TRANSPORTATION IMPROVEMENT PLAN

FOR UNION STATION

Prepared for

Los Angeles County Transportation Commission

Prepared by

Barton-Aschman Associates, Inc.
Parsons DeLeuw, Inc.

January 1993

Contents

Chapters

Exhibits

EXECUTIVE SUMMARY

This study analyzes plans for new transit facilities in Union Station and assesses the adequacy of these facilities to meet anticipated demand. Two time frames were analyzed:

- 1998, a near-term scenario prior to the opening of the Blue Line downtown connector; and
- 2010, a longer term scenario when a substantial portion for the 30-year plan is completed.

The analysis consisted of developing demand projections of future transit patronage and mode-to-mode transfer movements, comparing them to the expected capacities of the facilities, and assessing the adequacy of the facilities to handle the demand.

Demand Projections

Development of the demand projections was based on previous studies. Matrices of transit demand by mode were prepared, as were matrices of the various mode-to-mode transfer movements. These matrices were used to estimate pedestrian travel within Union Station for the peak hour and for a five-minute "surge", or worst case condition.

The anticipated future demand at Union Station is as follows:

	1998	2010
Total Transfer Movements		
Daily	106,000	131,000
Peak Hour	17,000	21,000
"Surge" 5 Minutes	4,500	4,800

Capacity Analysis

Capacities were established for the transit services based on system plans and operating standards. Pedestrian facility capacities were determined using the dimensions of the facilities and a series of formulas developed and published by John J. Fruin.

A comparison of the demand to the capacities made it possible to identify potential problem areas. The potential problems were analyzed further, and recommendations were made for remedial action.

Conclusions/Recommendations

In general, the capacity analysis confirms that the modified Transit Master Plan for Union Station is adequately designed for transit use and pedestrian transfer activity. Specific issues raised during the analysis that require further attention, together with recommendations of the consultant team are as follows:

1. AMTRAK passengers should be physically separated from other rail passengers as much as possible. Carts should be removed from the passenger tunnel because they are a capacity constraint and a serious safety hazard to the commuters.

2. The recent addition of a second pedestrian ramp from the Blue Line platform to the pedestrian tunnel in the Transit Master Plan is a vital component of the successful operation of the Blue Line.

3. A compromise design of the transit concourse, was recently proposed. It truncates the tracks by 155 feet (as measured from the southern edge of the property to the northern edge of the concourse at platform 6) and then extends further north along platforms 7 and 8. This compromise design appears to be adequate to meet the operational needs of Metrolink, the transit demand, and the development goals of Catellus.

4. The interlock area must be redesigned to meet future rail operational needs.

5. From a purely technical perspective, looking only at pedestrian-flow capacities and ignoring the aesthetic impacts, the passenger tunnel is adequate to handle anticipated pedestrian demands even without a platform-level concourse through the year 2010. This assumes that all AMTRAK carts and most AMTRAK patrons are removed from the tunnel. If tunnel demand continues to grow beyond 2010, then additional capacity, either at platform level or in tunnel, may be needed.

6. The Station Courtyard (the landscaped square located at the northwest edge of the track-level concourse) should be removed from the plans to accommodate rail operations.

7. A study of bus operations at Union Station is needed, and should be conducted in mid-1993. There are many uncertainties about the magnitude and location of future bus operations at Union Station. An objective of the Union Station Transit plan should be to promote rail/rail transfers, thereby minimizing the need for specialized bus services for rail/bus transfers at the station.

8. It appears that the Blue Line downtown connector may be unable to handle the demand during surge conditions, and may be overburdened during normal peak hours as well.

9. Union Station should not be thought of as the control hub of all future transit services in the area. Some transfer opportunities, and even some transit routes, may be more appropriately located away from the station. If too many transfers occur at Union Station, the facility may not be able to handle all of the demand. The solution to this problem is to better understand all of this transfer movements that will be desired and to determine whether some transfer opportunities may be more appropriately located elsewhere.

10. There is a need for improved communication among all entities planning and implementing the various projects at Union Station. This could be achieved through a number of actions including:

    - A regular meeting schedule in which the various agencies and companies present and discuss their plans and activities;

    - A series of "fact sheets" which describe the projects and plans at Union Station. The fact sheets should be updated and distributed regularly.

1. INTRODUCTION

In October, 1992, the Los Angeles County Transportation Commission (LACTC) commissioned a study to be conducted by Barton-Aschman Associates, Inc. and Parsons De Leuw, Inc., for the purpose of analyzing both the "near-term" (through 1999) and "longer-term" (beyond 1999) capacity of Union Station in terms of patronage and transit system ancillary uses. This meant investigating the effectiveness and utility of the various formal plans and proposals for the Los Angeles Union Passenger Terminal (LAUPT), more commonly known as Union Station.

This investigation largely consisted of an examination of the Alameda District Master Plan, which covers the Union Station terminal building, the railroad platforms, the proposed Gateway development, the Post Office Terminal Annex property and connecting facilities. In addition, existing and proposed future operations were examined for AMTRAK, METROLINK commuter rail service, the Metro Red Line, the Metro Blue Line, and bus services of numerous operators. The focus of these analyses could be thought of in terms of the following questions:

- Is pedestrian capacity adequate?
- Are transit vehicle capacities adequate?
- Will the public dollars proposed for investment be effectively spent on public facilities?

1992 has been an extremely active year for Union Station and promises to be the first of many to come. On October 26, 1992 a new regional commuter rail system came to Los Angeles and Union Station. On that date the Southern California Regional Rail Authority (SCRRA), a regional commuter rail operating agency running trains under the name "Metrolink", began operation of three lines, all of which terminate at Union Station. More Metrolink lines are due to start operating in 1993. Los Angeles' first heavy rapid rail line, the Red Line, is scheduled to open in early 1993 with an interim terminus at Union Station. A light rail line from Pasadena is scheduled to open in 1996, also with an interim terminus at Union Station. In addition, Union Station and its immediate environs have always been a focal point for numerous local bus routes, operated by many providers. All of these transit services will require dedicated facilities to handle the passengers transferring between modes, as well as those travelers for whom the Alameda District is a destination.

This study positions itself, first and foremost, from a riders' point of view. Can I get there from here? How easy or difficult is it? What are the encumbrances, if any? Is there sufficient space to handle pedestrian movements, or is it too crowded? The technical responses to these and similar questions make this study a capacity analysis. But a result of this capacity analysis are answers to the next set of questions posed by LACTC: Are there any proposed improvements that are intended to benefit the rider directly but do not adequately do so? Are there those that have not been proposed but should be? What are the investments required for the ridership? In summary, based on existing proposals, what is it that will make Union Station work?

The analysis was conducted for two timeframes, near term (1998) and longer term (2010). The transit services available, as well as the amount of development in the Alameda District for each timeframe are provided in Exhibit 1-1.

A capacity analysis was performed for both 1998 and 2010, and for two design scenarios. One design scenario includes a platform-level passenger concourse at the southern end of the tracks. This concourse provides for substantial pedestrian movements at track level and for transfers to taxis, buses and autos directly below. It also requires truncation of the tracks by roughly 200 feet. The other design scenario does not include a platform-level concourse. This scenario eliminates the track truncation, but also reduces the opportunities for pedestrian movements at platform level.

Finally, the capacity analysis was performed for two peak conditions. One is the normal AM peak hour. The other is a "surge" condition. The surge condition is assumed to occur during a five minute portion of the AM peak hour. During the surge, three fully loaded 8-car Metrolink trains are assumed to arrive simultaneously and to unload their passengers during the same five-minute period.

In all, the capacity analysis was performed eight times, representing all possible combinations of the following:

- 1998 and 2010 timeframes;
- With-Concourse and without-concourse design scenarios;
- AM peak hour and five-minute surge conditions.

This methodology was reviewed by the SCRTD Planning Department. It incorporates the comments and suggestions made by SCRTD.

Exhibit 1-1
Assumptions for 1998 and 2010

	1998	2010
Metrolink Lines	Ventura	Ventura
	Santa Clarita	Santa Clarita
	San Bernardino	San Bernardino
	Riverside	Riverside
	Orange County	Orange County
Red Line	Full Segments 1 and 2	Full Segments 1 and 2
		Segment 3 to Sepulveda, Century City and I-5/Atlantic
Blue Line	Pasadena	Pasadena
		Downtown Connector
		Glendale/Burbank
		Santa Monica
		Long Beach
Busway Routes	El-Monte Busway	El Monte Busway
		Bus-priority street connection to Harbor Busway
Bus Services	RTD Local and Express	RTD Local and Express
	LADOT Metrolink Transfer	LADOT Metrolink Transfer (possible minimal service)
	AMTRAK Bus	AMTRAK Bus
	DASH	DASH
	Other Operators	Other Operators
Development	Catellus 1.25 Million s.f.	Catellus 5 Million s.f.
	Ratkovich 1.00 Million s.f.	Ratkovich 2.0 Million s.f.

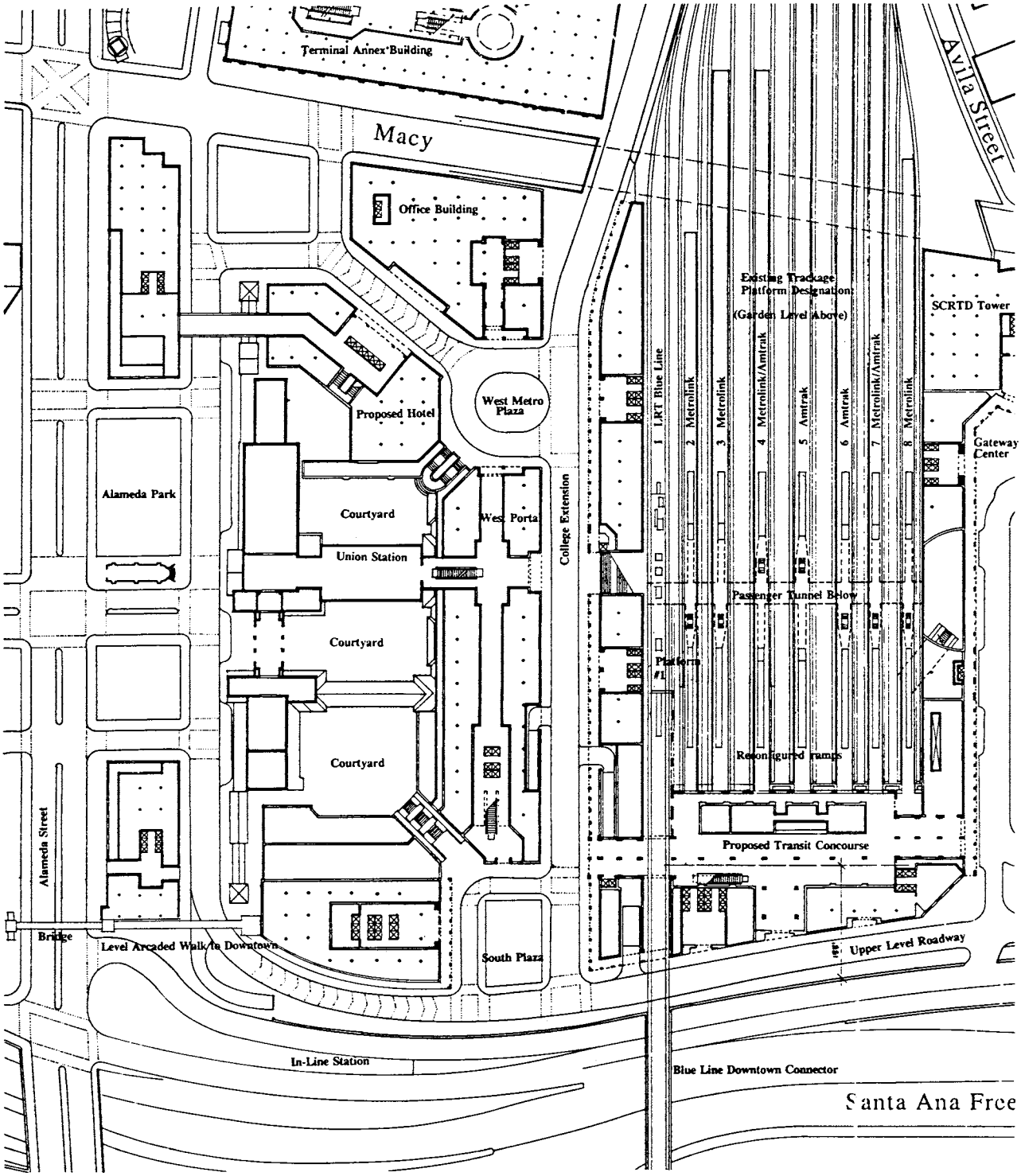
2.
CURRENT PLANS

Plans and Studies

An initial step in the analysis was to review previous plans and studies and to determine the current status of the Transit Master Plan for Union Station. Exhibits 2-1 and 2-2 illustrate the plan at platform level and at street level.

A number of plans and studies were reviewed and serve as the basis for this analysis. They include:

- Union Station Transit Master Plan, August 1992, Catellus Development Corporation et al;
- Alameda District Plan - Master Plan Summary, November 1991, Ehrenkrantz & Eckstut;
- LACTC 30-Year Plan - Bus and Rail Operations and Ridership, November 1991, Manuel Padron and Associates;
- Rail System Operations Analysis, March 1991, Manuel Padron & Associates;
- Final EIR — Los Angeles Rail Rapid Transit Project, June 1983, SCRTD;
- Draft Supplemental EIR — Rail Rapid Transit Project, November 1987, UMTA (FTA)
- Final EIS/EIR —Pasadena - Los Angeles Light Rail Transit Project, February 1990, LACTC
- Southern California Commuter Rail 1991 Regional System Plan, June 1991, Southern California Commuter Rail Coordinating Council



ALAMEDA

DISTRICT PLAN

Union Station/LACTC

Workshops and Consultations

Ehrenkrantz & Eckstut Architects

November 1992

Level +20' Plan

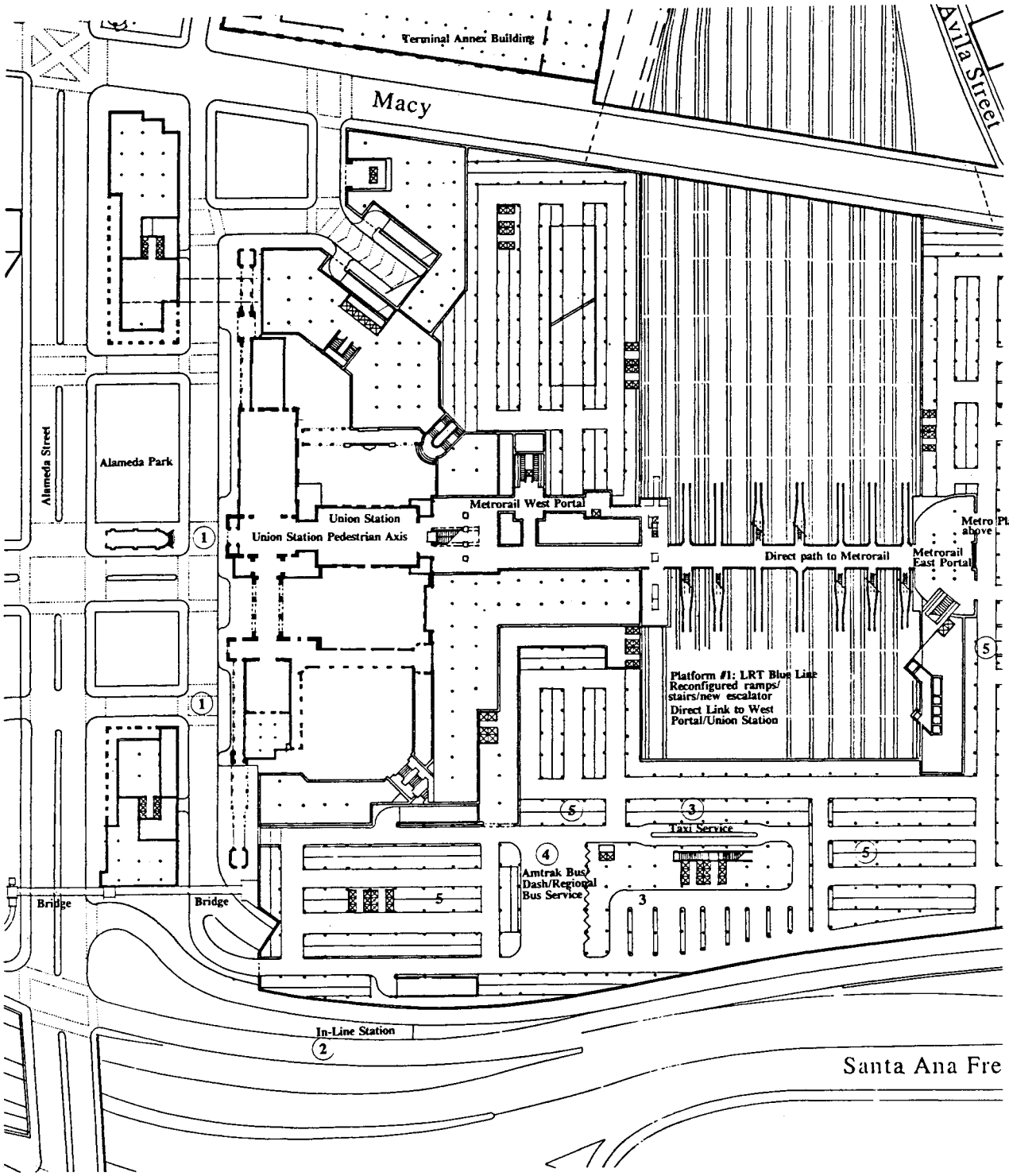
Pedestrian Paths to the North serve to:

1) To West Metro Plaza and parcels
2) To Terminal Annex area
3) To Chinatown
4) To corner of Macy and Alameda
5) To corner of Macy and Alameda (SCRTD)
6) To SCRTD Tower and Gateway Center

Exhibit 2-1

ALAMEDA DISTRICT PLAN - LEVEL +20

Barton-Aschman Associates, Inc.



ALAMEDA

DISTRICT PLAN

Union Station/LACTC

Workshops and Consultations

Ehrenkrantz & Eckstut Architects

November 1992

Pedestrian Paths: Level 0'

Pedestrian Paths to the South serve to:

1) Walk Downtown and Civic Center
2) Catch RTD Bus at In-Line Station
3) Catch a taxi below Concourse
4) Catch Amtrak/Dash/Regional Bus below Concourse
5) Go to parking below Concourse/at Gateway Center
6) Transfer to Metrolink and Amtrak

Exhibit 2-2

ALAMEDA DISTRICT PLAN - LEVEL 0

Barton-Aschman Associates, Inc.

- LACTC Glendale Corridor Rail Transit Project — Final Report, February 1991, Glendale/LACTC
- Union Station Bus/Rail Interface Plan, April 1992, Korve Engineering
- Central Los Angeles Year 1995 Multimodal Transit Study — Draft Volumes through seven, January 1990, Wilbur Smith Associates
- LA Union Station Pedestrian Analysis, September 1990, PBQ&D.
- Improving Interagency and Interproject Coordination at Union Station, November 1991, Psomas and Associates.

These documents provided estimates of ridership on the transit lines, as well as estimates of some of the transfer movements to occur at Union Station. They also provided descriptions of the 1998 and 2010 timeframes used in this analysis.

Interviews

Numerous individuals were also interviewed to provide additional information on the future utilization of Union Station. Individuals interviewed were:

- LACTC — Mike Francis;
- Catellus — Ted Tanner;
- Ratkovich — Wayne Ratkovich and Claire DeBriere;
- SCRRA — Richard Stanger and David Solow;
- RCC — Lawrence Weldon and Charles Stark;
- CRA — Dan Beal;
- SCRTD — Steve Parry, Dana Woodbury, Robin Blair, and John Bollinger; and
- LADOT — James Okazaki and Mike Ueno

Information obtained in the interviews made it apparent that much of the design of facilities at Union Station is yet to be completed. This makes it difficult to determine the probable pedestrian flows of people making transfer movements within Union Station, and makes some of the capacities difficult to ascertain. At the same time, it creates the opportunity to add or subtract to the planned facilities without causing significant cost impacts.

Recent Revisions to the Transit Master Plan for Union Station

Shortly before or during this analysis, the Transit Master Plan for Union Station was modified somewhat. These modifications include the following:

- A second ramp connecting the Blue Line Platform (Platform 1) to the pedestrian tunnel has been added. This second ramp had been omitted from some earlier drawings of the plan.

- A proposal for a new transit concourse design has been introduced. This proposal represents a compromise between the SCRRA and Catellus. It allows for the track-level pedestrian movements and development opportunities desired by Catellus. It also stays within boundaries established by SCRRA for efficient Metrolink operations.

The compromise proposal is an L-shaped concourse which limits the amount of track truncation at platforms 1 through 6. The concourse then extends further north along platforms 7 and 8.

3.
FORECASTS OF TRANSIT PATRONAGE, TRANSFER MOVEMENTS, AND PEDESTRIAN FLOWS

This chapter develops multi-modal patronage forecasts for the transit lines serving Union Station, and estimates the number of transfer movements from one mode to another. It then establishes pedestrian flow paths between the platforms, tunnel, portals and concourses included within the Union Station phasing plans. These projections were prepared for a near-term (1998) prior to Blue Line through connection in downtown Los Angeles, as well as a longer-term (2010) scenario.

Transit Patronage Projections

The patronage estimates obtained from previous plans and studies were synthesized and modified as required to make them consistent in timeframe. In addition, patronage forecasts for Metrolink commuter rail, metrorail and bus were adjusted to reflect the full complement of multimodal services expected to be available at Union Station. The patronage forecasts used in this effort are shown in Appendix A.

Pedestrian Transfer Matrices

Matrices showing mode-to-mode transfer movements were prepared for both 1998 and 2010. These matrices were completed based on the transit patronage forecasts, with assumptions used as needed to complete the matrix. Many of the assumptions about mode-to-mode transfers were taken from the Bus/Rail Interface Study. Other assumptions, such as those for bus and AMTRAK transfer activity, were developed based on the particular characteristics of lines (and levels of service) assumed at Union Station and estimates of probable mode to mode transfer distributions.

Pedestrian Transfer Matrices were developed for both an average weekday and a typical AM peak hour. As shown in Exhibits 3-1 through 3-4, Barton-Aschman has established mode-to-mode transfer data for Metrolink, all Metro Red and Blue Lines, Amtrak, Bus

Exhibit 3-1
Pedestrian Transfer Matrix
Daily 1998

	Person-Trip Departures									
Person-Trip Arrivals	Metrolink	Red Line Segment 1	Red Line Segment 3 (eastern)	Blue Line (Pasadena)	Burbank/ Glendale Line	Amtrak	Bus	Walk	Other	Total
Metrolink	-	3,100	0	200	0	200	1,000	1,100	1,400	7,000
Red Line-Segment 1	3,100	-	0	8,100	0	200	14,900	600	5,100	3,200
Red Line-Segment 3 (eastern)	0	0	-	0	0	0	0	0	0	0
Blue Line (Pasadena)	200	8,100	0	-	0	200	2,500	2,600	3,400	17,000
Burbank/Glendale Line	0	0	0	0	-	0	0	0	0	0
Amtrak	200	200	0	200	0	1,400	200	0	4,800	7,000
BUS	1,000	14,900	0	2,500	0	200	1,200	1,200	0	21,000
Walk	1,100	600	0	2,600	0	0	1,200	-	500	6,000
Other	1,400	5,100	0	3,400	0	4,800	0	500	800	16,000
Total	7,000	32,000	0	17,000	0	7,000	21,000	6,000	16,000	106,000

Exhibit 3-2
Pedestrian Transfer Matrix
Daily 2010

	Person-Trip Departures									
Person-Trip Arrivals	Metrolink	Red Line Segment 1	Red Line Segment 3 (eastern)	Blue Line (Pasadena)	Burbank/ Glendale Line	Amtrak	Bus	Walk	Other	Total
Metrolink	-	2,480	100	1,480	200	240	1,200	1,320	1,680	8,700
Red Line-Segment 1	2,480	-	-	3,200	2,680	240	8,350	720	6,120	23,790
Red Line-Segment 3 (eastern)	100	-	-	200	400	100	1,250	1,300	1,700	5,050
Blue Line (Pasadena)	1,480	3,200	200	-	0	240	5,570	3,120	4,080	17,890
Burbank/Glendale Line	200	2,680	400	0	-	200	1,250	2,600	3,400	10,730
Amtrak	240	240	100	240	200	1,680	240	0	5,760	8,700
BUS	1,200	8,350	1,250	5,570	1,250	240	1,440	1,440	0	20,740
Walk	1,320	720	1,300	3,120	2,600	0	1,440	-	600	11,100
Other	1,680	6,120	1,700	4,080	3,400	5,760	0	600	960	24,300
Total	8,700	23,790	5,050	17,890	10,730	8,700	20,740	11,100	24,300	131,00

Exhibit 3-3
Pedestrian Transfer Matrix
AM Peak Hour - 1998

	Person-Trip Departures									
Person-Trip Arrivals	Metrolink	Red Line Segment 1	Red Line Segment 3 (eastern)	Blue Line (Pasadena)	Burbank/ Glendale Line	Amtrak	Bus	Walk	Other	Total
Metrolink	-	2,325	0	150	0	150	750	825	1,050	5,250
Red Line-Segment 1	0	-	0	360	0	20	300	180	100	960
Red Line-Segment 3 (eastern)	0	0	-	0	0	0	0	0	0	0
Blue Line (Pasadena)	0	2,020	0	-	0	20	600	625	815	4,080
Burbank/Glendale Line	0	0	0	0	-	0	0	0	0	0
Amtrak	0	20	0	20	0	140	20	0	480	680
BUS	0	3,090	0	145	0	20	180	290	0	3,725
Walk	0	125	0	150	0	0	70	-	30	375
Other	0	1,060	0	195	0	480	0	120	120	1,975
Total	0	8,640	0	1,020	0	830	1,920	2,040	2,595	17,045

Assumptions:

1. 50% of Metrolink arrivals transfer to rail (from bus/rail interface study).
2. 50% of Blue Line arrivals transfer to rail.
3. Blue Line trips are 15% of total daily trips, with 80% arrivals and 20% departures.
4. Red Line trips are 15% of total daily trips, with 90% departures and 10% arrivals.
5. Metrolink transfers to bus, walk, other-percentages taken from bus/rail interface study.

Exhibit 3-4
Pedestrian Transfer Matrix
AM Peak Hour 2010

	Person-Trip Departures									
Person-Trip Arrivals	Metrolink	Red Line Segment 1	Red Line Segment 3 (eastern)	Blue Line (Pasadena)	Burbank/ Glendale Line	Amtrak	Bus	Walk	Other	Total
Metrolink	-	1,860	75	630	630	180	900	990	1,260	6,525
Red Line-Segment 1	0	-	-	150	150	25	195	15	145	680
Red Line-Segment 3 (eastern)	0	-	-	300	300	10	200	210	275	1,295
Blue Line (Pasadena)	0	800	400	-	0	25	385	375	490	2,475
Burbank/Glendale Line	0	800	400	0	-	20	385	375	490	2,470
Amtrak	0	25	10	25	20	170	25	0	575	850
BUS	0	1,765	20	295	295	25	215	350	0	2,965
Walk	0	150	25	250	250	0	85	-	35	795
Other	0	1,295	30	330	330	575	0	145	145	2,850
Total	0	6,695	960	1980	1975	1,030	2,390	2,460	3,415	20,905

1. 52% of Metrolink and Blue Line arrivals transfer to rail.
2. Pasadena Line trips are 55% arrivals and 45% departures.
3. Burbank/Glendale Line trips are 55% arrivals and 45% departures.
4. Red Line, Segment 1 trips are 10% arrivals and 90% departures.
5. Red Line Segment 3 (eastern) trips are 55% arrivals and 45% departures.
6. Blue Line departures are about 50% of Red Line departures.
7. Red Line and Blue Line departures are about 90% toward downtown and 10% away from downtown.

(including express, DASH, local and Metrolink distributer), walk, and other. Other includes taxi, vanpool, park and ride, kiss and ride, private bus, and employer-sponsored van. The Metro Red Line will function as the major distributor of trips from Union Station to downtown in the near term.

As shown in Exhibit 3-3, significant transferring is forecast to occur in 1998 from the Metro Blue Line and Metrolink to the Metro Red Line-Segment 1. In the AM peak, 8,640 passengers are forecast to transfer from these and other modes to the Red Line. In total, over 17,000 peak hour transfer movements are projected to occur at Union Station in 1998.

Union Station will be served by new rail lines and services in the longer term, and will experience a higher volume of overall transit tripmaking. In 2010, the Burbank/Glendale Blue Line and the Red Line Segment 3 (Eastern) are assumed to be operational. The Blue Lines are also assumed to connect through downtown Los Angeles to the Long Beach and Exposition Blue Lines. This Blue Line connector will function as a companion downtown distributer to the Metro Red Line, and thereby capture a large segment of the distributor departures from Union Station. This Blue Line connection will also reduce the transfers from the Pasadena Blue Line to the Metro Red Line since the Blue Line will distribute it own trips. As shown in Exhibit 3-4, projected longer term pedestrian transfer activity at Union Station will grow to a total of 21,000 peak hour transfer movements. Transfers to the Red Line Segment 1 will be reduced from 8,640 in 1998 to only 6,695 in 2010. The Blue Line downtown connector will receive roughly half that number of transfers.

Pedestrian Flows

The near-term and long-term pedestrian transfer matrix volumes were assigned to paths between the various transit service locations at Union Station. The path choice assumptions were based on field research at Union Station as well as information on where within the complex different lines and services will board and alight passengers in the near and long term. The assumptions used to develop these flows, together with specific assumptions about passenger tunnel movements, are provided in Appendix A.

Peak hour pedestrian assignments for the passenger tunnel were prepared for years 1998 and 2010. Pedestrian assignments were performed from the AM peak hour and for a 5-minute "surge" condition. In the surge condition, three fully loaded Metrolink trains are assumed to arrive simultaneously. These assignments were performed twice; once assuming that the South Concourse included in the Catellus Master Plan is built, and a second time assuming the South Concourse is not built. In all, eight assignments were performed.

The Union Station pedestrian assignments are shown in Exhibits 3-5 through 3-12. As shown, the maximum pedestrian volumes are projected to occur at both ends of the passenger tunnel where Metro Blue Line, Metrolink, and AMTRAK passenger flows accumulate near the Red Line portals.

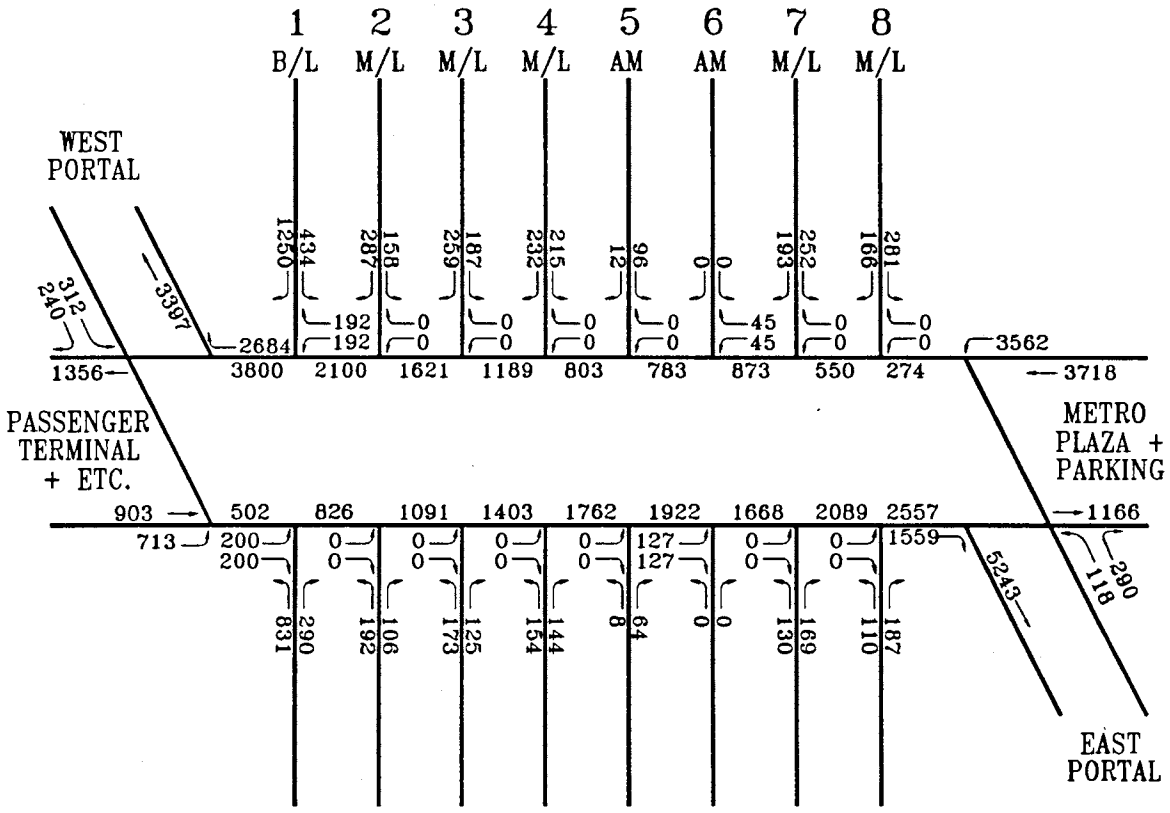


Exhibit 3-5

TUNNEL MOVEMENTS - 1998 AM PEAK HOUR WITH CONCOURSE

Barton-Aschman Associates, Inc.

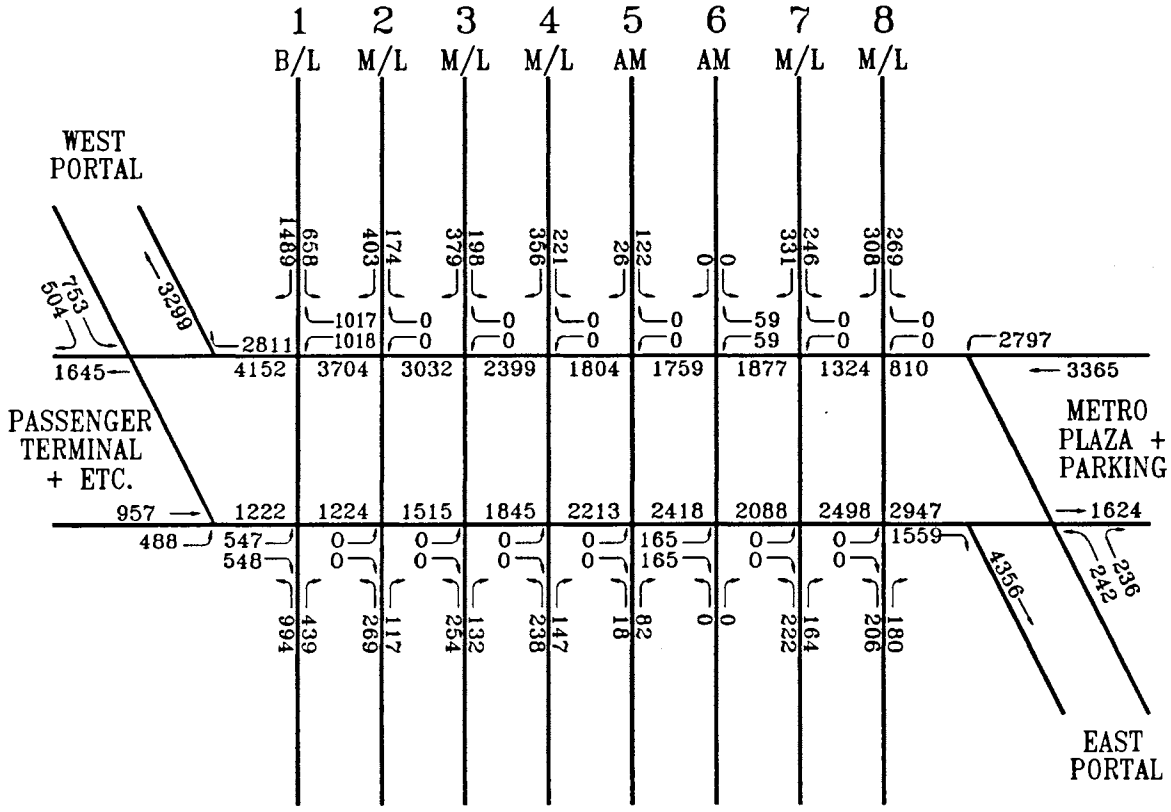


Exhibit 3-6

TUNNEL MOVEMENTS - 2010 AM PEAK HOUR WITH CONCOURSE

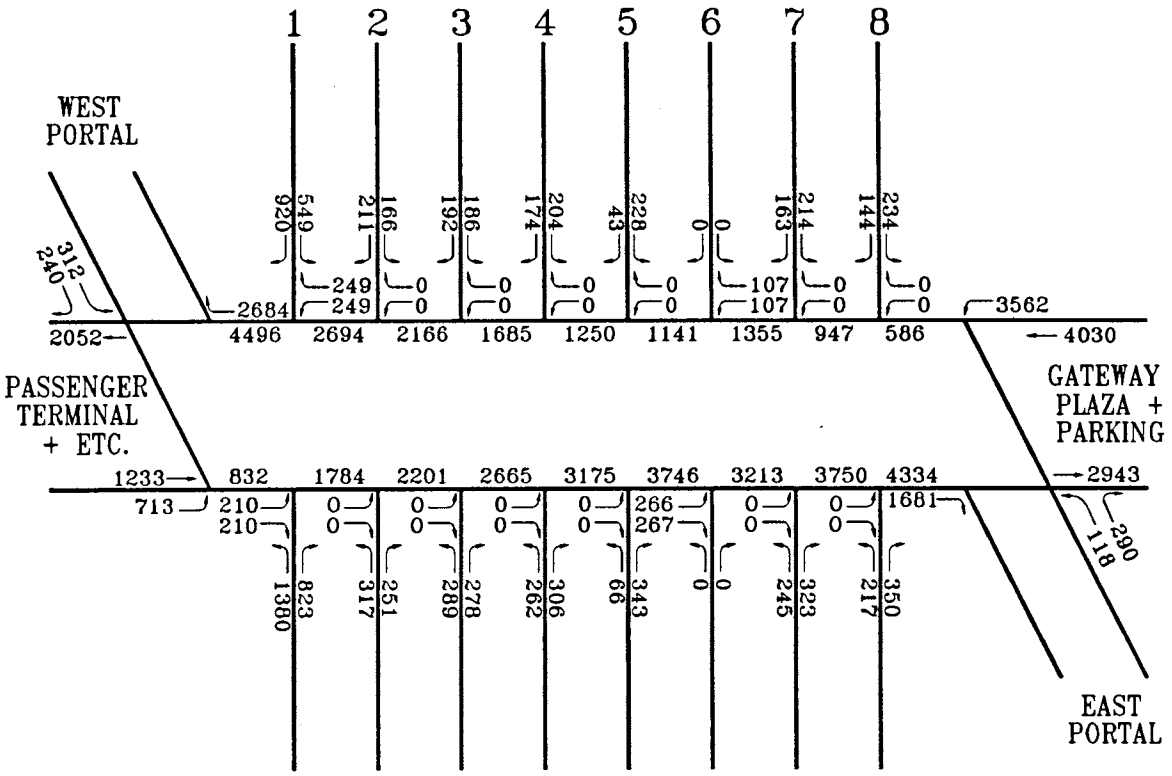


Exhibit 3-7

TUNNEL MOVEMENTS - 1998 AM PEAK HOUR

NO CONCOURSE

Barton-Aschman Associates, Inc.

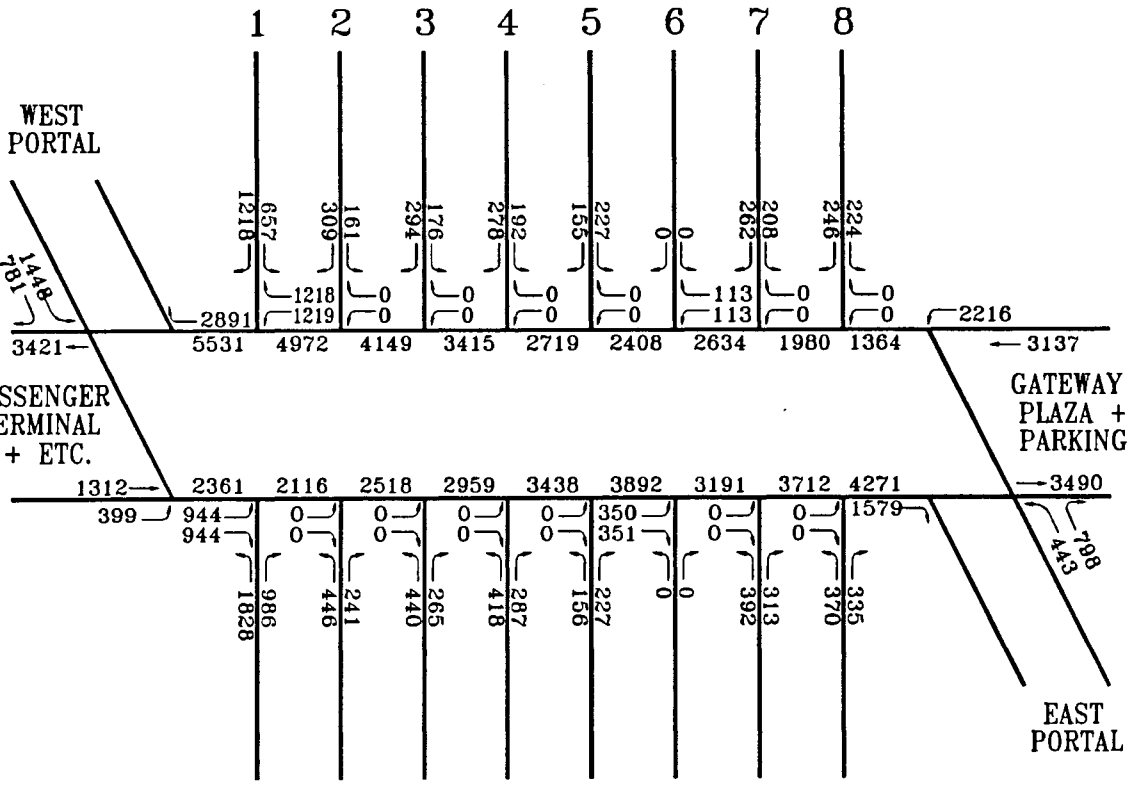


Exhibit 3-8

TUNNEL MOVEMENTS - 2010 AM PEAK HOUR

NO CONCOURSE

Barton-Aschman Associates, Inc.

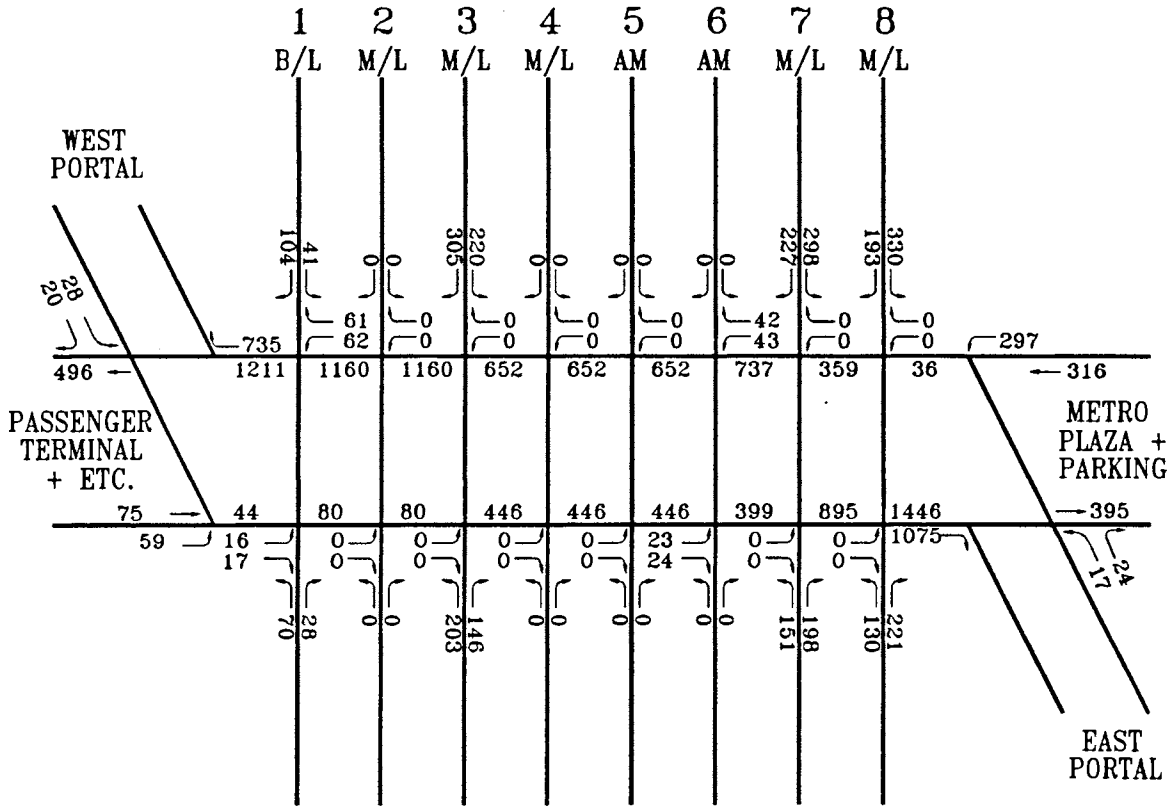


Exhibit 3-9

TUNNEL MOVEMENTS - 1998 AM SURGE WITH CONCOURSE

Barton-Aschman Associates, Inc.

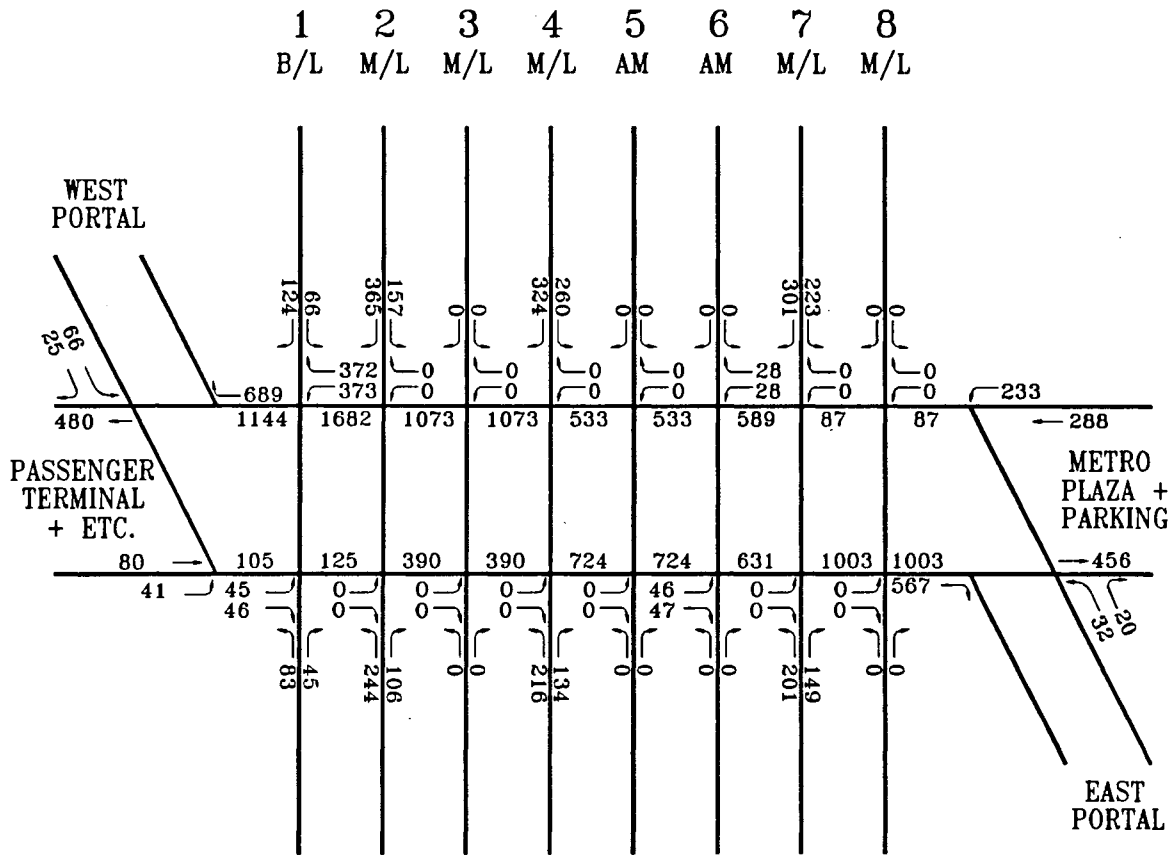


Exhibit 3-10

TUNNEL MOVEMENTS - 2010 AM SURGE WITH CONCOURSE

Barton-Aschman Associates, Inc.

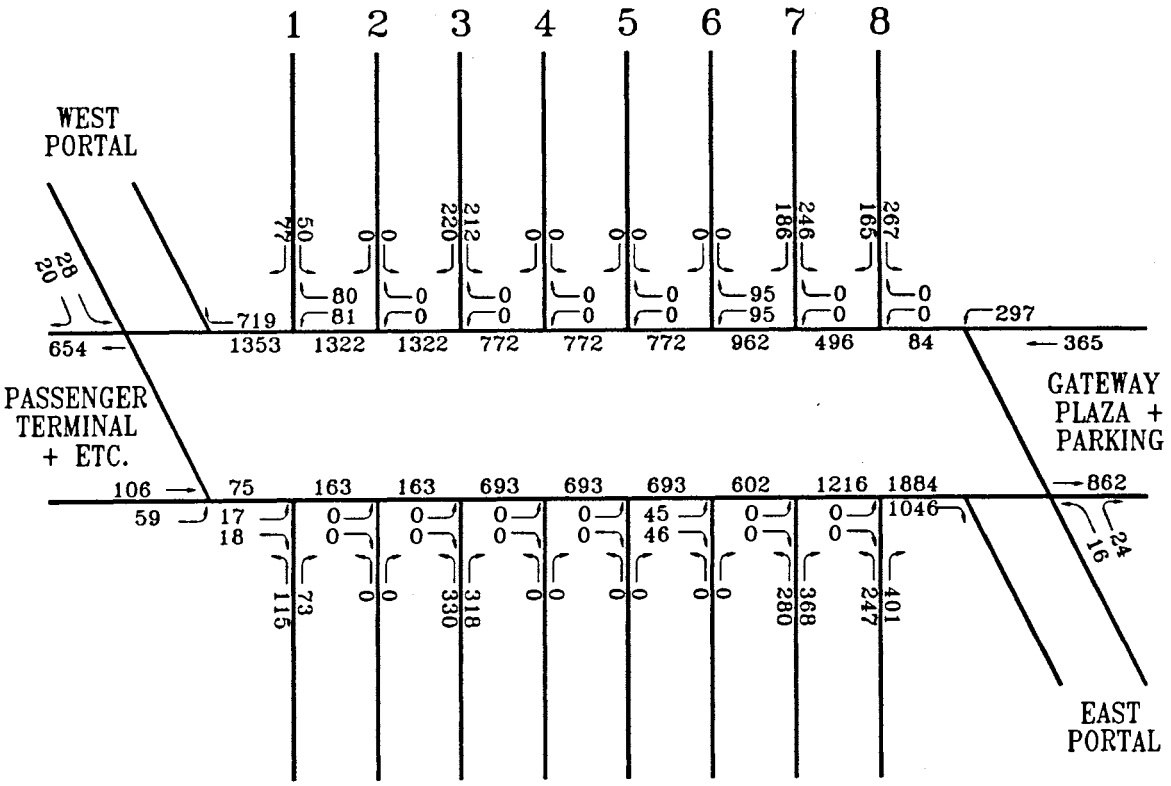


Exhibit 3-11

TUNNEL MOVEMENTS - 1998 AM SURGE
NO CONCOURSE

Barton-Aschman Associates, Inc.

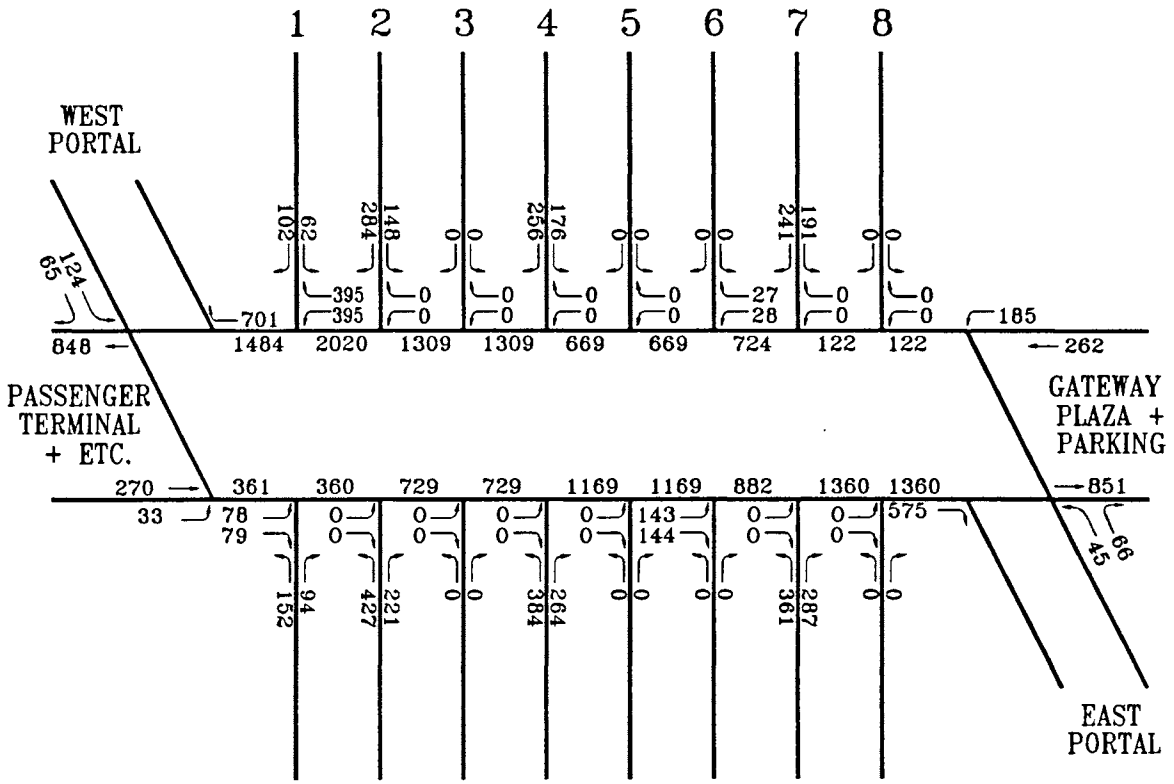


Exhibit 3-12

TUNNEL MOVEMENTS - 2010 AM SURGE

NO CONCOURSE

Barton-Aschman Associates, Inc.

4.
CAPACITY ANALYSIS

In this chapter the capacities of the transit services at Union Station are determined, and compared to the demands. An assessment of the adequacy of proposed services is then provided.

Vehicle Capacities

Exhibit 4-1 shows the capacities of the various rail services that are or will be available at Union Station. The Red Line has a crush-load capacity of 954 persons per 6-car train. The Blue Line capacity will be 435 persons per train (3-car trains) in 1998 and 363 persons per train (average of 2½ car trains) in 2010. In 2010, trains running through downtown and continuing to Long Beach can only be two cars long because of design limitations on the Long Beach Line. Metrolink will have a capacity of 1,184 seats per 8-car train.

Capacity Analysis of Commuter Rail Operations

There are constraints currently on the ability of SCRRA to operate as many trains as they would like into Union Station. This is caused by the age of the interlocking plant and the design of the station/yard leads to the north, not the station/platform layout itself[1].

---

(1) The theoretical capacity of Union Station itself, for METROLINK and AMTRAK together, is approximately 70 trains per hour. For 5 METROLINK routes this translates into an average 5.5 minute headway per route, far in excess of SCRRA's plans.

Exhibit 4-1
Vehicle Capacities

	Seats	Standees	Total
METROLINK			
6-Car Train	888	930	1,818
8-Car Train	1,184	1,240	2,424
RED LINE			
4-Car Train	236	400	636
6-Car Train	354	600	954
BLUE LINE			
2-Car Train	152	138	290
3-Car Train	228	207	435

Improvements need to be constructed north of the station. Those improvements will give SCRRA the capability to operate, if necessary, three 8 car trains simultaneously into the station. It was against the standard of three eight car trains arriving simultaneously (3600 seated riders) that the analysis in this study was carried out.

It was determined, both by use of pedestrian planning standards and consulting with GO Transit of Toronto (who uses the same rail coaches) that it takes 5 minutes for a fully seated rail car to discharge. Because of the relatively narrow north ramps that connect the commuter rail platforms to the pedestrian tunnel/passageway, and the width of the remaining platform between the ramps and the platform edge, the location of peak congestion at Union Station was identified to be the commuter rail platforms themselves.

Capacity Analysis of Heavy Rail Operations

The Metro Red Line is a conventional heavy rapid rail line capable of operating trains on scheduled two minute intervals. The stations have been designed to handle trains as long as 450 feet which is six car lengths (each car is 75' long). The cars have 59 seats with room, based on the loading guidelines adopted by the SCRTD board of Directors, for 100 standees[2]. In the period of one hour, capacity can be provided in each direction for 11,500 passengers at 5-minute headways (as currently planned for 1998), for 17,500 passengers at 3.3 minute headways (as currently planned for 2010), and for a maximum of 28,500 passengers at 2-minute headways.

During normal peak hours, the Red Line will have sufficient capacity to meet demand at Union Station through the Year 2010. In the year 1998[3], it is forecast that there will be 8,640 westbound[4] boarding Red Line riders at Union Station in the morning peak hour; in 2010 the number of westbound riders boarding at Union Station in the AM peak hour is forecast to be 6,095. The number is reduced from the year 1998 due to the opening of the Blue Line downtown connector and the resultant diversion of riders from the Red Line to the Blue Line. However, in addition to the Union Station Red Line boarding riders, in 2010 there will be those eastside (Segment 3) Red Line riders who will be riding through Union Station. The estimated number of "through" riders is 5000 in the peak hour. Together with the Union Station boarding riders this totals to approximately 12,000 riders in the peak hour, significantly less than the planned 2010 directional capacity of 17,500 riders

---

[2] This standard, which is approximately 3 square feet, is at Level Of Service "E", standard for most US subway systems. The cars can actually handle more than 100 standing riders but the resulting condition, which is known as "crush loading", is considered undesirable.

[3] In the year 1998 only the Red Line segments to the west, segments 1 and 2, will be open; by the year 2010 the Red Line segment to the east and west, parts of segment 3 (formerly known as the Orange Line), will also be open.

[4] Westbound is the train direction towards the CBD from Union Station.

per hour. As evening rush hour traffic is less subject to the peaking and surging characteristics of the morning rush hour, when Metrolink commuter rail trains discharge their riders en masse, no capacity related problems are forecast in the PM rush hour.

During surge conditions, the demand on the Red Line may meet or exceed its capacity for about five to 15 minutes. In 1998, the five-minute surge will bring 2,166 people to the Red Line platform. This is equivalent to full capacity of 14 cars, or 2.3 trains. Therefore it will take three Red Line trains to serve all 2,166 riders. If the Red Line is operating at five-minute headways, then it will take ten to fifteen minutes for three trains to arrive and meet the demand.

In 2010, the five-minute surge will bring 1,494 people to the Red Line platform, with 1,345 of them wishing to go toward downtown. At that time, the Red Line will already be 39 percent full with passengers from the eastern extension. It will take two Red Line trains to serve these 1,345 trips. At 3.3 minute headways, the surge loading should be fully served in four to seven minutes.

There may be some uneven distribution of passengers *within* the Red Line trains as they leave Union Station. The East Portal access to the Red Line platform is at the far eastern end. As a result, there is the likely potential that the rear cars of AM westbound Red Line trains will be carrying riders above guideline loads (at "crush loading") while middle cars of the train will have significantly fewer standees (for example, 150-160 standees in the rear cars versus 80 standees in the middle cars). This is not a problem at the West end of the platform because multiple access points from the west mezzanine are provided.

Capacity Analysis of Light Rail Operations

In 1998, the Blue Line will terminate at Union Station. The peak hour load is projected to be about 4,000. Current plans are for this line to operate at five-minute headways in 1998, which will give it a capacity of 5,200 riders per hour with three car trains, but only 3,500 riders per hour with two car trains. If the ridership projection is accurate, then at least one-half of the Pasadena Line trains will need to be three cars long.

In the AM peak hour in 2010 however, it is estimated that 3,960 riders who arrive at Union Station on all modes will board Blue Line trains. 3,564 of these will be toward downtown. The Blue Line trains from Burbank/Glendale and Pasadena will already be carrying 4,000 through riders to downtown. The resulting total ridership of 7,564 peak hour trips will exceed capacity of the Blue Line downtown connector if only two-car trains are used and the planned 2010 headway of 2.7 minutes is provided. Two-car trains are the largest trains that can proceed along the Long Beach Line due to design limitations. If the trains leaving Union Station can average 2.3 to 2.5 cars per train, then the peak hour demand will be 93% to 100% of full capacity. This will still be an unacceptable condition as patrons will be forced to wait on platforms unable to board fully loaded trains for a substantial portion of the peak hour. The trains will need to average 2.7 to 3 cars per train before an acceptable condition will exist during the normal peak hour. This assumes that a 2.7 minute headway

can be achieved. Currently, the Blue Line control system is designed to handle a minimum 3 minute headway. The reduced headway will require a design change.

In the 2010 surge condition, operation of the Blue Line Downtown Connector faces a serious challenge. The five-minute surge adds 475 more people to the Blue Line Downtown Connect than in normal peak conditions. The size of the Blue Line trains becomes critical in this situation. If the trains average 2.5 cars per train or less, then it will take 48 minutes (18 trains) or longer to dissipate the queue that will be on the Blue Line platform. At 2.7 cars per train, the time to dissipate the queue drops to 23 minutes (9 trains). At 3 cars per train, the time drops to 13 minutes (5 trains). Again, this assumes that 2.7 minute headways are achieved.

METROLINK and local bus transfer riders should be encouraged to use the Red Line, which can better accommodate heavy load conditions. Riders could also be encouraged to take advantage of the space provided on El Monte busway trips that will be continuing downtown. Local buses will be used as distributors as well. If needed, a reduced Metrolink/bus transfer function could be continued.

The capacity problem here lies with the light rail line(s) and its capacity -- not Union Station in and of itself. There is no physical change that can be recommended or made to Union Station itself to resolve the capacity issue.

Capacity Analysis of Bus Operations

Whereas capacity on the rail lines can be thought of as the *capability* to move trains and/or people, for this study bus capacity can best be thought of in terms of "quantity of space provided to accommodate buses".

To conduct an analysis appropriately, both the requirements and capacity must be known. Ambiguities exist in both areas. On the requirements side this can largely be attributed to the fact that the particular service plans for buses which will be in effect in 1998 and 2010 aren't precisely known, and therefore the exact requirements are not known. To a large extent, that is to be expected. It is not appropriate this far in advance to undertake the detailed planning that would identify exactly the number of routes and their requirements (layover facilities or not; if so, how large, etc.). RTD felt that there was enough room at Gateway Plaza for its own operations. LADOT was not sure where they would operate their shuttle buses. Some LADOT staff felt, however, that after intensive operations began, they might be better off dispersing some of their operations off-site.

The uncertainty of future operations makes it difficult to assess the adequacy of the bus/auto/taxi transfer location underneath the concourse to handle the future activity. Until this uncertainty is resolved, it would be desirable to keep the interim Metrolink Transfer Facility in place to ensure that adequate bus facilities will be available. The future upper level roadway is designed to accommodate in-line bus loading and unloading, and the nearby El Monte busway bus station is to be better

integrated into the Union Station design and will include an elevated walkway to the upper (platform) level.

In the near future a detailed bus operations analysis should be undertaken to better understand probable future bus activity. Perhaps the best time to perform this study would be in mid-1993, after the Red Line has opened and the interrelationship between bus and rail can be better assessed.

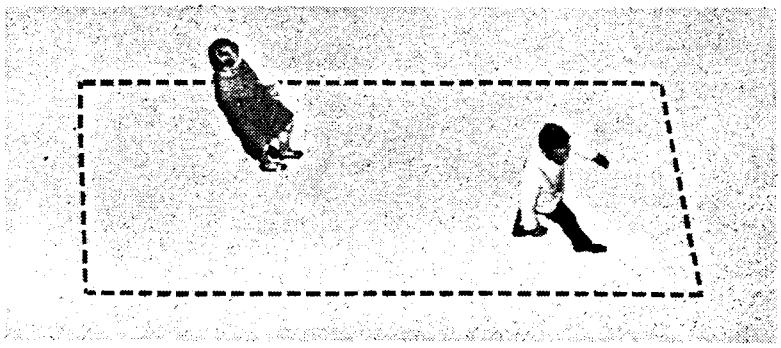
5.
CAPACITY ANALYSIS-PEDESTRIAN FACILITIES

The capacity of the key pedestrian facilities within the Union Station intermodal complex was analyzed based on the methods presented in the 1971 publication, *Pedestrian Planning and Design*, by John J. Fruin. The facilities analyzed included:

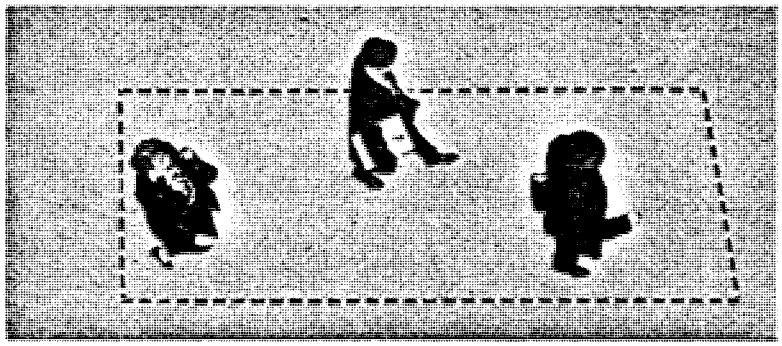
- The pedestrian tunnel under the Metrolink and Amtrak tracks;
- The ramps connecting the Metrolink and Amtrak tracks with the tunnel, leading into the tunnel from the north;
- The ramps/stairs connecting the tracks and the tunnel, leading into the tunnel from the south, as shown in the A136 contract drawings;
- The ramp connecting the future Blue Line tracks to the tunnel, also as shown in the A136 contract drawings; and
- The stair/escalator arrangements leading from the Red Line east and west portals down to the Red Line mezzanine;

In his book, Mr. Fruin defines pedestrian levels of service (LOS A, the best, to LOS F, the worst) on walkways and stairways in a way analogous to the Highway Capacity Manual's definitions of intersection capacity. Exhibit 5-1 illustrates the density levels associated with each level of service on walkways. Mr. Fruin determines that ramps have 90% of the capacity of a walkway of equal width.

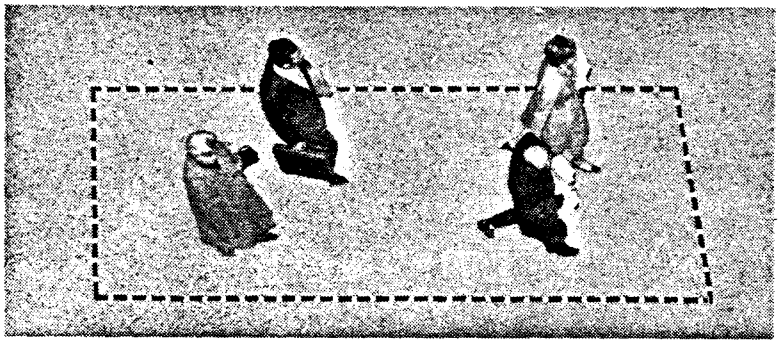
LEVEL OF SERVICE ILLUSTRATIONS FOR WALKWAYS



Level of Service A



Level of Service B

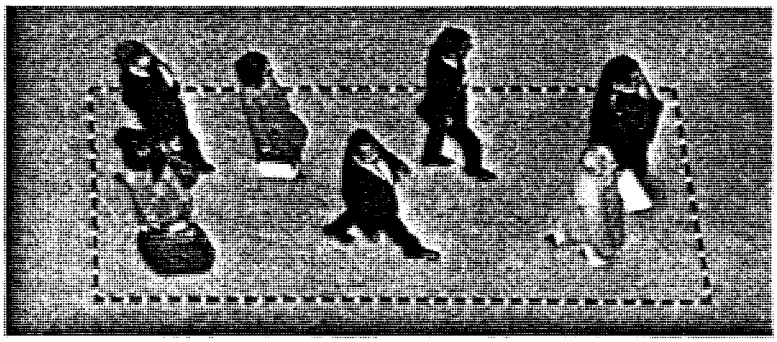


Level of Service C

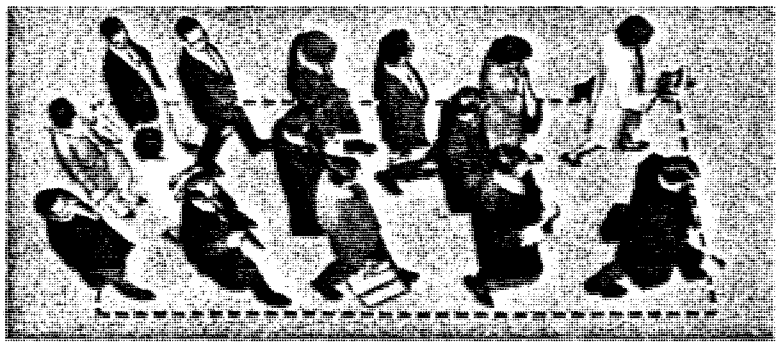
Exhibit 5-1

LEVEL OF SERVICE ILLUSTRATIONS FOR WALKWAYS

LEVEL OF SERVICE ILLUSTRATIONS FOR WALKWAYS



Level of Service D



Level of Service E

Level of Service F

Exhibit 5-1 (Continued)

LEVEL OF SERVICE ILLUSTRATIONS FOR WALKWAYS

The definitions of LOS B through E for walkways and stairways, including maximum pedestrian throughput, are quoted below, in slightly edited form:[5]

- Walkway LOS B, maximum flow volume 10 pedestrians per foot width of walkway per minute (PFM). Sufficient space available to select normal walking speed, and to bypass other pedestrians in primarily one-direction flow. Where reverse-direction or pedestrian crossing movements exist, minor conflicts will occur.

- Walkway LOS C, maximum flow volume 15 PFM. Freedom to select individual walking speed and freely pass other pedestrians is restricted. Where pedestrian cross movements and reverse flows exist, there is a high probability of conflict requiring frequent adjustment of speed and direction to avoid contact.

- Walkway LOS D, maximum flow volume 20 PFM. 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.

- Walkway LOS E, maximum flow volume 25 PFM. Virtually all pedestrians would have their normal walking speeds restricted, requiring frequent adjustments of gait. Insufficient area would be available to bypass slower-moving pedestrians. Extreme difficulties would be experienced by pedestrians attempting reverse-flow and cross-flow movements.

- Stairway LOS B, maximum flow volume 7 PFM. Virtually all persons may freely select locomotion speeds. However, in the lower range of area occupancy, some difficulties would be experienced in passing slower-moving pedestrians. Reverse flows would cause minor traffic conflicts.

- Stairway LOS C, maximum flow volume 10 PFM. Locomotion speeds would be restricted slightly, due to an inability to pass slower-moving pedestrians. Minor reverse-traffic flows would encounter some difficulties.

---

[5] It should be noted that pedestrian movements are not uniformly distributed, even in a time period as short as five minutes. Therefore some fluxuation in level of service will occur. Because of this phenomenon, a facility that averages LOS D or LOS E may experience short periods when severe congestion and queuing (LOS F) occurs. This will generally dissipate in a short time, from a few to several seconds in length.

- Stairway LOS D, maximum flow volume 13 PFM. Locomotion speeds are restricted for the majority of persons, due to the limited open tread space and an inability to bypass slower-moving pedestrians. Reverse flows would encounter significant difficulties and traffic conflicts.

- Stairway LOS E, maximum flow volume 17 PFM. Virtually all persons would have their normal locomotion speeds reduced, because of the minimum tread length space and inability to bypass others. Reverse-traffic flows would experience serious conflicts.

The pedestrian facility capacities are summarized in Exhibit 5-2. The levels of service for each facility under the eight different demand scenarios are summarized in Exhibit 5-3.

Pedestrian Tunnel

The pedestrian tunnel is 28 feet wide. Its maximum capacity at LOS B through E is therefore 280 people per minute (PPM) at LOS B, 420 PPM at LOS C, 560 PPM at LOS D, and 700 PPM at LOS E. With 7 feet roped off for Amtrak carts, the tunnel capacity falls to 210 PPM at LOS B, 315 PPM at LOS C, 420 PPM at LOS D, and 525 PPM at LOS E.

Tunnel capacity vs. demand was analyzed under eight different scenarios: 1998 peak and surge, both with and without a south concourse; and 2010 peak and surge, also with and without the South concourse. With the concourse, the tunnel performs at LOS B during the peak (both 1998 and 2010) and at LOS C during the surge in both years According to Fruin, LOS C is appropriate for heavily used transportation terminals. Without the concourse, the tunnel still performs at LOS B during both peaks. However, it falls to LOS D during the 1998 surge and to LOS E in the 2010 surge. Fruin describes LOS D as consistent with only the most crowded public areas, and LOS E as acceptable only for bulk arrival traffic patterns that immediately exceed available capacity. It should be noted that with AMTRAK carts in the tunnel, not only is capacity reduced by 25%, but a potential safety hazard is introduced, given the relative speed of the carts and pedestrians. The carts should be kept out of the tunnel for safety and capacity reasons.

North Ramps and Blue Line Ramps

The ramps leading into the tunnel from the north are each 7 feet wide. Subtracting a foot of width from each side (a kind of buffer zone in which people do not walk) leaves an effective width of 5 feet. Taking into account, as noted above, that a ramp has 90% of the capacity of a walkway of the same width, each ramp has the following capacity: 45 PPM at LOS B, 65 PPM at LOS C, 90 PPM at LOS D, and 110 PPM at LOS E. These capacity figures also apply to the ramps leading from the tunnel to the future Blue Line track. This connection has recently been modified and now consists of two ramps.

Exhibit 5-2
Pedestrian Capacities
(Persons Per Minute)

	LOS B	LOS C	LOS D	LOS E
Pedestrian Tunnel	280	420	560	700
- with carts	210	310	420	520
North Ramps (each ramp)	45	65	90	110
South Ramps/Stairs	105	150	205	255
Blue Line Ramp	45	65	90	110
Red Line Portals (to mezzanine)	170	200	225	265

Exhibit 5-3
Pedestrian Capacity vs. Demand
(Level of Service)

	1998		2010	
With Concourse	Peak	Surge	Peak	Surge
Pedestrian Tunnel	B	C	B	C
North Ramps	B	E	B	E
South Ramps/Stairs	B	B	B	B
Blue Line Ramp	C	D	F	F
West Portal	B	B	B	B
East Portal	B	F	B	B
Without Concourse				
Pedestrian Tunnel	B	D	B	E
North Ramps	B	D	B	D
South Ramps/Stairs	B	C	B	C
Blue Line Ramp	D	E	F	F
West Portal	B	B	B	C
East Portal	B	F	B	C

The north ramps provide LOS B during the peak period both in 1998 and in 2010, and both with and without the concourse. Under surge conditions, the ramps perform at LOS E with the concourse in place (1998 and 2010), and at LOS D without the concourse (1998 and 2010). This somewhat counter intuitive result can be explained by the fact that the presence of the concourse, with the required track truncation, pushes the trains to the north and thus places more demand on the north ramps. It should be noted that, in a sense, the north ramps meter the tunnel, restricting the number who can enter.

A single Blue Line ramp performs at LOS F in 2010 under all scenarios. In 1998, it provides LOS C in the peak and LOS D in the surge with a Concourse. Without the Concourse, it provides LOS D in the peak and LOS E in the surge. Recognizing the unacceptability of the 2010 service levels, the Pasadena Line staff and consultants are already planning a second ramp to provide more capacity.

South Ramps/Stairs

At the south end of the tunnel, two ramps and a stair join the platform and the tunnel at several of the tracks. Each of the ramps is 5 feet 6 inches wide (effective width 3 feet 6 inches), and the stairway is 7 feet wide (from which we subtract a 6-inch buffer zone at each side; the buffer zone is smaller than for a ramp because people walk right next to the handrail). The capacity of the ramp/stair/ramp arrangement is as follows, in PPM:

	LOS B	LOS C	LOS D	LOS E
Ramp	31	45	63	77
Stair	42	60	78	102
Ramp	31	45	63	77
Total	104	150	204	256

The south ramp/stair facilities provide LOS B under all conditions, with the concourse in place. Without the concourse, they perform at LOS B during the peak (1998 and 2010) and at LOS C during the surge (1998 and 2010).

Red Line Portals

At the Red Line east portal and west portal, two stairs and two escalators connect the pedestrian tunnel level with the mezzanine below. One escalator is assumed to go up and one down at all times, so only one of the two escalators is included in the capacity calculations. The escalator is also assumed to be a two-lane escalator running at 90 FPM rather than 120 FPM. It therefore has a capacity of 100 PPM, according to Fruin. Each stairway is 5 feet 10 inches wide, for an effective width of 4 feet 10 inches. The capacity of the stair/escalator/stair arrangement is as follows, in PPM:

	LOS B	LOS C	LOS D	LOS E
Stair	34	48.5	62.5	82
Escalator	100	100	100	100
Stair	34	48.5	62.5	82
Total	168	197	225	265

The pathway from the Red Line west portal to the mezzanine provides LOS B under all conditions, except it drops to LOS C in the 2010 surge, without the concourse. With the concourse, the pathway from the east portal to mezzanine performs at LOS B in the 1998 peak, 2010 peak, and 2010 surge. Without the concourse, it provides LOS B in the 1998 and 2010 peaks, and LOS C in the 2010 surge. However, with or without the concourse, the East Portal drops to LOS F during the 1998 surge. This is due to an assumption that two of the three Metrolink trains arrive at Platforms 7 and 8. This assumption was made to illustrate the potential consequences of uneven loading of the east and west portals. The capacity analysis indicated in all scenarios that the east portal tends to load more heavily than the west portal. This could become an operational problem during heavy volume periods, as the 1998 surge condition illustrates. The problem can be corrected by encouraging greater use of the west portal. This can be accomplished by putting the larger, more heavily used metrolink trains on platforms 2 and 3, and putting smaller trains on platforms 7 and 8.

6.
CONCLUSIONS/RECOMMENDATIONS

In general, the capacity analysis confirms that the modified Transit Master Plan for Union Station is adequately designed for transit use and pedestrian transfer activity. Specific issues raised during the analysis that require further attention, together with recommendations of the consultant team are as follows:

1. AMTRAK passengers should be physically separated from other rail passengers as much as possible. Carts should be removed from the passenger tunnel because they are a capacity constraint and a serious safety hazard to the commuters.

2. The recent addition of a second pedestrian ramp from the Blue Line platform to the pedestrian tunnel in the Transit Master Plan is a vital component of the successful operation of the Blue Line.

3. A compromise design of the transit concourse, was recently proposed. It truncates the tracks by 155 feet (as measured from the southern edge of the property to the northern edge of the concourse at platform 6) and then extends further north along platforms 7 and 8. This compromise design appears to be adequate to meet the operational needs of Metrolink, the transit demand, and the development goals of Catellus.

4. The interlock area must be redesigned to meet future rail operational needs.

5. From a purely technical perspective, looking only at pedestrian-flow capacities and ignoring the aesthetic impacts, the passenger tunnel is adequate to handle anticipated pedestrian demands even without a platform-level concourse through the year 2010. This assumes that all AMTRAK carts and most AMTRAK patrons are removed from the tunnel. If tunnel

demand continues to grow beyond 2010, then additional capacity, either at platform level or in tunnel, may be needed.

6. The Station Courtyard (the landscaped square located at the northwest edge of the track-level concourse) should be removed from the plans to accommodate rail operations.

7. A study of bus operations at Union Station is needed, and should be conducted in mid-1993. There are many uncertainties about the magnitude and location of future bus operations at Union Station. An objective of the Union Station Transit plan should be to promote rail/rail transfers, thereby minimizing the need for specialized bus services for rail/bus transfers at the station.

8. It appears that the Blue Line downtown connector may be unable to handle the demand during surge conditions, and may be overburdened during normal peak hours as well.

9. Union Station should not be thought of as the control hub of all future transit services in the area. Some transfer opportunities and even some transit routes, may be more appropriately located away from the station. If too many transfers occur at Union Station, the facility may not be able to handle all of the demand. The solution to this problem is to better understand all of this transfer movements that will be desired and to determine whether some transfer opportunities may be more appropriately located elsewhere.

10. There is a need for improved communication among all entities planning and implementing the various projects at Union Station. This could be achieved through a number of actions including:

    - A regular meeting schedule in which the various agencies and companies present and discuss their plans and activities;

    - A series of "fact sheets" which describe the projects and plans at Union Station. The fact sheets should be updated and distributed regularly.

APPENDIX
DEMAND PROJECTIONS

TRANSIT VOLUME COMPARISON

YEAR 2010 AM PEAK HOUR FORECASTS
TRIPS AT UNION STATION

	LACTC 30-YEAR PLAN		BARTON-ASCHMAN STUDY	
	INBOUND	OUTBOUND	INBOUND	OUTBOUND
METROLINK	6,300	0	6,525	0
RED LINE EAST	6,000	N/A	5,960	0
RED LINE WEST	7,500	12,000	3,795	11,695
BLUE LINE NORTH	8,000	1,500	7,955	1,790
BLUE LINE SOUTH	N/A	8,800	990	7,165

Exhibit 3-5
Union Station Pedestrian Flow Interchanges
Year 2000 AM Peak Hour

From	To: Pass Term	West Portal	Plat 1	Plat 2	Plat 3	Plat 4	Plat 5	Plat 6	Plat 7	Plat 8	East Portal	Metro Plaza	Total
Pass. Term.	—	713	112	0	0	0	0	0	0	0	0	78	903
West Portal	240	—	288	0	0	0	0	4	0	0	0	20	552
Plat 1	468	1,611	—	0	0	0	0	20	0	0	404	300	2,808
Plat 2	124	3,325	30	—	0	0	0	30	0	0	139	96	744
Plat 3	124	278	30	0	—	0	0	30	0	0	186	96	744
Plat 4	124	232	30	0	0	—	0	30	0	0	233	96	745
Plat 5	0	0	20	0	0	0	—	140	0	0	20	0	180
Plat 6	0	0	0	0	0	0	0	—	0	0	0	0	0
Plat 7	123	140	30	0	0	0	0	30	—	0	326	95	744
Plat 8	123	93	30	0	0	0	0	30	0	—	373	95	744
East Portal	30	0	72	0	0	0	0	16	0	0	—	290	408
Metro Plaza	0	0	142	0	0	0	0	14	0	0	3,562	—	3,718
Total	1,356	3,397	784	0	0	0	0	344	0	0	5,243	1,166	12,290

Passenger Mode to Mode Flow Assumptions (AM Peak Hour):

1. Metrolink Commuter Rail arrivals destined for the Red Line will evenly split between the East and West Red Line Portals, based on location of Metrolink platform.
2. Metro Blue Line arrivals transferring to the Red Line will split 80% to the West Portal and 20% to the East Portal.
3. Metrolink transfers to bus will evenly split between the South Concourse/Upper Level Roadway and Gateway Plaza.
4. AMTRAK arrivals transferring to the Red Line will split 20% to the West Portal and 80% to the East Portal.
5. AMTRAK arrivals to bus will all transfer to AMTRAK buses.
6. All Metrolink, Metro Blue Line, and AMTRAK arrivals transferring to "Other" will do so at the South Concourse/Upper Level Roadway.
7. 50% of Metrolink, Metro Blue Line and AMTRAK arrivals walking out of Union Station will be destined for the Civic Center. The other 50% will walk elsewhere (Development in the Alameda District).
8. Bus arrivals at Union Station are assumed to be split as follows: 80% local bus arrivals (90% of these are RTD at the Metro Plaza, 10% other operators at the South Concourse), 10% Metrolink distributor buses arriving at the upper level South Concourse, 10% El Monte Busway Station walking into Union Station via the South Concorse.
9. 100% of bus to bus transfers occur at the Metro Bus Plaza.
10. Walk arrivals enter evenly split from all three directions (north, east, and west)
11. "Other" arrivals are evenly split between park-n-ride (garages) and the South Concourse (kiss-n-ride, taxi, van, private shuttles, etc.)

Exhibit 3-6
Union Station Pedestrian Flow Interchanges
Year 2000 AM Surge

From	To: Pass Term	West Portal	Plat 1	Plat 2	Plat 3	Plat 4	Plat 5	Plat 6	Plat 7	Plat 8	East Portal	Metro Plaza	Total
Pass. Term.	—	59	9	0	0	0	0	0	0	0	0	7	75
West Portal	20	—	24	0	0	0	0	2	0	0	0	2	48
Plat 1	39	135	—	0	0	0	0	10	0	0	34	25	243
Plat 2	0	0	0	—	0	0	0	0	0	0	0	0	0
Plat 3	146	327	35	0	—	0	0	35	0	0	218	113	874
Plat 4	0	0	0	0	0	—	0	0	0	0	0	0	0
Plat 5	0	0	0	0	0	0	—	0	0	0	0	0	0
Plat 6	0	0	0	0	0	0	0	—	0	0	0	0	0
Plat 7	144	164	35	0	0	0	0	35	—	0	384	112	874
Plat 8	144	109	35	0	0	0	0	35	0	—	439	112	874
East Portal	3	0	6	0	0	0	0	8	0	0	—	24	41
Metro Plaza	0	0	12	0	0	0	0	7	0	0	297	—	316
Total	496	794	156	0	0	0	0	132	0	0	1,372	395	3,345

5-minute surge period.
Metrolink - 3,600 arrivals
AMTRAK Arrivals - 0
AMTRAK Departures - 50% of AM peak hour
All Others - 8.333% of AM peak hour.

Exhibit 3-7
Union Station Pedestrian Flow Interchanges
Year 2010 AM Peak Hour

From	To: Pass Term	To: West Total	To: Upper Platforms Plat 1	Plat 2	Plat 3	Plat 4	Plat 5	Plat 6	Plat 7	Plat 8	To: East Portal	To: Metro Plaza	Total
East Terminal	-	488	375	0	0	0	0	0	0	0	0	94	957
West Terminal	304	-	720	0	0	0	0	7	0	0	0	26	1,057
Platform 1	563	1920	-	0	0	0	0	45	0	0	480	572	3,580
Platform 2	149	271	252	-	0	0	0	36	0	0	116	139	963
Platform 3	149	232	252	0	-	0	0	36	0	0	154	140	963
Platform 4	149	194	252	0	0	-	0	36	0	0	193	139	963
Platform 5	0	0	45	0	0	0	-	170	0	0	35	0	250
Platform 6	0	0	0	0	0	0	0	-	0	0	0	0	0
Platform 7	149	226	252	0	0	0	0	36	-	0	271	139	993
Platform 8	148	78	252	0	0	0	0	36	0	0	310	139	963
East Portal	34	0	180	0	0	0	0	28	0	-	-	236	478
Metro Plaza	0	0	550	0	0	0	0	18	0	0	2,797	-	3,365
Total	1,645	3,299	3,130	0	0	0	0	448	0	0	4,356	1,624	14,502

Exhibit
Tunnel Movements
Year 2010 AM Surge

From	To												Total
	Pass Term	West Portal	Plat 1	Plat 2	Plat 3	Plat 4	Plat 5	Plat 6	Plat 7	Plat 8	East Portal	Metro Plaza	
East Terminal	-	41	31	0	0	0	0	0	0	0	0	8	80
West Portal	25	-	60	0	0	0	0	4	0	0	0	2	91
Platform 1	47	160	-	0	0	0	0	23	0	0	40	48	318
Platform 2	135	246	228	-	0	0	0	33	0	0	106	126	874
Platform 3	0	0	0	0	-	0	0	0	0	0	0	0	0
Platform 4	135	177	228	0	0	-	0	33	0	0	175	126	874
Platform 5	0	0	0	0	0	0	-	0	0	0	0	0	0
Platform 6	0	0	0	0	0	0	0	-	0	0	0	0	0
Platform 7	135	106	228	0	0	0	0	33	-	0	246	126	874
Platform 8	0	0	0	0	0	0	0	0	0	-	0	0	0
East Portal	3	0	15	0	0	0	0	14	0	0	-	20	52
Metro Plaza	0	0	46	0	0	0	0	9	0	0	233	-	288
Total	480	730	836	0	0	0	0	149	0	0	800	456	3,451

5-minute surge period
Metrolink - 3,600 arrivals
AMTRAK Arrivals - 0
AMTRAK Departures - 50% of AM peak hour
All Others - 8.333% of AM peak hour