal Light Rail 96th Street station
- No route change

Route 115
- Serves Harbor Busway Manchester station
- No route change

Route 117
- Serves Coastal Light Rail Century Boulevard station and 96th Street station
- No route change

Route 124
- Serves Coastal Light Rail Douglas & El Segundo and Rosecrans and Aviation stations

Route 125
- Serves Harbor Busway Rosecrans station
- Serves Coastal Light Rail Rosecrans station
- No route change

Route 127
- Extended to serve Artesia and Vermont (Southbay Transit Center) station for connection with Harbor Busway buses

Route 128
- Re-routed to cover part of the route formerly served by Route 127 before changes in its alignment related to Harbor Busway

1995 NETWORK
BACKGROUND BUS CHANGES (Cont.)

Route 130
- Serves Artesia and Vermont (Southbay Transit Center) station for connection with Harbor Busway buses
- No route change

Route 220
- Serves Coastal Light Rail Lincoln & Jefferson and 96th Street stations
- No route change

Route 225 - 226
- Serve Coastal/Century Light Rail 96th Street station
- Routes shortened to terminate at Coastal Light Rail Rosecrans & Aviation station

Route 232
- Serves Harbor Busway Pacific Coast Highway station
- Serves Coastal Light Rail 96th Street station
- No route change

Route 437
- Re-routed to serve Coastal Light Rail Culver & Lincoln station

Route 438
- Serves Coastal Light Rail Culver & Lincoln station
- No route change

Route 439
- Serves Coastal Light Rail Rosecrans & Aviation station
- Route shortened to terminate at Coastal Light Rail 96th Street station

Route 440
- New route (Harbor Busway Route)

Route 441
- New route (Harbor Busway Route)

Route 443
- Re-routed to terminate at Artesia & Vermont (Southbay Transit Center) for connection with Harbor Busway buses

Route 444
- Re-routed to terminate at Artesia & Vermont (Southbay Transit Center) for connection with Harbor Busway buses

Route 445
- Line cancelled as a result of Harbor Busway service

Route 446
- Re-routed to terminate at Artesia & Vermont (Southbay Transit Center) for connection with Harbor Busway buses

1995 NETWORK
BACKGROUND BUS CHANGES (Cont.)

Route 448
- Re-routed to terminate at Harbor Busway Pacific Coast Highway station

Route 560
- Serves Coastal Light Rail 96th Street Station
- No route change

MUNICIPAL BUS LINES

Culver City Line 6
- Serves Coastal Light Rail 96th Street Station
- No route change

Gardena Line 1
- Re-routed to terminate at Harbor Busway Rosecrans Avenue station

Santa Monica Line 3
- Serves Coastal Light Rail 96th Street station
- Re-routed to terminate at Coastal Light Rail Culver and Lincoln Boulevards station

Torrance Line 1
- Re-routed to terminate at Harbor Busway Rosecrans station

Torrance Line 2
- Re-routed to terminate at Harbor Busway Rosecrans station

"No-name" Company Airport shuttle (new service)
- Operates between Coastal Light Rail station at Lincoln and Liberator and LAX terminal buildings, stopping at Century Light Rail 96th Street station and Sepulveda and Century Boulevards

4. PARK-AND-RIDE LOCATIONS AND AVAILABLE PARKING CAPACITY

Station	Parking Capacity
Union Station	2500
Wilshire Boulevard and Fairfax Avenue (Metro Rail)	1000
Beverly Boulevard and Fairfax Avenue (Metro Rail)	1000
Universal City (Metro Rail)	2450
Chandler and Lankershim Boulevards - North Hollywood (Metro Rail)	2200
Long Beach Light Rail Right-of-Way and 103rd Street	50
Long Beach Light Rail Right-of-Way and Imperial Highway	500
Long Beach Light Rail Right-of-Way and Compton Boulevard	50
Long Beach Light Rail Right-of-Way and Artesia Boulevard	425
Long Beach Light Rail Right-of-Way and Del Amo Boulevard	260
Long Beach Light Rail Right-of-Way and Wardlow Road	50
Long Beach Light Rail Right-of-Way and 28th Street ("Willow")	100
Harbor Busway and Martin Luther King Boulevard	200
Harbor Busway and Slauson Avenue	200
Harbor Busway and Manchester Avenue	200
Harbor Busway and Rosecrans Avenue	300
Artesia Boulevard and Vermont Avenue-Southbay Transit Center (Harbor Freeway Busway)	800
Harbor Busway and Carson Street	600
Harbor Busway and Pacific Coast Highway	500
Channel and Gaffey Streets - San Pedro Transit Center	700
96th Street near LAX lot "C" (Century/Coastal Light Rail)	1000
Century Freeway Right-of-Way and Aviation Boulevard	500
Century Freeway Right-of-Way and Hawthorne Boulevard	500
Century Freeway Right-of-Way and Crenshaw Boulevard	550
Century Freeway Right-of-Way and Vermont Avenue	250
Century Freeway Right-of-Way and Avalon Boulevard	250
Century Freeway Right-of-Way and Wilmington Avenue	400
Century Freeway Right-of-Way and Long Beach Boulevard	700
Century Freeway Right-of-Way and Lakewood Boulevard	300
Century Freeway Right-of-Way and Studebaker Road	1450
Near Culver and Lincoln Boulevards (Coastal Light Rail)	500
Lincoln and Jefferson Boulevards (Coastal Light Rail)	400
Rosecrans Avenue and Aviation Boulevard (Coastal Light Rail)	1000
Canoga Avenue and Nordhoff Street (San Fernando Valley Light Rail)	100
Canoga Avenue and Roscoe Boulevard (San Fernando Valley Light Rail)	100
Canoga Avenue and Vanowen Street (San Fernando Valley Light Rail)	50
De Soto Avenue and Victory Boulevard (San Fernando Valley Light Rail)	1000
Victory Boulevard and Winnetka Avenue (San Fernando Valley Light Rail)	100

PARK-AND-RIDE LOCATIONS (Cont.)

Tampa Avenue and Topham Street (San Fernando Valley Light Rail)	200
Oxnard Street and White Oak Avenue (San Fernando Valley Light Rail)	200
Balboa and Victory Boulevards (San Fernando Valley Light Rail)	200
Victory Boulevard and Woodley Avenue (San Fernando Valley Light Rail)	100
Oxnard Street and Woodman Avenue (San Fernando Valley Light Rail)	100
Ventura Boulevard and Riverton Avenue	200
Fallbrook Avenue and Criswell Street	200
Victory Boulevard and Topanga	300
Shirley Avenue and Plummer Street	100
Roscoe Boulevard and Noble Avenue	(1000) +
Battery and Gaffey Streets	100
Hamilton Avenue and Torrance Boulevard	200
La Mirada Boulevard and Ocaso Avenue	200
Santa Ana Freeway and Alondra Boulevard	(1000) +
Orangethorpe Avenue and Magnolia Avenue	900
Citrus Street and Foothill Boulevard	100
Barranca Street and Workman Avenue	800
Diamond Bar and Pomona Boulevards	150
Albatross Road and Castleton Street	150
Monte Vista and San Jose Avenues	200
Mc Kinley and White Avenues	500
Mc Kinley and Garey Avenues	70
Santa Anita Avenue and Ramona Boulevard	1500
4665 Lampson Street	60
Colorado Boulevard and St. John Avenue	100
Lakewood Boulevard and Wardlow Road (Long Beach Airport)	200

\+ - These park-and-ride lots are no longer used in the real world. Nonetheless, parking capacity is represented at these obsolete levels in the 30 Year Financial Plan networks.