Final Report
Harbor Subdivision Transit Analysis



Submitted to
The Los Angeles County Metropolitan Transportation Authority
by **Wilbur Smith Associates**
in association with
UltraSystems Environmental
RAW International
December 22, 2006

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PLANNERS
ECONOMISTS
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Metro

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Executive Summary
HARBOR SUBDIVISION TRANSIT ANALYSIS

ANALYSIS BACKGROUND AND PURPOSE

In 1992, the former Los Angeles County Transportation Commission (LACTC) purchased the majority of the Harbor Subdivision, the mainline of the former Atchison Topeka & Santa Fe Railway (ATSF or Santa Fe) between downtown Los Angeles and the Ports of Los Angeles and Long Beach. As part of that agreement, ATSF retained the right to provide freight rail service on the portion of the line owned by the LACTC, and LACTC retained the right to operate passenger service on the line. Today, the Burlington Northern Santa Fe Railway (BNSF), the successor railroad to the ATSF, still operates freight trains on the line, although the total is a small fraction of what it was at the time of the purchase. Neither LACTC nor its successor agency, the Los Angeles County Metropolitan Transportation Authority (Metro), ran any passenger service on the line. The line studied appears as Figure ES-1 on the following page.

With this analysis, Metro has attempted to investigate the feasibility of the potential deployment of various transit modes on its portion of the Harbor Subdivision. The attempt has been to make use of as much of the 26.36-mile right-of-way as may be practical, realizing that some sections of the line run through primarily industrial land uses. In all, six different transit service alternatives were investigated. The potential environmental constraints for the alternatives were identified and rough order-of-magnitude ridership and costs were estimated. Thirteen potential station locations along the Harbor Subdivision also were preliminarily assessed. Should Metro decide to pursue transit operations on the Harbor Subdivision, a more detailed costing, ridership modeling and environmental analysis would be necessary. Discussions also would need to take place with the BNSF.

During the course of this analysis, there were some discussions of the analysis's purpose with selected stakeholders. However, no formal public outreach was conducted. Further detailed investigation of the transit service alternatives should include such an effort as well.

TRANSIT SERVICE ALTERNATIVES

The following transit service alternatives were considered in this analysis for deployment on the Harbor Subdivision:

- ***FRA Compliant DMU's 30"***. Diesel multiple units (DMUs) are self-propelled diesel-powered rail cars that comply with the crashworthiness standards for operation on tracks shared with freight trains and conventional passenger trains, as specified by the Federal Railroad Administration (FRA), the federal agency having the responsibility for oversight of safety issues for the national railroad system. The DMUs would operate between Los Angeles Union Station (LAUS) and Torrance, accessing the Harbor Subdivision via a new flyover of the Alameda Corridor, the BNSF Transcon mainline, and Washington Boulevard. This alternative assumed 30-minute peak period, bi-directional headways. Off-peak and weekend headways would be hourly.
- ***FRA Compliant DMU's 15"***. This alternative was a variant of the first, and assumed 15-minute peak period, bi-directional headways. Off-peak and weekend headways would be hourly.

Figure ES-1
HARBOR SUBDIVISION
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- *Non-FRA Compliant DMU's 30".* These are DMUs which do not comply with FRA crashworthiness standards. They can only operate on track shared with freight and other passenger trains on a time-separated basis (temporal separation). The DMUs would operate between the Metro Blue Line crossing of the Subdivision at Long Beach and Slauson Avenues and Torrance. This alternative assumed 30-minute peak period, bi-directional headways. Off-peak headways would be half hourly, and weekend headways would be hourly.
- *Non-FRA Compliant DMU's 15".* This alternative was a variant of the non-FRA Compliant DMU's 30" alternative, and assumed 15-minute peak period, bi-directional headways. Off-peak headways would be half hourly, and weekend headways would be hourly.
- *Light Rail Transit (LRT) 15".* This analysis assumed that an extension of the Metro Blue Line LRT service could be deployed on the Harbor Subdivision. LRT service would operate between the 7th Street/Metro Center station in Downtown Los Angeles and Torrance, accessing the Harbor Subdivision via a new connection between the Metro Blue Line and the Subdivision at Long Beach and Slauson Avenues. This alternative assumed 15-minute, bi-directional headways all-day (6 AM to 12 AM) on weekdays. Weekend headways would be half hourly.
- *Bus Rapid Transit (BRT) 15".* This analysis assumed that buses could operate on portions of the Harbor Subdivision in a two-lane busway, in the same way that the Metro Orange Line BRT service operates today on an abandoned railroad right-of-way in the San Fernando Valley. BRT would operate between the Metro Blue Line crossing and Torrance. This alternative assumed 15-minute, bi-directional headways all-day on weekdays. Weekend headways would be half hourly.

The alternatives for the non-FRA Compliant DMU's, LRT, and BRT assumed that BNSF train operations between the Metro Blue Line crossing and the Metro Green Line crossing at Imperial Highway could be confined to a late/night early morning window, when the transit operations would not be running. This assumption was necessary, given the narrowness of the Harbor Subdivision in much of this segment and the fact that these modes can only share a right-of-way with freight trains given the provision of either temporal or spatial separation. Such a shift of freight train operations would require discussion and/or negotiation with the BNSF. The DMU alternatives assumed headways, consistent with the higher levels of service offered by commuter rail services, such as the Southern California Regional Rail Authority's (SCRRA) Metrolink commuter rail service.

The purpose in investigating such a range of transit alternatives was to identify the potential benefits and costs of transit improvements on the Harbor Subdivision. Heavy Rail, like the Metro Red Line, was initially identified as a potential transit mode for deployment on the Harbor Subdivision. However, Heavy Rail would be grade separated, triggering the greatest number of potential surface environmental constraints of all options studied. Accordingly, Heavy Rail was dropped from further analysis.

POTENTIAL SURFACE ENVIRONMENTAL CONSTRAINTS

The analysis looked at the potential environmental constraints inherent in implementation of DMU, LRT, BRT and Heavy Rail alternatives. Major constraints included noise and vibration impacts that would likely occur as a result of the shifting of freight train traffic between the Metro Blue Line crossing and the Metro Green Line crossing to a late night/early morning operating window. Doing so could increase train noise during a time when nearby residents would be trying to sleep. Other major constraints could be potential visual and safety impacts resulting from transit services near homes in the South Bay Area, as well as right-of-way acquisitions.

POTENTIAL STATION LOCATIONS

The analysis looked at 13 potential station locations along the Harbor Subdivision. These included:

- Slauson Avenue and Long Beach Avenue
- Slauson Avenue at Broadway
- Slauson Avenue at Figueroa Street
- Slauson Avenue and Normandie Avenue
- Slauson Avenue and Western Avenue
- Crenshaw Boulevard and 67th Street
- La Brea Avenue and Florence Avenue
- Century Boulevard and Aviation Boulevard
- Imperial Highway and Aviation Boulevard
- Douglas Street
- Marine Avenue
- The Galleria at South Bay
- Sepulveda Boulevard

A station at Slauson and Long Beach Avenues would provide a connection with the Metro Blue Line. Stations at Imperial Highway and Aviation Boulevard, Douglas Street, and Marine Avenue would provide connections to the Metro Green Line. A station at Crenshaw Boulevard would provide a connection to any future transit improvements proposed for the Crenshaw Corridor. A station at Sepulveda Boulevard was chosen as a southern terminus for costing purposes. The analysis found that all station locations have characteristics that would justify their consideration as possible station stops. Stations were assumed to consist of platforms with minimal shelter and ticket vending machines, rather than park-and-ride locations. No specific station plans were analyzed.

The LRT alternative assumed a northern terminus at the Downtown Los Angeles 7th Street/Metro Center station, used by the Metro Blue Line today. The FRA Compliant DMU alternative assumed access to LAUS. The capacity of either location to accommodate additional transit was not analyzed.

The 13 station locations above are conceptual only, and represent a universe of potential sites for this analysis. Each of the individual transit alternatives assumed a subset of these locations for costing purposes. Other station locations are certainly possible. Any decision on potential station locations beyond this analysis would require a detailed environmental assessment and a formal public outreach effort.

SUMMARY OF FINDINGS

This investigation found that implementation of all six transit service alternatives would be feasible. The major findings are summarized in Table ES-1. The analysis's ridership estimates were based on what Los Angeles area transit services, operating with similar service levels through similar land uses and having similar origins and destinations, are able to attain. These preliminary ridership estimates were sensitive to the length of headways and the convenience of access to Downtown Los Angeles. That is, the shorter the headways and the more direct the access to downtown, the higher the ridership estimate. LRT, with 15-minute frequencies all-day on weekdays and direct access to Downtown Los Angeles, would likely gain the highest average weekday ridership. BRT would have the same service level as LRT, but would not access Downtown Los Angeles directly. Rather, it would connect with the Metro Blue Line at Long Beach and Slauson Avenues. Accordingly, its ridership would likely be lower. Three of the four DMU alternatives would have lesser ridership, a result of lower service levels relative to both LRT and BRT.

Table ES-1: Harbor Subdivision Transit Service Alternatives Matrix						
	FRA Compliant DMU 30"	*FRA Complaint DMU 15"*	*Non FRA Compl. DMU 30"*	*Non FRA Compl. DMU 15"*	*LRT 15"*	*BRT 15"*
Total Route Miles	26.7	26.7	20.0	20.0	25.2	20.0[1]
Miles on Harbor Sub.	23.0	23.0	20.0	20.0	20.0	11.3
Total Capital Cost (2006$)	$306.2 million	$376.9 million	$326.9 million	$353.8 million	$667.8 million $1.4 billion[2]	$260.9 million
Operator	Metrolink	Metrolink	Metro	Metro	Metro	Metro
Annual Operating Cost (2006$)	$14.5 million	$18.5 million	$12.4 million	$15.2 million	$14.5 million	$10.9 million
Avg. Weekday Boardings[3]	4,000	5,000	10,000	12,000	40,000	15,000
Headways Peak	30 minutes	15 minutes	30 minutes	15 minutes	15 minutes	15 minutes
Headways Off-peak	1 hour	1 hour	30 minutes	30 minutes	15 minutes	15 minutes
Headways Weekends	1 hour	1 hour	1 hour	1 hour	30 minutes	30 minutes
Travel Time	Approx. 57"	Approx. 58"	Approx. 42"	Approx. 42"	Approx. 57"	Approx. 40-45"[4]
Major Surface Environmental Constraints	Safety impact in Torrance	Safety impact in Torrance	Noise from nighttime freight rail operation on northern portion; visual/safety impact in Torrance	Noise from nighttime freight rail operation on northern portion; visual/safety impact in Torrance	Noise from nighttime freight rail operation on northern portion; visual/safety impact in Torrance	Noise from nighttime freight rail operation on northern portion
Pros - Total Capital Cost - Operating Cost - Ridership - Environmental Impacts	Lower capital cost; moderate operating costs; fewer environmental impacts	Moderate capital cost; fewer environmental impacts	Lower capital cost; moderate operating cost; higher ridership	Moderate capital cost; higher ridership	Highest ridership	Lowest capital and operating costs; higher ridership; fewer environmental impacts
Cons - Total Capital Cost - Operating Cost - Ridership - Environmental Impacts	Lower ridership	Lower ridership; highest operating cost	More environmental impacts	Higher operating cost; more environmental impacts	Highest total capital cost; higher operating cost; more environ-mental impacts	Variability in travel time due to the use of city streets for almost half of the route

[1] Overall route mileage depends on the assumption of a loop at Hawthorne and Sepulveda; the Metro Orange Line has such a loop.
[2] The range of costs shows the difference between the consultant's cost estimate and typical Metro costs.
[3] Ridership was not modeled; figures based upon services with similar operating characteristics and density/demographics.
[4] Variance depends on traffic conditions on Aviation Blvd. and Hawthorne Blvd.

The order-of-magnitude capital costs include estimates for new track and structures, including stations; new grade crossing protection devices replacing existing systems; and rolling stock. The non-FRA Compliant DMU alternatives assumed a new maintenance facility along the Subdivision at Alcoa Yard in Torrance. All other alternatives assumed maintenance of equipment would be performed at existing facilities. No major acquisitions for right-of-way were assumed. FRA Compatible DMUs can share track with freight rail trains, albeit with significant track reconfigurations. The Non FRA Compliant, LRT and BRT alternatives assumed that freight operations between the Metro Blue Line crossing and the Metro Green Line crossing could be pushed to a late night/early morning window, when transit would not be operating. Aside from the flyover of the Alameda Corridor/BNSF Transcon/Washington Boulevard for the FRA Compliant DMU alternatives, no new grade separations or closures of existing crossings were assumed. LRT's cost of construction would be the highest, more than twice that of most of the other alternatives. The high cost was triggered by the need for a double track alignment, a trench along Aviation Boulevard to the east of the Los Angeles International Airport runways[5], and elevated structures through Alcoa Yard in Torrance[6], among other things.

Annual operating costs include the costs of running and maintaining the transit alternatives. The analysis relied on figures developed by the SCRRA, operator of the Metrolink commuter rail service, to calculate the FRA Complaint DMU estimate; and on the North County Transit District, operator of the future Escondido-Oceanside Sprinter DMU service, to calculate the Non FRA Compliant DMU estimates. Cost estimates for LRT and BRT were based on LRT and bus cost figures developed for Metro's 2007 budget. BRT would be the least expensive alternative to implement, since it would make use of city streets on a little under half of its route to and from Torrance. The comparatively high FRA Compliant DMU operating cost estimates were driven by longer routes and higher service-mile costs.

All options have the potential for triggering environmental impacts. These are primarily:

- For the non-FRA Compliant DMU, LRT and BRT alternatives, potential noise impacts in Los Angeles may result from the shift of BNSF freight train operations to a late night/early morning window between the Metro Blue Line crossing and the Metro Green Line crossing; the freight train shift could generate noise impacts just when residents would be trying to sleep. FRA Compliant DMUs, on the other hand, would not require shifting freight traffic to a late night/early morning window, and thus would not be likely to generate additional noise impacts at that time. Nor would freight traffic have to be shifted south of the Metro Green Line crossing, as the Non FRA Compliant DMU, LRT and BRT alternatives would operate on separate facilities (apart from the freight tracks) built on the right-of-way. Thus, none of these alternatives would trigger potential late night/early morning noise impacts in the South Bay Area.
- For the Non FRA Compliant DMU, LRT and BRT alternatives, potential visual impacts to some South Bay residents may result from new track near homes.
- For all DMU alternatives and the LRT alternative, potential safety impacts to some South Bay residents may result from either new trains or new track near homes. Residents there today cross the Harbor Subdivision on foot at a designated pedestrian crossing.

[5] A trench there likely would be a requirement to prevent the LRT electrified overhead contact system from interfering with airplane navigational systems.

[6] These structures would provide for total separation of LRT from freight train activities in Alcoa Yard.

NEXT STEPS

Deployment of any of the six transit service alternatives appears feasible between Los Angeles and Torrance on the Harbor Subdivision. However, given the narrow right-of-way width restrictions in various segments, deployment of only one alternative is practical, assuming continuing freight rail use of the corridor. No one alternative stands out as clearly superior through the length of corridor. Each has advantages and disadvantages relative to the others. To further refine which alternative makes the most sense for the corridor, further analysis is recommended.

Elements of further analysis should include a traditional travel demand forecast for each alternative. The ridership forecasts appearing in this analysis were based on what Metro and the SCRRA's Metrolink commuter rail service are generating on services running with comparable headways though comparable land uses.

Another element may include phasing of a transit alternative as well as costing, environmental analysis and a public participation component. For example, it might make sense to implement an alternative in just one segment of the route, where the ridership potential is high and implementation costs are low. If the service proves itself by steadily gaining substantial numbers of riders, the service could be expanded as funding becomes available. Such phasing would maximize the benefits while minimizing the costs.

Other elements to be included in additional analysis would be:

- A formal environmental assessment with public participation component, inclusive of community and local concerns relative to potential noise, visual and safety impacts that may be triggered by the transit alternatives.
- Additional discussions with the BNSF for implementation of alternatives which may require temporal separation of freight and certain transit modes on a shared Harbor Subdivision right-of-way.
- More detailed assessments of station locations, including development of conceptual station plans with parking and/or connecting transit access. Included would be an assessment of capacity at the Downtown 7th Street/Metro Center station, which would service as a northern terminus for the LRT alternative, as well as at LAUS, the northern terminus for the FRA Compliant DMU alternatives.
- Detailed assessments of maintenance facility options. Specifically assessed would be Metrolink's ability to maintain FRA Compliant DMUs at Taylor Yard; Metro's ability to accommodate additional rolling stock at its Carson LRT maintenance facility; and potential construction of a Non FRA Compliant maintenance facility west of Alcoa Yard.
- More detailed capital cost estimates.

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BACKGROUND

In 1992, the former Los Angeles County Transportation Commission (LACTC) purchased the majority of the Harbor Subdivision, the mainline of the former Atchison Topeka & Santa Fe Railway (ATSF or Santa Fe) between downtown Los Angeles and the Ports of Los Angeles and Long Beach. As part of that agreement, ATSF retained the right to provide freight rail service on the portion of the line owned by the LACTC, and LACTC retained the right to operate passenger service on the line. Today, the Burlington Northern Santa Fe Railway (BNSF), the successor railroad to the ATSF, still operates freight trains on the line, although the total is a small fraction of what it was at the time of the purchase. The LACTC and its successor agency, the Los Angeles County Metropolitan Transportation Authority (Metro), never ran passenger service on the line.

The portion of the line owned by Metro runs from the junction of the Harbor Subdivision and the BNSF Transcon mainline adjacent to Washington Boulevard near downtown Los Angeles in the north to the outskirts of Watson Yard in Wilmington in the south - a distance of 26.36 miles. BNSF retains ownership of the remaining two miles of right-of-way eastward to the Alameda Corridor, the connection to the San Pedro Bay ports. By virtue of the purchase agreement, Metro owns not only the right-of-way, but also "the tracks and other improvements on the property, including without limitation improvements constructed on the property at the cost and expense of Santa Fe."[1] Figure I-1 shows the portion of the Harbor Subdivision studied in this report.

Until the opening of the Alameda Corridor in 2002, BNSF had been running about 20 trains a day on the portion of the Harbor Subdivision which Metro owns. Most of the traffic consisted of intermodal "double stack" container trains going to and from the Ports of Los Angeles and Long Beach. With the opening of the Corridor, a common-user grade-separated rail line between downtown Los Angeles and the San Pedro Bay ports, BNSF shifted port-related trains onto the Corridor and off the Harbor Subdivision. What remains today on the Harbor Subdivision are about a handful of daily local freight train movements concentrated at the north end of the line and between Los Angeles International Airport (LAX) and Watson Yard. No regular freight trains operate on the section of the Harbor Subdivision between 4th Avenue (a half mile east of Crenshaw Boulevard) and 111th Street near LAX.

With parts of the Harbor Subdivision having become either unused or underutilized assets, Metro has increasingly become interested in the potential of using the Harbor Subdivision for transit.

ANALYSIS PURPOSE

With this analysis, Metro has attempted to investigate the feasibility of the potential deployment of various transit modes on its portion of the Harbor Subdivision. The attempt has been to make use of as much of the 26.36-mile right-of-way as may be practical, realizing that some sections of the line run through primarily industrial land uses. In all, six transit service alternatives were investigated. Preliminary planning-level ridership forecasts for the alternatives were estimated, along with rough order-of-magnitude capital and operating costs.

[1] Shared Use Agreement, between LACTC and ATSF, October 1992, Section 2.3 Ownership.

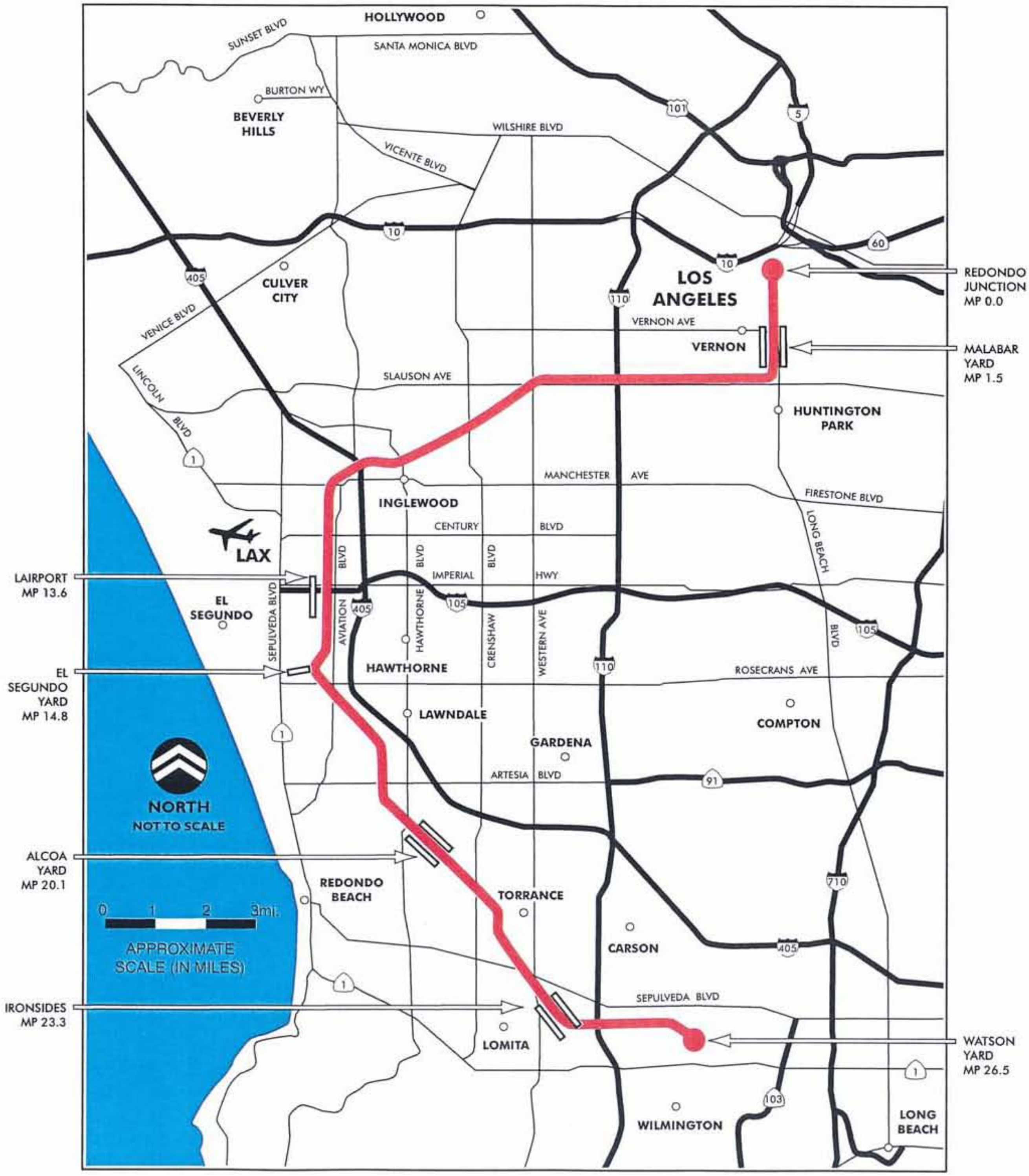

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Figure I-1
HARBOR SUBDIVISION
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ANALYSIS PROCESS

The first step in this analysis was to document existing conditions in the corridor. The analysis team met with BNSF in April 2006 to verify traffic volumes on the Harbor Subdivision. BNSF provided the volumes as well as speeds of trains on the line. BNSF also provided the team with track charts which contained such information as the weight of the rail, the year of rail installation, the year of cross tie installation, and the locations of yards, sidings, and industrial spurs, public and private at grade crossings, overcrossings and undercrossings, and gradients. The analysis team toured the 26.36 miles of the rail line, confirmed grade crossing protection detail obtained from the California Public Utilities Commission, and took more than 100 photographs documenting conditions. The team's assessment of the existing conditions on the line appears as ***Chapter 1*** of this report.

The next step was to assess the line in terms of surface environmental constraints relevant to the potential deployment of various transit modes. Constraints include such things as the existence of sensitive noise receptors near the Subdivision, which could be impacted either by noise generated construction or increasing train volumes. Right-of-way width is also a constraint, because it limits what can be added to the right-of-way without triggering potentially disruptive land acquisition. Modes considered for deployment included Diesel Multiple Units (DMUs), or self-propelled diesel powered rail cars; Light Rail Transit (LRT), like the Metro Blue Line; Heavy Rail, a grade-separated electrical powered system like the Metro Red Line; and Bus Rapid Transit (BRT), like the Metro Orange Line. Due to the preponderance of constraints relative to Heavy Rail, this mode was dropped from further consideration. The team's assessment of the surface environmental constraints appears in ***Chapter 2***.

The team then assessed the potential of 13 areas along the Harbor Subdivision to serve as station locations. The team visited each site, cataloguing the various qualities such as the amount of retail and pedestrian activity, the presence of redevelopment, the type of nearby housing and/or office space. The 13 sites comprised the universe of potential station sites, from which a subset was selected for the modal alternatives evaluated separately. The team's assessment of the potential station locations appears in ***Chapter 3***.

With the assessments of the environmental constraints and potential station locations complete, the analysis team began its investigation of transit service alternatives. These totaled six: four DMU alternatives, one LRT alternative, and one BRT alternative. The team developed a service concept for each alternative, specifying the terminals, intermediate stations, and service level. A summary of these service concepts appears in ***Chapter 4***.

The final stage of the analysis was to evaluate the feasibility of each of the six transit service alternatives. The team developed preliminary ridership estimates and rough order-of-magnitude estimates of implementation costs and operating costs. The team incorporated the surface environmental constraints identified as part of Chapter 2, and concluded with a listing of the relative pros and cons of each alternative. The team's conceptual-level analysis of the alternatives appears in ***Chapter 5***. The specific assumptions used in estimating transit alternative costs appear in ***Appendix A***. Summary conceptual cost tables appear in ***Appendix B***.

The analysis concludes with a summary of the analysis. The summary contains an elaboration of: the engineering challenges and solutions contained in the service concepts for each transit alternative; the compatibility of the alternatives with existing land uses; BNSF concerns of sharing the right-of-way with potential transit service; and the regulatory agencies (federal, state, and local) with jurisdiction over the Harbor Subdivision. The roles of these agencies are cited more specifically in ***Appendix C***.

Lastly, potential next steps are identified. The summary and next steps appear in ***Chapter 6***.

LITERATURE REVIEW

In conducting its analysis, the analysis team was mindful of numerous studies that have been done over the years pertaining to transit implementation on the Harbor Subdivision. Metro provided all team members with copies of these reports for review. Brief summaries of these studies appear in ***Appendix D***.

ANALYSIS TEAM

This analysis was conducted over a seven-month period, starting in March 2006. Team members included representatives of Metro's South Bay Area Planning Team and Metro's Construction Team, Wilbur Smith Associates, UltraSystems Environmental, and RAW International.

Chapter 1
EXISTING CORRIDOR CONDITIONS

INTRODUCTION

This chapter addresses existing Harbor Subdivision conditions and reviews issues that need to be addressed in order to operate passenger rail and/or bus service in the corridor.

EXISTING CORRIDOR CONDITIONS

The Harbor Subdivision extends 28.3 miles from Harbor Junction at the north, where it diverges from the Transcon mainline of the Burlington Northern and Santa Fe Railway (BNSF), to Long Beach Junction at the south, where it joins the trackage leading to and from the Alameda Corridor. From milepost 0.00 at Harbor Junction to milepost 26.36 at the west end of Watson Yard[1], the corridor is owned by the Los Angeles County Metropolitan Transportation Authority (Metro), with freight service over the line operated by the BNSF. From milepost 26.36 through Watson Yard (milepost 26.60) to the Alameda Corridor (milepost 28.30), the line is owned and operated by BNSF. This chapter evaluates existing conditions on the 26.36 miles of the Harbor Subdivision owned by Metro.

Although the line is publicly owned, BNSF maintains the track facilities and dispatches the trains using the line. The 1992 Harbor Subdivision purchase agreement between the former Atchison, Topeka and Santa Fe Railway (ATSF), now BNSF, and the former Los Angeles County Transportation Commission (LACTC), now Metro, provided that LACTC would take over maintenance and dispatching if it were to operate passenger service on the line, and the passenger service would have priority over freight. To date, LACTC's successor, Metro, has not seriously considered passenger operations.

Background

The Harbor Subdivision was originally built by the ATSF from Redondo Junction near downtown Los Angeles southwesterly to access anticipated port facilities at Redondo Beach and to provide rail service to the oil facilities and other industrial uses in the areas south and west of Los Angeles. Much of the line was built before the adjacent communities were developed. As major harbor facilities were constructed in Long Beach and San Pedro, tracks were extended to those ports and the route became the primary access route for ATSF/BNSF port and intermodal traffic. ATSF sold most of the line to Metro's predecessor, LACTC, in 1992.

Most of the Harbor Subdivision traverses developed communities with well-established land use patterns. Along its length, the rail line threads through residential neighborhoods, commercial and warehousing districts, and industrial developments including major oil fields and refineries. The Los Angeles International Airport (LAX) complex lies to the west of the line along Aviation Boulevard near Century Boulevard.

Prior to the opening of the Alameda Corridor, the Harbor Subdivision carried approximately 14 through trains (trains operating across the entire length of the subdivision) per day, with additional local industrial service provided on the north and south ends of the line. When the Alameda Corridor opened in 2002,

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[1] A yard is a facility where railcars are assembled into trains and disassembled for delivery to shippers nearby.

BNSF shifted all of its through trains to the new corridor and relegated the Harbor Subdivision to local trains serving online industries and the still important traffic generated by oil facilities south of LAX. BNSF continues to serve customers on the north end of the Harbor Subdivision by one local train based in Malabar Yard near Harbor Junction. Customers south of LAX are served by local trains running out of Watson Yard. Freight for the south end of the Harbor Subdivision (south of LAX) moves through the Alameda Corridor from Los Angeles (Hobart Yard) to Watson Yard, and thence north on the Harbor Subdivision. Currently, BNSF does not operate any through trains on the line. The central portion of the Harbor Subdivision, from milepost 7.42 (Fourth Avenue) to milepost 12.92 (111th Street), is used only occasionally, but is maintained in serviceable condition. Recently, the trackage along Aviation Boulevard has been used to store empty intermodal container platforms. Figure 1-1 shows daily local train activity on the Harbor Subdivision.

HARBOR SUBDIVISION TRACK CONDITIONS

Maximum Speeds

The Harbor Subdivision was never a higher speed freight route. Numerous grade crossings, local switching to industrial customers, and reduced clearances and sight lines tended to keep BNSF train speeds low. Now, with removal of through trains to the Alameda Corridor, BNSF maintains the line only to Federal Railroad Administration (FRA) Class 1 standards, which permit trains to operate at 10 miles per hour or less.

The FRA, the federal agency charged with oversight on railroad safety issues, has established standard track classifications and related standards of maintenance reflecting differences in classification. The basic difference between classifications is that higher classifications permit higher train operating speeds, but require higher standards of maintenance and inspection to warrant the higher speeds. Most railroads maintain their track to a particular classification based on the relative importance of the line and the maintenance budget that they determine is appropriate for the nature of the rail traffic moved over the line. Secondary tracks used principally for switching will be maintained to low classifications, while mainline tracks carrying high volumes of time-sensitive freight will be maintained to high classifications. Speeds for freight and passenger trains per track class appear in Table 1-1.

Table 1-1
FRA Track Classifications

Class Type	Maximum Freight Speed (mph)	Maximum Passenger Speed (mph)
Excepted Track[2]	10	Not Permitted
Class 1 Track	10	15
Class 2 Track	25	30
Class 3 Track	40	60
Class 4 Track	60	80
Class 5 Track	80	90

Source: FRA

Note: Maximum speeds for Classes 6 through 9 track are 110 through 200 mph, respectively. These speeds are for both passenger and freight trains.

[2] Track not maintained even to FRA Class 1 standards.

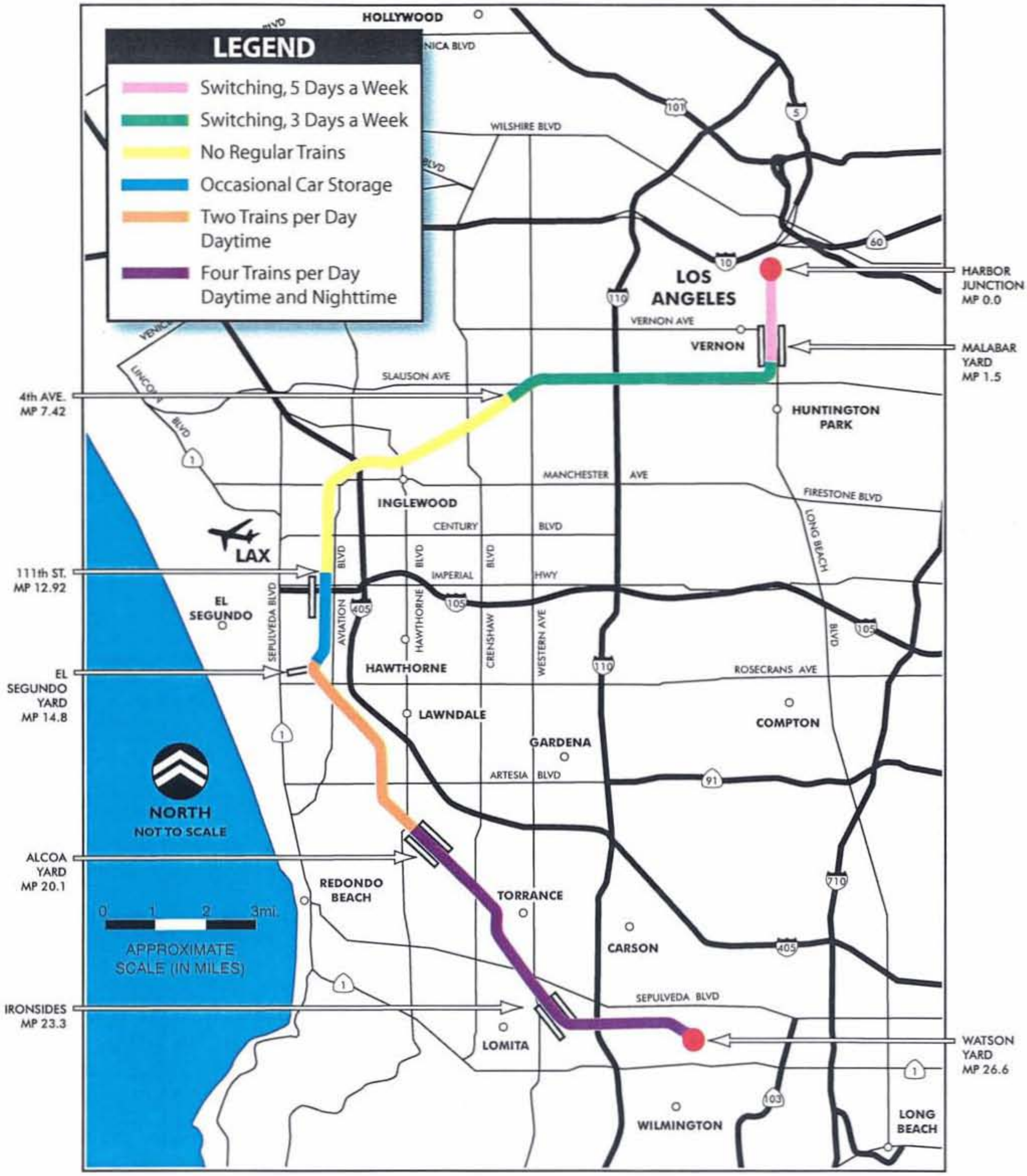

Figure 1-1
LOCAL TRAINS PER DAY - HARBOR SUBDIVISION
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Adherence to track maintenance standards is enforced by periodic unannounced inspections of the track by qualified FRA inspectors, often working in conjunction with state regulatory agencies. Where inspectors find track that does not meet the standards, slow orders are imposed requiring operation at speeds commensurate with actual conditions until repairs are completed to restore the track to its intended class. Track inspections may be by visual inspection of track conditions, and by operation of track geometry cars containing electronic measuring and recording instruments. Typically, track used for commuter rail operations is maintained to Class 4 standards. The most critical standards that apply to track classifications include:

- *Gage* measures differences in the distance between the rails. Higher classifications have less tolerance for variations in track gage.
- *Alignment* measures horizontal variations within a specified distance along the track. Higher classifications have less tolerance for variations in alignment.
- *Curve elevation* (or super elevation) measures the height of the outside rail of a curve in relation to the inside rail. Maximum speeds are specified based on a combination of elevation and the sharpness of the curve.
- *Surface* measures the vertical variations within a specified distance along the track. Higher classifications have less tolerance for variations.
- *Track structure* measures the condition of ballast (aggregate that holds crossties in place), crossties (lumber or concrete ties to which steel rails are attached), track assembly fittings (e.g. tie plates, which grip the steel rail and through which spikes are driven, thus fastening rails to cross ties), and the physical condition of the rails. For each characteristic, higher standards of construction and maintenance apply to the higher track classifications.

The FRA regulations specify how often railroads are required to make their own inspections of track, with the higher classifications requiring more frequent inspections. Special inspections are required following any event that might cause damage to the track structure to ensure safety of train operations. Railroads are required to maintain records demonstrating compliance with the inspection requirements, and documenting maintenance activities necessary to support each track classification. Given the current freight volume on the Harbor Subdivision and the line's Class 1 status[3], the line requires monthly inspections, per Title 49 CFR Part 213.233 Track Inspections Other Than Main Track and Sidings[4].

Right-of-Way Width

The right-of-way is of varying width, ranging from as narrow as 30 feet (considered substandard even for a little-used branch line) to as much as 150 feet. Typically, the right-of-way is 40 to 80 feet with the single main track positioned approximately in the center of the right-of-way. Over the entire length of Metro's ownership, there are:

- 4.99 miles of right-of-way less than 50 feet in width
- 13.17 miles with a width of 50 to 99 feet
- 8.20 miles with a width of 100 feet or more

The narrower segments predominate at the north end of the line. Table 1-2 shows the right-of-way widths by milepost. A key implication from this table is that to use any significant portion of the right-of-way for

[3] Per Richard Dennison, BNSF, April 4, 2006.

[4] Code of Federal Regulations (CFR).

transit operations, like a two-lane express busway or double track light rail line, significant property acquisition would be necessary to secure sufficient right-of-way for transit use while still maintaining a track for local freight service.

Table 1-2
Harbor Subdivision Right-of-Way Width by Track Segment

MP	Location	MP	Location	Distance (Miles)	Width (Feet)
0.00	Harbor Junction	0.31	26th Street	0.31	*40
0.31	26th Street	1.61	52nd Street	1.30	150
1.61	52nd Street	2.02	58th Street	0.41	*40
2.02	58th Street	2.68	Holmes Avenue	0.66	60
2.68	Holmes Avenue	2.83	Long Beach Avenue	0.15	60
2.83	Long Beach Avenue	3.31	Hooper Street	0.48	30
3.31	Hooper Street	3.56	Central Avenue	0.25	105
3.56	Central Avenue	4.81	Broadway	1.25	30
4.81	Broadway	5.82	Budlong Avenue	1.01	40
5.82	Budlong Avenue	6.31	Danker Avenue	0.49	80
6.31	Danker Avenue	6.60	Western Avenue	0.29	45
6.60	Western Avenue	6.80	Milepost 6.8	0.20	30
6.80	Milepost 6.8	7.97	67th Street	1.17	40
7.97	67th Street	8.14	Victoria Avenue	0.17	100
8.14	Victoria Avenue	8.32	West Boulevard	0.18	40
8.32	West Boulevard	10.82	Hindry Avenue	2.50	50
10.82	Hindry Avenue	11.90	Milepost 11.9	1.08	*55
11.90	Milepost 11.9	14.65	Douglas Street	2.75	60
14.65	Douglas Street	15.41	Rosecrans Boulevard	0.76	60-100
15.41	Rosecrans Boulevard	16.87	Manhattan Beach Boulevard	1.46	150
16.87	Manhattan Beach Boulevard	17.15	Milepost 17.15	0.28	125
17.15	Milepost 17.15	17.62	170th Street	0.47	100
17.62	170th Street	19.80	Milepost 19.8	2.18	80
19.80	Milepost 19.8	20.70	Milepost 20.7	0.90	55-60
20.70	Milepost 20.7	21.00	Milepost 21.0	0.30	150
21.00	Milepost 21.0	22.00	Milepost 22.0	1.00	75
22.00	Milepost 22.0	22.70	Milepost 22.7	0.70	80
22.70	Milepost 22.7	22.90	Milepost 22.9	0.20	125
22.90	Milepost 22.9	25.40	Milepost 25.4	2.50	100
25.40	Milepost 25.4	26.36	West End Watson Yard	0.96	*100
26.36	West End Watson Yard	28.30	Long Beach Junction	1.94	NA

Sources: BNSF Track charts, LA County Assessor Maps, WSA Estimates (*)

Note: Metro ownership ends at milepost 26.36

Existing Rail Inventory

Railroad track charts maintain data on track alignment, grades, rail weight, tie replacements, and other data. Relevant data from the latest available BNSF track charts (2004) are summarized in Tables 1-3 and 1-4. The entire line, except for the connection at Harbor Junction, consists of welded rail of 112 or 115 pounds per linear yard weight. The bulk of this rail was installed in 1965. Short segments, predominately on curves where greater wear occurs, were replaced in 1984 or later. Ties were renewed where necessary in 1979-80 and again in 1994-95. While the track charts indicate most of the line is good for 15-20 mph freight operations, BNSF advises that it currently maintains the line for 10 mph operations. Some sections may still be operable at 20 mph. Eventually, however, these will be downgraded unless the railroad returns to a higher level of maintenance.

Ballast and subgrade (ground preparation underlying and supporting the ballast, crossties and rails) data do not appear on the track charts. From observation, the ballast has received only minimal attention in recent years, consistent with the low speed of train operations.

Table 1-3
Harbor Subdivision Rail Inventory

MP	MP	Distance	Rail Type	Rail Weight	Rail Year	Tie Year	Speed
0.00	0.15	0.15	Bolted	115	1998	1979	20
0.15	1.60	1.45	Welded	112	1965	1979	12
1.60	1.80	0.20	Welded	112	1965	1979	15
1.80	2.30	0.50	Welded	115	1998	1979	15
2.30	3.00	0.70	Welded	112	1965	1979	15
3.00	9.25	6.25	Welded	112	1965	1980	15
9.25	9.40	0.15	Welded	112	1954	1980	15
9.40	9.70	0.30	Welded	115	1995	1980	15
9.70	9.80	0.10	Welded	115	1998	1980	15
9.80	10.10	0.30	Welded	112	1965	1980	15
10.10	10.90	0.80	Welded	112	1965	1980	20
10.90	11.55	0.65	Welded	115	1998	1980	20
11.55	12.25	0.70	Welded	112	1965	1980	20
12.25	12.35	0.10	Welded	115	1998	1980	20
12.35	13.00	0.65	Welded	112	1965	1980	20
13.00	14.05	1.05	Welded	112	1965	1995	20
14.05	14.50	0.45	Welded	112	1965	1995	20
14.50	16.80	2.30	Welded	112	1965	1995	20
16.80	17.10	0.30	Welded	115	1991	1995	20
17.10	18.40	1.30	Welded	112	1965	1995	20
18.40	18.65	0.25	Welded	115	1991	1995	20
18.65	19.40	0.75	Welded	112	1965	1995	20
19.40	19.47	0.07	Welded	115	1998	1995	20
19.47	20.63	1.16	Welded	115	1984	1995	20
20.63	21.00	0.37	Welded	112	1965	1995	20
21.00	21.60	0.60	Welded	112	1965	1994	20
21.60	21.80	0.20	Welded	115	1991	1994	20
21.80	23.93	2.13	Welded	112	1965	1994	20
23.93	24.25	0.32	Welded	115	1991	1994	20
24.25	25.00	0.75	Welded	112	1965	1994	20
25.00	26.36	1.36	Welded	115	1990	1994	20

Source: BNSF Track Charts

Table 1-4 Harbor Subdivision Summary Mileage	
Welded Rail	26.21
Bolted Rail	0.15
Total 112 Lbs	20.90
Total 115 Lbs	5.46
Rail Laid 1954	0.15
Rail Laid 1965	20.75
Rail Laid 1984	1.16
Rail Laid 1990	1.36
Rail Laid 1991	1.07
Rail Laid 1995	0.30
Rail Laid 1998	1.57
Ties Renewed 1979	3.00
Ties Renewed 1980	10.00
Ties Renewed 1994	5.36
Ties Renewed 1995	8.00

RAILROAD SIGNALIZATION

The Harbor Subdivision is unsignaled: There are no wayside signals which direct the locomotive engineer how to progress a train over the Subdivision. Trains are operated under authority granted by the BNSF dispatcher responsible for the line. Dispatchers, typically located in a location remote from the rail line, have the responsibility for progressing a train across the line. The dispatcher's authorization for train movement typically is transmitted by radio, and confirmed by the train crew prior to moving over any authorized segment of trackage. While suitable for low density branch lines, this technique would not be sufficient for a route with multiple passenger operations, or for mixed freight and passenger service. Use of all or a part of the Harbor Subdivision tracks for passenger service could require installation of a complete signal system to ensure timely operation of the passenger service without undue delays. Such a system would likely be required for a rail transit service even without freight rail service.

HIGHWAY GRADE CROSSINGS

There are 96 grade crossings along the 26.36 miles of track owned by Metro. Of these, 91 are public street crossings. In addition, there are 3 private road crossings and 2 pedestrian grade crossings (one of these appears to have been practically eliminated). The northern portion of the line has the greatest density of crossings, with an average of 5.5 crossings per mile in the first 10 miles from the Harbor Junction in Vernon west through Los Angeles and south to Eucalyptus Avenue in Inglewood. The southernmost 16.36 miles average only 2.5 crossings per mile. Most of the crossings are protected by flashing lights and automatic gates. Some crossings have only flashing lights as warnings to approaching vehicular traffic, and a few have only standard crossbuck signs (typically two wooden planks, crossed, forming an "X"; one plank saying "railroad" and the other "crossing"). The flashing lights and gates are set for activation by low speed trains, and undoubtedly would require resetting of the timing mechanism if the route were upgraded for passenger service. Some crossings with low traffic volumes might be candidates for closure. A complete inventory of the grade crossings and the type of warning devices at each crossing is presented in Table 1-5.

Table 1-5
Harbor Subdivision At-grade Crossings and Warning Devices

No.	Mile Post	Crossing and Jurisdiction	Type of Protection
1	0.11	Harriet Street, Vernon	2 - Flashing lights with automatic gates
2	0.24	25th Street, Vernon	2 - Flashing lights with automatic gates
3	0.31	26th Street, Vernon	1 - Flashing lights with automatic gate; 1 - Overhead cantilever flashing lights with automatic gate
4	0.41	27th Street, Vernon	2 - Crossbuck signs
5	0.48	28th Street, Vernon	2 - Flashing lights with automatic gates
6	0.69	37th Street, Vernon	2 - Flashing lights with automatic gates
7	0.70	38th Street, Vernon	2 - Flashing lights with automatic gates
8	0.94	Vernon Avenue, Vernon	2 - Flashing lights with automatic gates
9	1.04	Pacific Boulevard, Vernon	4 - Flashing lights with automatic gates
10	1.38	49th Street, Vernon	2 - Crossbuck signs; wig wag
11	1.57	Fruitland Avenue, Vernon	2 - Flashing lights with automatic gates
12	1.61	52nd Street, Huntington Park	2 - Flashing lights with automatic gates
13	1.65	53rd Street, Huntington Park	2 - Flashing lights with automatic gates
14	1.80	55th Street, Huntington Park	2 - Flashing lights with automatic gates
15	1.85	56th Street, Huntington Park	2 - Flashing lights with automatic gates
16	1.94	57th Street, Huntington Park	2 - Flashing lights with automatic gates
17	2.02	58th Street, Huntington Park	2 - Flashing lights with automatic gates
18	2.05	Santa Fe Avenue, Huntington Park	2 - Crossbuck signs
19	2.30	2nd Street, Vernon	2 - Flashing lights
20	2.48	Alameda Street, Los Angeles	1 - Flashing lights; 4 - Flashing lights with automatic gates
21	2.68	Holmes Avenue, Los Angeles	4 - Flashing lights with automatic gates
22	2.83	Long Beach Avenue, Los Angeles	1 - Flashing lights; 1 - Flashing lights with automatic gate
23	3.06	Compton Avenue, Los Angeles	2 - Flashing lights with automatic gates
24	3.31	Hooper Avenue, Los Angeles	2 - Flashing lights with automatic gates
25	3.56	Central Avenue, Los Angeles	2 - Flashing lights with automatic gates
26	3.81	McKinley Avenue, Los Angeles	2 - Flashing lights with automatic gates
27	3.90	Paloma Avenue, Los Angeles	2 - Flashing lights with automatic gates
28	4.06	Avalon Boulevard, Los Angeles	2 - Flashing lights with automatic gates
29	4.18	Towne Avenue, Los Angeles	2 - Flashing lights with automatic gates
30	4.34	San Pedro Street, Los Angeles	2 - Flashing lights with automatic gates
31	4.56	South Main Street, Los Angeles	2 - Flashing lights with automatic gates
32	4.81	South Broadway, Los Angeles	2 - Flashing lights with automatic gates
33	5.06	Figueroa Street, Los Angeles	2 - Flashing lights with automatic gates
34	5.32	Hoover Avenue, Los Angeles	2 - Flashing lights with automatic gates
35	5.57	Vermont Avenue, Los Angeles	2 - Flashing lights with automatic gates
36	5.82	Budlong Avenue, Los Angeles	2 - Flashing lights with automatic gates
37	6.07	Normandie Avenue, Los Angeles	2 - Flashing lights with automatic gates
38	6.31	Danker Avenue, Los Angeles	2 - Flashing lights with automatic gates
39	6.42	Slauson Avenue, Los Angeles	1 - Flashing lights; 2 - Flashing lights with automatic gates
40	6.60	Western Avenue, Los Angeles	2 - Flashing lights with automatic gates
41	7.11	Van Ness Avenue, Los Angeles	2 - Flashing lights with automatic gates

Table 1-5
Harbor Subdivision At-grade Crossings and Warning Devices

No.	Mile Post	Crossing and Jurisdiction	Type of Protection
42	7.42	4th Avenue, Los Angeles	2 - Flashing lights with automatic gates
43	7.75	8th Avenue, Los Angeles	2 - Flashing lights with automatic gates
44	7.94	11th Avenue, Los Angeles	2 - Flashing lights with automatic gates
45	7.97	67th Street, Los Angeles	2 - Flashing lights; 2 - Flashing lights with automatic gates
46	8.03	Crenshaw Boulevard, Los Angeles	4 - Flashing lights with automatic gates
47	8.14	Victoria Avenue, Los Angeles	1 - Flashing lights; 2 - Flashing lights with automatic gates
48	8.23	Brynhurst Avenue, Los Angeles	2 - Flashing lights with automatic gates
49	8.32	West Boulevard, Inglewood	3 - Flashing lights with automatic gates
50	8.60	Redondo Boulevard, Inglewood	2 - Flashing lights with automatic gates
51	8.89	Pedestrian Crossing, Inglewood	NA; this crossing appears to be closed
52	9.13	Centinela Avenue, Inglewood	4 - Flashing lights with automatic gates
53	9.59	La Brea Avenue, Inglewood	4 - Flashing lights with automatic gates
54	9.82	Ivy Avenue, Inglewood	2 - Flashing lights with automatic gates
55	9.94	Eucalyptus Avenue, Inglewood	2 - Flashing lights with automatic gates
56	10.21	North Cedar Avenue, Inglewood	2 - Flashing lights with automatic gates
57	10.36	Oak Street, Inglewood	2 - Overhead cantilever flashing lights with automatic gates
58	10.52	Hyde Park Boulevard, Inglewood	2 - Flashing lights with automatic gates
59	10.63	La Cienega Boulevard, Inglewood	4 - Flashing lights with automatic gates
60	10.82	Hindry Avenue, Inglewood	2 - Flashing lights with automatic gates
61	11.11	Manchester Blvd, Inglewood	4 - Flashing lights with automatic gates
62	11.63	Arbor Vitae Street, Los Angeles	2 - Flashing lights with automatic gates
63	12.36	104th Street, Los Angeles	2 - Flashing lights with automatic gates
64	12.92	111th Street, Los Angeles	2 - Flashing lights with automatic gates
65	13.13	Imperial Highway, Los Angeles	1 - Flashing lights with automatic gates; 3 - Overhead cantilever flashing lights with automatic gates
66	13.37	118th Street, El Segundo	2 - Flashing lights with automatic gates
67	13.62	120th Street, El Segundo	2 - Flashing lights with automatic gates
68	13.89	124th Street, El Segundo	2 - Flashing lights with automatic gates
69	14.69	Douglas Street, El Segundo	2 - Flashing lights; 2 - Flashing lights with automatic gates
70	14.79	Chapman Way (private), El Segundo	2 - Crossbuck signs
71	15.08	Rosecrans A./Aviation B., El Segundo	2 - Flashing lights
72	16.14	Marine Boulevard, Hawthorne	2 - Flashing lights with automatic gates; 2 - Overhead cantilever flashing lights with automatic gates
73	16.74	Inglewood Avenue, Lawndale	2 - Overhead cantilever flashing lights with automatic gates
74	16.87	Manhattan Beach Boulevard, Lawndale	4 - Flashing lights with automatic gates
75	16.94	159th Street, Lawndale	2 - Flashing lights with automatic gates
76	17.01	160th Street, Lawndale	2 - Flashing lights with automatic gates
77	17.08	161st Street, Lawndale	2 - Flashing lights with automatic gates
78	17.14	162nd Street, Lawndale	2 - Flashing lights with automatic gates
79	17.62	170th Street, Lawndale	2 - Flashing lights with automatic gates
80	18.38	182nd Street, Redondo Beach	2 - Flashing lights with automatic gates

Table 1-5
Harbor Subdivision At-grade Crossings and Warning Devices

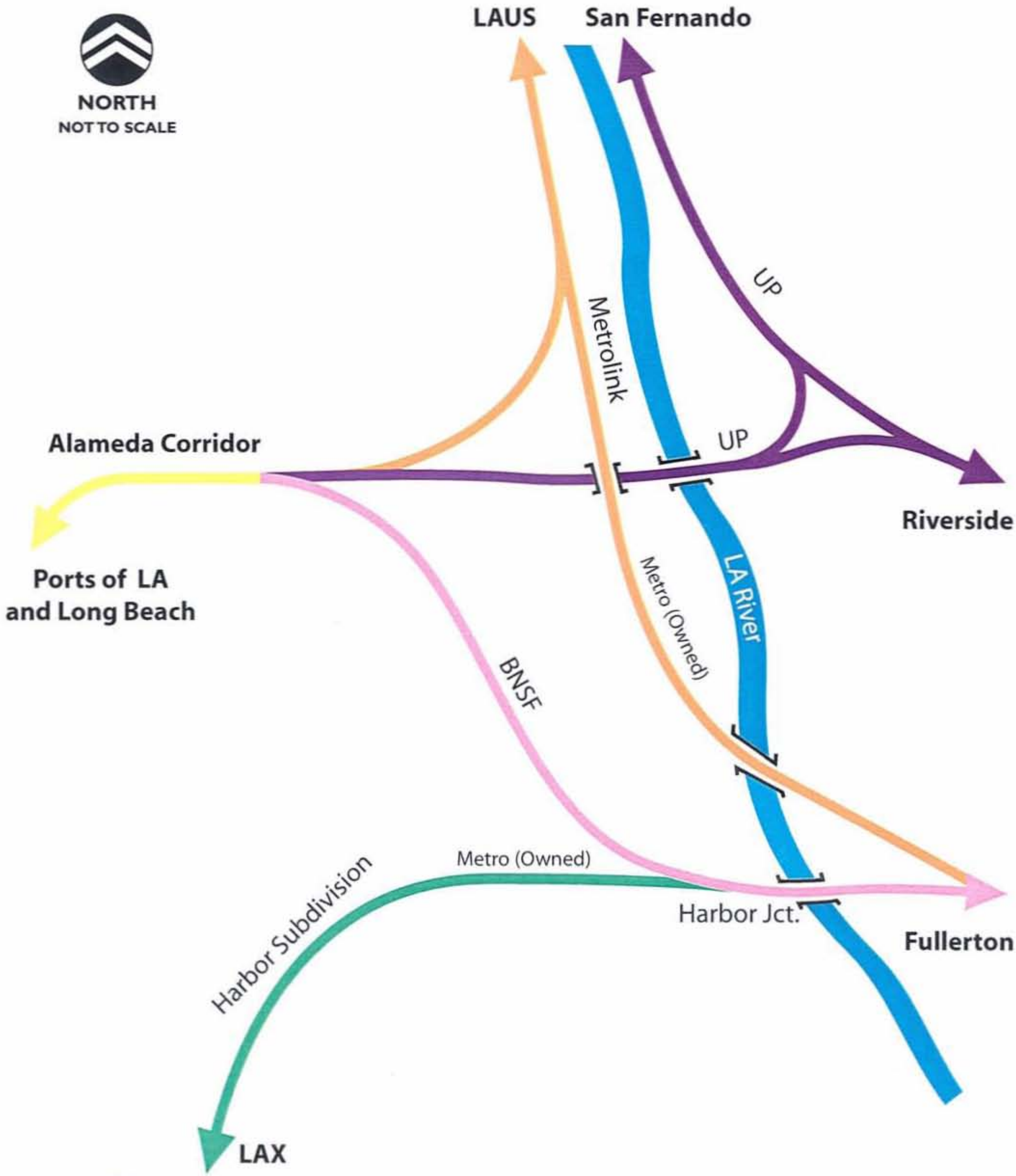
No.	Mile Post	Crossing and Jurisdiction	Type of Protection
81	21.24	Torrance Boulevard, Torrance	1 - Flashing lights; 1 - Flashing lights with automatic gates; 2 - Overhead cantilever flashing lights with automatic gates
82	21.36	Pedestrian Grade Crossing, Torrance	2 - Pedestrian/bicycle warning signs
83	21.48	Sonoma Street, Torrance	2 - Flashing lights with automatic gates
84	21.60	Carson Street, Torrance	2 - Flashing lights; 2 - Flashing lights with automatic gates
85	22.10	Washington Avenue, Torrance	2 - Flashing lights with automatic gates
86	22.24	Arlington Avenue, Torrance	2 - Flashing lights; 2 – Flashing lights with automatic gates
87	22.49	Cabrillo Avenue, Torrance	2 - Flashing lights with automatic gates
88	22.57	Border Avenue, Torrance	2 - Flashing lights with automatic gates
89	22.78	Sepulveda Boulevard, Torrance	1 - Flashing lights; 4 - Flashing lights with automatic gates
90	23.03	Western Avenue. Torrance	4 - Flashing lights with automatic gates
91	24.79	South Figueroa Street, Carson	4 - Flashing lights with automatic gates
92	24.92	Private Grade Crossing, Carson	2 - Flashing lights
	24.97	Private Grade Crossing, Carson	NA
93	25.94	Avalon Boulevard, Los Angeles	4 - Flashing lights with automatic gates
94	26.04	Broad Avenue, Los Angeles	2 - Flashing lights with automatic gates
95	26.11	Lakme Avenue, Los Angeles	2 - Flashing lights with automatic gates
96	26.36	Wilmington Avenue, Los Angeles	2 - Flashing lights with automatic gates

Source: FRA and PUC data; WSA field observations; street maps

CONNECTIONS TO OTHER CORRIDORS

At the north end, the Harbor Subdivision connects to the BNSF Transcon (more specifically, the San Bernardino Subdivision) near the north end of the Alameda Corridor. At this point, the Harbor Subdivision is within a few hundred yards of trackage utilized by the Southern California Regional Rail Authority (SCRRA), operator of the Los Angeles area Metrolink commuter rail system, and owned by Metro; and other trackage owned by Union Pacific Railroad (UP). The Metro-owned, Metrolink-operated trackage runs to Los Angeles Union Station (LAUS) and connects with Metrolink lines running to Ventura County, San Bernardino County, Riverside County, and the Antelope Valley. A schematic of connections at the north end of the Subdivision appears as Figure 1-2.

At the south end, Harbor Subdivision trackage passes through the BNSF Watson Yard facilities and connects the Watson Yard to the Alameda Corridor.



Wilbur Smith Associates
ENGINEERS
PLANNERS
ECONOMISTS

Figure 1-2
NORTH END CONNECTIONS - HARBOR SUBDIVISION
100011/BASE - 11/27/06

ABILITY OF RIGHT-OF-WAY TO ACCOMMODATE TRANSIT

Modal Options Studied

There were six transit modes initially considered as part of the Harbor Subdivision Transit Analysis. The six modes studied are listed below:

- FRA Compatible DMUs, similar to those in operation on the South Florida Tri-Rail commuter rail system. These can share track with freight trains and conventional passenger trains.
- Non FRA Compatible DMUs, like those planned for the Oceanside-Escondido Sprinter service. These do not comply with FRA crashworthiness standards for operation on track shared with freight and conventional passenger trains. These can only share track with freight trains and conventional passenger trains on a time-separated basis.
- Light Rail Transit (LRT), like the Metro Blue Line.
- Heavy Rail, like the Metro Red Line.
- Bus Rapid Transit (BRT), like the Metro Orange Line.
- Metro Rapid express bus service.

Excess right-of-way is not a feature of the Harbor Subdivision. However, with the exception of Heavy Rail, all of the modes can be implemented with at most comparatively minor property acquisitions, although some would require temporal separation of freight and transit modes in a portion of the Subdivision. As a result of the Surface Environmental Constraints analysis in Chapter 2, Heavy Rail was dropped from further consideration; deployment of Heavy Rail would face the greatest number of such constraints, particularly right-of-way constraints. Also, BRT was assumed to run on both its own fixed guideway system as well as city streets, thus comprising elements of both BRT and Metro Rapid service. Accordingly, Metro Rapid service *per se* was dropped from further consideration.

Width Requirements of Modes Studied

While some portions of the Harbor Subdivision right-of-way are of ample width to accommodate both a freight rail line and an adjacent transit facility, other segments are so restricted that BNSF and transit operations could not operate simultaneously unless either additional right-of-way were acquired to make construction and operation feasible, or innovative solutions were adopted. Table 1-6 shows ideal minimum right-of-way requirements for the various modes studied for the Harbor Subdivision. The table represents just the right-of-way section, and does not allow for any station platforms, parking or bus loading zones, or other special features such as storage tracks and passing tracks that might be necessary for railroad and transit operations.

While the table shows minimum right-of-way widths for the various combinations of rail and transit use, greater widths might be required in specific locations. For example, a BRT or LRT system may need additional width at grade crossings with local streets, to accommodate safety devices such as automatic gates and flashers. Additional width may be necessary for adequate sight distances on curves. Railroad and transit signalization may require additional width, and pockets or turnouts for disabled or maintenance vehicles will be in addition to the minimum widths shown.

Table 1-6
Ideal Minimum Required Right-of-Way Widths

Use	Minimum Width	Minimum Width with Siding
Freight Railroad	40 ft.	55 ft. for Siding
Freight Rail with FRA Compliant DMUs on Same Track	40 ft.	55 ft. for Siding
Freight Rail with Non FRA Compliant DMUs with Temporal Separation (i.e. Same Track; Different Time)	40 ft.	55 ft. for Siding
Freight Rail with Non FRA Compliant DMUs with Spatial Separation (i.e. Separate Track)	65 ft.	80 ft. for Siding
Freight Rail Using LRT Tracks with Temporal Separation	45 ft.	60 ft. for Siding
Freight Rail with Light Rail (LRT) with Spatial Separation	70 ft.	85 ft. for Siding
Freight Rail with Two-lane Busway (BRT and Metro Rapid)	70 ft.	85 ft. for Siding
Freight with Heavy Rail (Elevated or Subway)	70 ft.	85 ft. for Siding

Sources: Metro, Bay Area Rapid Transit District (BART), and WSA

Table 1-7 shows areas where the various modes would encounter right-of-way constraints, potentially triggering right-of-way acquisition.

Table 1-7 Harbor Subdivision Right-of-Way Constraints per Transit Modes Studied						
Subdivision Segment	Mileposts	FRA Compliant DMU	Non FRA Compliant DMU	LRT	Heavy Rail	BRT and Metro Rapid
1. Harbor Jct. - 37th	0.00-0.69		X	X	X	X
2. 37th - Santa Fe	0.69-2.05				X	
3. Santa Fe - Avalon	2.05-4.06			X	X	
4. Avalon - Western	4.06-6.60			X	X	
5. Western - Crenshaw	6.60-8.03			X	X	
6 Crenshaw - Manchester	8.03-11.11				X	
7 Manchester - I-105	11.11-13.11			X	X	X
8 I-105 - El Segundo	13.11-14.13		X	X	X	X
9 El Segundo - Rosecrans	14.13-15.41		X	X	X	X
10 Rosecrans - Mhtn. Beach	15.41-16.87					
11 Mhtn. Beach - 190th	16.87-19.03					
12 190th - Vermont	19.03-24.42		X	X	X	X
13 Vermont - Watson Yard	24.42-26.36					
Source: BNSF Track Charts						

Heavy Rail transit, such as the Metro Red Line, requires a grade separated trackway because of the third rail power system. Either elevated or subway sections could be accommodated in a 70-foot right-of-way, but if there were transitions between the two designs, additional right-of-way might be required.

The current freight operation could co-exist with an FRA Compliant DMU operation on the same track throughout the length of the Harbor Subdivision. Three track segments at the northerly end of the line have substandard width of only 30 feet, but could accommodate transit operations on the same track. The DMU operation would need to be of a low frequency nature, probably with not more than one train every 30 minutes in each direction during the peak commute periods or, alternatively, a directional service, thereby avoiding the need for building a second track and the potential acquisition of right-of-way. With two-way service at headways less than 30 minutes, the need for frequent sidings becomes necessary. With frequencies of about 20 minutes, the necessary passing sidings become so close to each other that construction of a second track is a more practical solution. With any type of operation other than a few passenger trains during peak hours only, the freight service would need to be operated only at night to avoid delays.

If Non FRA Compatible equipment and temporal separation of the freight service were not possible, a separate track would be required for the DMU service, with a minimum 65-foot right-of-way. This would be challenging north of Douglas Street because most of the right-of-way is 60 foot or less in width. If temporal separation were possible, the minimum right-of-way of 40 feet would be required.

Similarly, the restricted right-of-way widths north of Douglas Street might preclude the remaining options of a BRT two-lane busway, LRT double tracks, or Heavy Rail elevated tracks, but these could easily be provided in the right-of-way south of Douglas Street.

Operation of any transit option on the Harbor Subdivision raises concerns for the design of signalization and protective equipment at the grade crossings. No train control wayside signalization exists along the length of the Subdivision, and crossing warning devices are both decades old and geared for a slow moving freight operation only. Traffic signals would need to be coordinated with the grade crossing protection to ensure that the rail (or busway) right-of-way would be clear of vehicles stopped for Slauson Avenue well before the approach of a train or bus.

Innovative Solutions to Right-of-Way Width Challenges

By varying assumptions on train frequency, route, termini, and freight train operational patterns, most of the right-of-way width challenges can be overcome. For example, if freight trains between the Metro Blue Line crossing of the Harbor Subdivision at Long Beach Avenue (MP 2.81) and the Metro Green Line crossing at Imperial Highway (MP 13.13) were restricted to a late night/early morning window, then it is conceivable LRT trains and freight trains could use a new double track facility between those points, eliminating the need for additional new right-of-way. Also, a two-lane BRT busway could be paved around freight track (much line a street car track) with signal protection and/or temporal separation of infrequent rail service. More detail on such solutions for DMUs, LRT and BRT options appears in later chapters of this analysis. As noted, the one exception is Heavy Rail, whose elevated structures have a footprint which would exceed the available right-of-way in numerous locations.

It is worth remembering that the widths cited in Table 1-6 are ideal minimum widths. Indeed Metrolink operates today with double track in segments of its own right-of-way on the San Bernardino Line that are less than 40 feet.

IMPROVEMENTS NECESSARY FOR TRANSIT USE

For continued freight operations alone, few improvements are required on the Harbor Subdivision other than maintenance of the track structure consistent with the minimal level of train operations.

Transit options that involve providing the transit on a separate track or guideway parallel to parts or all of the Harbor Subdivision (Non FRA Compliant DMUs, LRT, Heavy Rail, and BRT) obviously will require totally new facilities, meeting all current standards for the transit operations. If the options involve frequent operation of trains or buses, the volumes will probably trigger the need for additional grade separations to avoid delays to both transit and vehicular traffic, as well as to provide an acceptable level of safety. In addition to the transit trackage or guideway, these options are likely to require shifting of the current freight track to one side of the available right-of-way, in order to make room for both rail freight and transit lines. Anyplace this shift is greater than a few feet will mean reconstruction of the freight track with new or used materials, and at a standard consistent with the planned continued freight operation.

Transit options that involve use of the existing freight track, such as FRA Compliant DMU operations, will require reconstruction of the freight track to accommodate the higher speeds of the passenger service. On a non-signaled railroad, operating speeds up to 60 mph are permitted on Class 3 track. Where current track consists of 115-pound per linear yard rail or greater, existing rail can be used. However, substantial portions of the Harbor Subdivision have rail of 112-pound weight (too light for passenger use), and much of this was installed about 40 years ago. Thus, it is reasonable to assume that most of the rail will need replacement even for low frequency DMU operations. This analysis estimates that, based on available data on BNSF track charts, 100 percent replacement would be required for approximately 18 miles of freight track in the six segments shown in Table 1-8. For DMU operations on freight track, this analysis assumes that freight track would be rebuilt to Class 4 standards with wayside signals, allowing for a maximum speed of 80 mph.

Table 1-8 100 Percent Track Replacement
Milepost 0.0 to 1.8: Harbor Junction to 55th Street
Milepost 2.3 to 10.9: 2nd Street to west of Hindry Avenue
Milepost 12.4 to 16.8: South of 104th Street to south of Inglewood Avenue
Milepost 17.1 to 18.4: South of 116th Street to south of 182nd Street
Milepost 18.7 to 20.0: North end of Alcoa Yard in Torrance
Sources: BNSF Track Charts and WSA

If freight track were used for DMU operations, ties and ballast also will require renewal, with an estimated 60 percent of the ties requiring replacement where track is not changed out, and 100 percent renewal where new track is installed. Again, based on data contained in the track charts, it appears that 100 percent tie replacement would be required from milepost 0.00 (Harbor Junction) to 13.00 (south of 111th Street), and 60 percent replacement from milepost 13.00 (south of 111th Street) to 20.00 (north end of Alcoa Yard).

A 100 percent replacement of track, ties, and ballast also would be needed at track transition locations, where there are changes in the track support structure such as at bridges, grade crossings, turnouts, and crossings of other rail lines. These locations present greater stress and replacement would be necessary for ride quality, safety, and reduction of long term maintenance costs. There are approximately 30 turnouts (switches) along the Harbor Subdivision. Some of these might be removed if they are no longer needed for access to local industrial users. In addition, there are railroad grade crossings at milepost 2.80 (UP at Long Beach Avenue) and at milepost 14.63 (also UP at Douglas Street) that would require replacement and interlocking signals (signals that control the rail-to-rail crossing). Grade crossings would need to be rebuilt to standards per Title 49 CFR Part 234 Grade Crossing Signal Safety.

All of the options, other than freight-only use and Heavy Rail transit on elevated or underground guideways, will trigger a complete need to upgrade and retime the flashing lights, automatic gates, and other protective devices at grade crossings, and install wayside signals. The primary need is to retime the operation of the lights and gates to reflect the higher transit vehicle speeds. However, since many of the options will require shifting of the freight track and construction of totally new transit tracks, the lights and gates will need to be relocated outward within the right-of-way and will probably require all new installations.

SUMMARY

The Harbor Subdivision presents an opportunity for transit use, but not without significant improvements. All options under analysis would require new facilities, and all at-grade options would require new grade crossing protection devices. Some street closures may be prudent to enhance safety, but street closures *per se* were not part of this analysis. Because at-grade transit options, both rail and bus, would traverse existing crossings in a matter of seconds, it is not likely that any of these options will trigger the need for grade separations.

Chapter 2
SURFACE ENVIRONMENTAL CONSTRAINTS

INTRODUCTION

This chapter evaluates the surface environmental constraints inherent in implementing various transit modes on Metro's Harbor Subdivision for transit service. Specifically, surface environmental constraints include:

- ***Noise and Vibration Impacts:*** Noise and vibration sensitive land uses are locations where people reside or where the presence of unwanted sound could have adverse affects. Land uses such as residences, schools, hospitals, guest lodging, libraries, and some passive recreation areas would be considered noise and vibration sensitive and thus constraints, which may warrant measures for protection from intruding noise and vibration. For this analysis, the potential for a noise and vibration impact is not dependent on the number of receptors: a noise constraint to just one residence is a noise constraint.
- ***Park and Recreational Facilities:*** For purposes of this analysis, any City, County, or State designated park or recreation area located adjacent to the rail corridor may be considered an environmental constraint, which may preclude the potential acquisition of right-of-way.
- ***Right-of-Way Width Restrictions:*** These restrictions pertain to areas where the existing right-of-way is insufficient to accommodate joint transit and freight rail uses. In such locations, acquisition of right-of-way may be required.
- ***Elevated Structures:*** These would include a freeway overcrossing of the Harbor Subdivision, which would be a constraint for a grade separated, elevated Heavy Rail line (defined in the next section) running along the subdivision. The overcrossing would force the Heavy Rail line to either return to grade or pass under the overcrossing in a subway.
- ***Cultural Resources:*** For the purpose of this analysis, any City, County, or State designated historic resources located adjacent to the rail corridor may be considered an environmental constraint, precluding the potential acquisition of right-of-way.
- ***Visual Constraints:*** An elevated railway structure may be incompatible with the visual setting and considered a visual constraint in segments of the Harbor Subdivision. For industrial areas, an elevated railway structure would be consistent with the visual quality of the surrounding area and not present a visual constraint. Industrial areas tend to be more urbanized and tolerant of differing types of developments. Many of the industrial areas along the Harbor Subdivision presently contain elevated structures. However, areas containing parks, designated cultural resources, and residential land uses may not be compatible with elevated railway structures. An elevated Heavy Rail line may act as a physical divide and affect the visual quality of the setting and also a divide of residential areas. Parks and designated cultural resources are areas where natural beauty is emphasized. In such places, elevated rail structures may affect the visual setting.
- ***Safety Concerns:*** For this analysis, a safety constraint mostly pertains to a clustering of residences where pedestrians frequently walk on the right-of-way. At-grade crossings per se are not considered safety constraints, as this analysis assumes crossings will have the highest level of protection and warning devices, i.e. automatic gates and flashing lights. Also, Federal Aviation Administration warnings of Light Rail Transit (defined in the next section) or elevated Heavy Rail near airport runways would amount to safety constraints.

MODAL OPTIONS CONSIDERED

This analysis considered potential surface environmental constraints relative to the five transit modes which potentially could be deployed on the Harbor Subdivision. These modes and the basic assumptions for their deployment are:

- *FRA Compliant Diesel Multiple Units (DMUs)* – These are self-propelled rail cars that comply with FRA crashworthiness standards for operation on track shared with freight and conventional passenger rail equipment.
- *Non FRA Compliant Diesel Multiple Units (DMUs)* – These are DMUs that do not conform to the FRA crashworthiness standards for operation on a track shared with freight and conventional passenger rail equipment. Such equipment could only operate on the Harbor Subdivision on track separated from those used for freight operations (spatial separation), or on a time-separated basis (temporal separation).
- *Light Rail Transit (LRT)* – Like the Metro Blue Line, this mode would require new double track and an overhead contact (catenary) system. Freight trains can use LRT track, but only on a time separated basis; otherwise, two separate facilities would be required.
- *Heavy Rail* – Heavy Rail service, like the Metro Red Line, would require a grade-separated, elevated track or a subway.
- *Bus Rapid Transit (BRT)* – Like the Metro Orange Line, BRT is characterized by its own right-of-way, separate from streets, arterials and highways, with its own stations and potentially its own equipment. It could operate on city streets, similar to Metro Rapid bus service.

Metro Rapid bus service is characterized by frequent service, fewer stops versus regular service, color coded buses, enhanced stations with on-line information systems, bus priority at traffic signals and low floor equipment. Metro Rapid operates on city streets, rather than on a fixed guideway as does the Metro Orange Line BRT system. For this analysis, the BRT option would also operate for part of its route on city streets, like Metro Rapid service. Thus, the BRT option in this analysis comprises elements of both Metro BRT service and Metro Rapid bus service.

A conventional commuter rail service, as provided by the Southern California Regional Rail Authority's Metrolink operation, uses locomotive-hauled trainsets which can be operated bi-directionally. Metrolink cars are bi-level cars, maximizing passenger carrying capacity. These trainsets are typically much heavier and longer than DMU trainsets, and generate greater noise and vibration impacts. This analysis used DMUs to represent a commuter rail service operation.

FREIGHT RAIL SERVICE AND IMPLICATIONS FOR TRANSIT MODES

This analysis assumed that BNSF would continue to operate freight rail service on all portions of the Harbor Subdivision indefinitely into the future. Accordingly, BNSF would need access to all portions of the line, even to those which are unused or lightly used now. At the same time, where BNSF traffic is lighter or nonexistent, this analysis assumed that the freight traffic could be shifted to a late night/early morning window, freeing the right-of-way for transit use during most of the day. Specifically:

- Between Harbor Junction (near 25th Street and Santa Fe Avenue) and Malabar Yard (between Pacific Boulevard and 52nd Street), where BNSF trains operate 5 days a week, the trains would retain their current operating patterns.

- Between Malabar Yard and Interstate 105 (I-105), where BNSF trains operate thrice weekly or less, the trains would operate in a late night/early morning window, assuming deployment of Non FRA Compliant DMUs, LRT and BRT.
- Between I-105 and Watson Yard (near Wilmington Avenue and Lomita Boulevard), where BNSF trains are more frequent, the trains would retain their current operating patterns.

Assumptions used for the evaluation of surface environmental constraints relative to the various modal options included the following. For all options, a southern terminus on Sepulveda Boulevard was included for planning purposes. Specific locations for termini and intermediate stations would require further analysis and discussions with local planning authorities.

- ***FRA Compliant DMUs*** would operate on the Harbor Subdivision between 25th Street in Los Angeles and Sepulveda Boulevard in Torrance. They would have a new connection to Los Angeles Union Station (LAUS) via a flyover of the Alameda Corridor and BNSF mainline tracks to Metrolink-controlled tracks adjacent to the Los Angeles River. The DMUs would share track with BNSF freight trains on the Harbor Subdivision.
- ***Non FRA Compliant DMUs*** would operate between the Metro Blue Line crossing (connection to the Blue Line) and Sepulveda Boulevard in Torrance. The DMUs would share track with BNSF freight trains between the Metro Blue Line crossing and the Metro Green Line crossing, given that the BNSF freight trains operate only during a light night/early morning window in this area. They would operate on a separate facility apart from the BNSF freight tracks south of the Green Line crossing.
- ***LRT*** would have a northern terminus at the 7th Street/Metro Center Station in downtown Los Angeles, but would operate on the Harbor Subdivision between the Metro Blue Line crossing and Sepulveda Boulevard in Torrance. LRT would also share track with BNSF freight trains between the Metro Blue Line crossing and the Metro Green Line crossing, given that the BNSF freight trains operate only during a light night/early morning window in this area. They would operate on a separate facility apart from BNSF freight tracks south of the Metro Green Line crossing.
- ***Heavy Rail*** would operate on the Harbor Subdivision between 25th Street in Los Angeles to the Galleria in Torrance. It would have a connection to LAUS, though the route and cost for such is not specified in this report. Heavy Rail would be grade-separated from motor vehicle traffic and have a separate facility from BNSF freight tracks.
- ***BRT*** would operate only in portions of the Harbor Subdivision between the Metro Blue Line crossing (connection to the Metro Blue Line) and Sepulveda Boulevard in Torrance. The portions that would use the right–of-way are between the Metro Blue Line crossing and Manchester Boulevard and Aviation Boulevard and between Rosecrans Avenue and 182nd Street. Between the Metro Blue Line crossing and Manchester Boulevard, where the right-of-way is insufficient to accommodate separate busways and a freight rail track, the freight rail track would be embedded in the busways; freight trains would be restricted to a late night/early morning window in this segment. For the remaining segments of the route, BRT would operate on city streets, as does the Metro Rapid service.

ENVIRONMENTAL CONSTRAINTS BY SEGMENT

This analysis considered the surface environmental constraints relative to the five modal options cited above on the 26.36 miles of the Harbor Subdivision owned by Metro.

Because of the length of the Metro-owned line portion and the varied surrounding land uses, this analysis assesses the corridor by 13 segments. The segments were identified by two considerations: the potential station locations for the transit modes and changes in land uses.

The analysis team visited each segment and utilized previous reports (see Appendix D) and other available information for the following assessments.

1. Harbor Junction to 37th Street

This segment is entirely within the City of Vernon. The northern terminus of the Subdivision and the junction with the BNSF east-west Transcon mainline is near the Los Angeles River. This area is well-suited to accommodate transit traffic. The land uses are primarily industrial and transportation-related. Only right-of-way constraints were noted. Using this segment would be FRA Compliant DMUs and Heavy Rail.

Possible Sensitive Noise and Vibration Constraints: None.

Possible Park and Recreation Constraints: None.

Possible Right-of-Way Constraints: Portions of this right-of-way are about 40 feet in width, which is insufficient for Heavy Rail and freight rail operations.

Possible Elevated Structures Constraints: None.

Possible Cultural Resources Constraints: None.

Possible Visual Constraints: None.

Possible Safety Constraints: None.

2. 37th Street to Slauson Avenue

This segment is entirely within the City of Vernon. This area is also highly compatible for transit use. The land uses are primarily industrial and commercial. Only right-of-way constraints were noted. Using this segment would be FRA Compliant DMUs and Heavy Rail.

Possible Sensitive Noise and Vibration Constraints: None.

Possible Park and Recreation Constraints: None.

Possible Right-of-Way Constraints: Portions of this right-of-way are about 40 feet in width, which is insufficient for Heavy Rail and freight rail operations.

Possible Elevated Structures Constraints: None.

Possible Cultural Resources Constraints: None.

Possible Visual Constraints: None.

Possible Safety Constraints: None.

3. Santa Fe Avenue / Slauson Avenue to Avalon Boulevard

The segment traverses portions of the Cities of Vernon and Los Angeles. Numerous surface environmental constraints were identified in this segment. FRA Compliant DMU, Non FRA Compliant DMU, LRT, Heavy Rail, and BRT modes would use either part or all of this segment.

Possible Sensitive Noise and Vibration Constraints: The following areas adjacent to the rail corridor contain noise and vibration sensitive land uses:

- Augustus Hawkins Natural Park, located adjacent to the rail corridor at Slauson Avenue between Fortuna Street and Compton Avenue.
- The Los Angeles Academy Middle School located adjacent to the rail corridor between Avalon Boulevard and Paloma Avenue.
- Avalon Memorial Medical located at Avalon Boulevard on the south side of the rail corridor.

With the Non FRA Compliant DMU, LRT and BRT modes, the thrice weekly freight rail service will be pushed to a nighttime window. The nighttime freight operations will trigger greater potential impacts to noise and vibration sensitive land uses as opposed to daytime operations. Also, LRT, Heavy Rail, and BRT would require major construction, triggering short-term noise impacts.

Possible Park and Recreation Constraints: Overall, the rail corridor is located in a highly built-out urban setting. Park and open space and recreational options are limited to a few areas along the 26.36-mile corridor. In this segment, one park exists:

- Augustus Hawkins Natural Park, adjacent to the rail corridor at Slauson Avenue between Fortuna Street and Compton Avenue.

The DMU alternatives can be implemented within the existing right-of-way, without possible right-of-way acquisition from parkland. This is true for LRT and BRT, as freight tracks can be added between LRT double track or within the two-lane busway for short segments. This would not be the case for Heavy Rail.

Possible Right-of-Way Constraints: The rail corridor right-of-way in this segment is limited to 30 feet in a few sections. This limited amount of right-of-way is a constraint for Heavy Rail with the continued operation of freight rail service.

Possible Elevated Structures Constraints: Heavy Rail on an elevated structure would be constrained by the presence of the Blue Line overcrossing at Slauson Avenue and Long Beach Avenue. The constraint might be avoided by placing the Heavy Rail option in a subway.

Possible Cultural Resources Constraints: None.

Possible Visual Constraints: None.

Possible Safety Constraints: None.

4. Avalon Boulevard to Western Avenue (Slauson and Western area)

This segment is within the City of Los Angeles. Numerous surface environmental constraints were identified. FRA Compliant DMU, Non FRA Compliant DMU, LRT, Heavy Rail, and BRT modes would use this segment.

Possible Sensitive Noise and Vibration Constraints: The following areas adjacent to the rail corridor contain noise and vibration sensitive land uses:

- Residences adjacent to the rail corridor and located from Main Street to Western Avenue.

With the Non FRA Compliant DMU, LRT and BRT modes, the thrice weekly freight rail service will be pushed to a nighttime window. The nighttime freight operations will trigger greater potential impacts to noise and vibration sensitive land uses as opposed to daytime operations. Also, LRT, Heavy Rail, and BRT would require major construction, triggering short-term noise impacts.

Possible Park and Recreation Constraints: None.

Possible Right-of-Way Constraints: The rail corridor right-of-way in this segment is limited to 30 feet in a few sections. This limited amount of right-of-way is a constraint for Heavy Rail with the continued operation of freight rail service.

Possible Safety Constraints: None.

Possible Elevated Structures Constraints: Elevated Heavy Rail would be constrained by the presence of the Interstate 110 (I-110) Freeway overcrossing.

Possible Cultural Resources Constraints: None.

Possible Visual Constraints: None.

Possible Safety Constraints: None.

5. Western Avenue to Crenshaw Boulevard

This segment is within the City of Los Angeles. Numerous surface environmental constraints were identified. FRA Compliant DMU, Non FRA Compliant DMU, LRT, Heavy Rail, and BRT modes would use this segment.

Possible Sensitive Noise and Vibration Constraints: The following areas adjacent to the rail corridor contain noise and vibration sensitive land uses:

- A few residences located less than 100 feet from the rail corridor at Wilton Street.
- Residences located across from Hyde Park Boulevard between Fourth Avenue and Seventh Avenue.
- Residences located adjacent to the rail corridor at 66th Place and 11th Avenue.
- Hyde Park Elementary School located near Hyde Park and Eighth Avenue.

With the Non FRA Compliant DMU, LRT and BRT modes, the thrice weekly freight rail service will be pushed to a nighttime window. The nighttime freight operations will trigger greater potential impacts to noise and vibration sensitive land uses as opposed to daytime operations. Also, LRT, Heavy Rail, and BRT would require major construction, triggering short-term noise impacts.

Possible Park and Recreation Constraints: None.

Possible Right-of-Way Constraints: The rail corridor right-of-way at one point is limited to 30 feet. This limited amount of right-of-way is a constraint for Heavy Rail with the continued operation of freight rail service.

Possible Elevated Structures Constraints: None.

Possible Cultural Resources Constraints: None.

Possible Visual Constraints: The elevated Heavy Rail alternative is less desirable in this area. The presence of residential land uses presents a visual constraint for an elevated Heavy Rail structure.

Possible Safety Constraints: None.

6. Crenshaw Boulevard to Manchester Boulevard/Aviation Boulevard

This segment is within the Cities of Los Angeles and Inglewood. Numerous surface environmental constraints were identified. FRA Compliant DMU, Non FRA Compliant DMU, LRT, Heavy Rail, and BRT modes would use this segment.

Possible Sensitive Noise and Vibration Constraints: The following areas adjacent to the rail corridor contain noise and vibration sensitive land uses:

- Inglewood Park Cemetery located across Florence Avenue.
- Edward Vincent Park, formerly known as Centinela Park, located at Centinela Avenue and Florence Avenue.

With the Non FRA Compliant DMU, LRT and BRT modes, the thrice weekly freight rail service will be pushed to a nighttime window in this segment. The nighttime freight operations will trigger greater potential impacts to noise and vibration sensitive land uses as opposed to daytime operations. Also, LRT, Heavy Rail, and BRT would require major construction, triggering short-term noise impacts.

Possible Park and Recreation Constraints: Edward Vincent Park is located adjacent to the rail corridor. The rail corridor right-of-way is limited mostly to 50 feet. This limited amount of right-of-way is a constraint for implementation of Heavy Rail with the continued operation of freight rail service. The DMU, LRT, and BRT alternatives could operate within the existing right-of-way. Acquisition of new right-of-way could be required for Heavy Rail. Such acquisition could impact parkland.

Possible Right-of-Way Constraints: The rail corridor right-of-way is limited mostly to 50 feet. This limited amount of right-of-way is a constraint for implementation of Heavy Rail with the continued operation of freight rail service.

Possible Elevated Structures Constraints: None.

Possible Cultural Resources Constraints: According to the Crenshaw-Prairie Transit Corridor Major Investment Study, Centinela Springs is a California Historic Landmark located in this area. It is located inside Edward Vincent Park, which is adjacent to the right-of-way. Heavy Rail may require right-of-way acquisition, which could impact Centinela Springs.

Possible Visual Constraints: The elevated Heavy Rail alternative is less desirable in this area. The presence of park, cultural resource, and residential land uses presents a visual constraint for an elevated Heavy Rail structure.

Possible Safety Constraints: None.

7. Manchester Boulevard/Aviation Boulevard to I-105 (Imperial Highway)

This segment runs through portions of the Cities of Los Angeles and Inglewood. This area is well-suited to accommodate transit traffic. The land uses are primarily industrial and transportation-related. Still, numerous surface environmental constraints were identified. FRA Compliant DMU, Non FRA Compliant DMU, LRT, and Heavy Rail modes would use this segment.

Possible Sensitive Noise and Vibration Constraints: The Century Boulevard overcrossing is only a single-track overcrossing. Both of the DMU alternatives could operate on the existing single track; LRT and Heavy Rail could not. Implementing LRT and Heavy Rail here would require major construction, triggering short-term noise and vibration impacts.

Possible Park and Recreation Constraints: None.

Possible Right-of-Way Constraints: As there is only a single track viaduct over Century Boulevard; LRT and Heavy Rail would require new facilities to cross Century Boulevard. While the LRT improvements could be implemented within the existing right-of-way, Heavy Rail would require additional right-of-way.

Possible Elevated Structure Constraints: Heavy Rail may be constrained by the elevated portion of Interstate 105 (I-105), and also the elevated portion of the Green Line. This constraint might be avoided by placing the Heavy Rail option in a subway.

Possible Cultural Resources Constraints: None.

Possible Visual Constraints: None.

Possible Safety Constraints: Implementing LRT and Heavy Rail would require below-grade construction along the airport itself. The Federal Aviation Administration (FAA) has previously expressed concerns of electromagnetic interference of the Green Line's overhead contact (catenary) system (OCS) with airport navigational aids and intrusion of the rail guideway and OCS into the runway protection zones for Runways 25L and 25R. To avoid these potential conflicts, LRT and Heavy Rail would likely have to operate in a subway or a trench alignment east of the runways.

8. I-105 to El Segundo Boulevard

This segment runs through portions of the Cities of Los Angeles and El Segundo. The land uses in this area are primarily industrial and transportation-related. Still, numerous surface environmental constraints were identified. FRA Compliant DMU, Non FRA Compliant DMU, LRT, and Heavy Rail modes would use this segment.

As previously noted, from I-105 south to Watson Yard, this analysis assumed that freight rail service is frequent enough that it cannot be pushed to a late night/early morning window. Accordingly, it assumed spatial separation for Non FRA Compliant DMUs, LRT and BRT, along with the requisite rights-of-way widths. Heavy Rail would also have a separate facility.

Possible Sensitive Noise and Vibration Constraints: The only noise and vibration sensitive land uses are residences located across North Aviation Boulevard between 118th Street and 124th Street. LRT and Heavy Rail would require major construction, triggering short-term noise impacts.

Possible Park and Recreation Constraints: None.

Possible Right-of-Way Constraints: This segment has a right-of-way width of 60 feet. This limited amount of right-of-way is a constraint for Heavy Rail with the continued operation of freight rail service.

Possible Elevated Structures Constraints: None.

Possible Cultural Resources Constraints: None.

Possible Visual Constraints: None.

Possible Safety Constraints: None.

9. El Segundo: El Segundo Boulevard to Rosecrans Avenue

This segment is in the City of El Segundo. This area is well-suited to accommodate all modes. The land uses in this area are primarily industrial and transportation-related. Still, numerous surface environmental constraints were identified. FRA Compliant DMU, Non FRA Compliant DMU, LRT, and Heavy Rail modes would use this segment.

Possible Sensitive Noise and Vibration Constraints: None.

Possible Park and Recreation Constraints: None.

Possible Right-of-Way Constraints: This segment has a right-of-way width as narrow as 60 feet in some locations. This limited amount of right-of-way is a constraint for Heavy Rail with the continued operation of freight rail service.

Possible Elevated Structures Constraints: Elevated Heavy Rail may be constrained by the proximity of the elevated portion of the Metro Green Line and the presence of the Rosecrans Avenue and Aviation Boulevard underpass.

Possible Cultural Resources Constraints: None.

Possible Visual Constraints: None.

Possible Safety Constraints: None.

10. Rosecrans Avenue to Manhattan Beach Boulevard

This segment runs through portions of the Cities of Hawthorne, Redondo Beach and Lawndale. This area is also well-suited to all modes. The land uses in this area are primarily commercial.

Possible Sensitive Noise and Vibration Constraints: None.

Possible Park and Recreation Constraints: None.

Possible Right-of-Way Constraints: None.

Possible Elevated Structures Constraints: Elevated Heavy Rail may be constrained by the proximity of the elevated portion of the Metro Green Line and the presence of the Rosecrans Avenue and Aviation Boulevard underpass.

Possible Cultural Resources Constraints: None.

Possible Visual Constraints: None.

Possible Safety Constraints: None.

11. Manhattan Beach Boulevard to 190th Street

This segment runs through portions of the Cities of Lawndale, Redondo Beach, and Torrance. Numerous surface environmental constraints were identified. FRA Compliant DMU, Non FRA Compliant DMU, LRT, Heavy Rail and BRT modes would use this segment.

Possible Sensitive Noise and Vibration Constraints: The following areas adjacent to the rail corridor contain noise and vibration sensitive land uses:

- Residences located adjacent to both sides of the rail corridor starting at 159th Street and continuing to 162nd Street.
- Residences located on the east side of the rail corridor between 162nd Street and 170th Street.
- Residences located on both sides of the rail corridor from 170th Street to Artesia Boulevard.
- Pacific Crest Cemetery located on Grant Avenue and Inglewood Avenue.
- El Nido Park located at 182nd Street and Kingsdale Avenue.
- Residences located on the west side of the rail corridor between 182nd Street and Spreckels Court.
- A sensitive receptor, a medical building, located at Hawthorne Boulevard and 190th Street.

Non FRA Compliant DMU, LRT, Heavy Rail, and BRT alternatives will require major construction, triggering short-term impacts to noise and vibration sensitive land uses through this segment.

Possible Park and Recreation Constraints: None.

Possible Right-of-Way Constraints: None.

Possible Elevated Structures Constraints: None.

Possible Cultural Resources Constraints: None.

Possible Visual Constraints: An elevated Heavy Rail alternative is less desirable in this area. The presence of park and residential land uses in this segment presents a visual constraint for an elevated Heavy Rail structure.

Possible Safety Constraints: This area has numerous residences located adjacent to both sides of the rail corridor. Residents can be observed crossing the tracks on foot on a frequent basis. With the exception of

Heavy Rail, all of the modal alternatives could result in increased safety concerns. Heavy Rail, which is grade separated, would have the least amount of safety issues from residents crossing the tracks.

12. 190th Street to Vermont Avenue

This segment runs through portions of the Cities of Torrance and the County of Los Angeles. Numerous surface environmental constraints were identified. FRA Compliant DMU, Non FRA Compliant DMU, and LRT modes would use this segment.

Possible Sensitive Noise and Vibration Constraints: The following areas adjacent to the rail corridor contain noise and vibration sensitive land uses:

- Residences located on both sides of the rail corridor from Crenshaw Boulevard to West Carson Street.
- Nativity Catholic School located adjacent to the rail corridor at West Carson Street.
- Torrance High School located within 400 feet of the rail corridor.
- Wilson Park and Torrance Elementary School located adjacent to the corridor at Washington Avenue.
- Torrance Park located at Arlington Avenue.
- Residences located on both sides of the rail corridor from Cabrillo Avenue to Sepulveda Boulevard.
- Residences located on the southwest side of the rail corridor between Walnut Street and Western Avenue.
- Residences located on both sides of the rail corridor from South Western to 238th Street; residences located on both sides of the rail corridor from Stonebryn Drive to Vermont Avenue.

Non FRA Compliant DMU and LRT alternatives will require major construction, triggering short-term impacts to noise and vibration sensitive land uses.

Possible Park and Recreation Constraints: None.

Possible Right-of-Way Constraints: None.

Possible Elevated Structures Constraints: None.

Possible Cultural Resources Constraints: None.

Possible Visual Constraints: Installation of a separate single track facility for Non FRA Compliant DMUs and a double track facility for LRT in addition to relocating the freight rail track south of Crenshaw Boulevard to Sepulveda Boulevard in Torrance would likely present a visual constraint for residents living adjacent to the right-of-way.

Possible Safety Constraints: The area south of Crenshaw Boulevard to Sepulveda Boulevard in Torrance has numerous residences located adjacent to both sides of the rail corridor. Residents in this area cross the tracks on foot on a frequent basis. The DMU and LRT modal alternatives could result in increased safety concerns.

13. Vermont Avenue to Watson Rail Yard (Lomita Boulevard)

This segment runs through portions of the County of Los Angeles and the Cities of Carson and Los Angeles. Numerous surface environmental constraints were identified.

None of the modal options included in this assessment are envisioned to run south of Sepulveda Boulevard (Segment 12). Nevertheless, the constraints were analyzed, assuming extension of DMU and LRT options.

Possible Sensitive Noise and Vibration Constraint: The following areas adjacent to the rail corridor contain noise and vibration sensitive land uses:

- Residences located on both sides of the rail corridor from Marebella Avenue to Avalon Boulevard.
- Residences located on the southwest side of the rail corridor between Avalon Boulevard and East Street.
- Residences located on both sides of the rail corridor from East Street to Wilmington Avenue.
- Wilmington Cemetery, located on Eubank Avenue.
- Residences located on both sides of the rail corridor from East L Street to East Grant Street.

Non FRA Compliant DMU and LRT alternatives will require major construction, triggering short-term impacts to noise and vibration sensitive land uses through this segment.

Possible Park and Recreation Constraints: None.

Possible Right-of-Way Constraints: None.

Potential Elevated Structures Constraints: None.

Possible Cultural Resources Constraints: None.

Possible Visual Constraints: None.

Possible Safety Constraints: This area has residences located adjacent to both sides of the rail corridor. Residents could cross the tracks on foot. Implementation of DMU and LRT service in this area could result in increased safety concerns.

SUMMARY ASSESSMENT BY MODE AND SEGMENT

Table 2-1 summarizes the presence of surface environmental constraints identified for the DMU, LRT, Heavy Rail and BRT alternatives using the Metro-owned Harbor Subdivision.

The foregoing analysis identifies the short-term construction that would generate short-term noise and vibration impacts, given specific assumptions of modes in specific route segments. The construction-related impacts pertained mostly to options other than FRA Compliant DMUs, as this mode could use the existing freight rail track through the length of the corridor. It is important to note, however, that there will be construction required for this option as well: the need to upgrade the existing line to handle higher speed DMUs. The pending operating plans for each of the modal options will identify more precisely where the construction for all modes will occur.

Because of the preponderance of environmental constraints facing the potential implementation of Heavy Rail service on the Harbor Subdivision (as seen the Table 2-1), this mode was dropped from further evaluation.

Table 2-1: Summary of Surface Environmental Constraints of Transit Modes

Segment	FRA Compl. DMU	Non FRA Compl. DMU	LRT	Heavy Rail	BRT	Surface Environmental Constraint
1				X		Possible right-of-way constraints
2				X		Possible right-of-way constraints
3		X	X	X	X	Possible noise and vibration constraints
3				X		Possible park and recreation constraints
3				X		Possible elevated structure constraints
4		X	X	X	X	Possible noise and vibration constraints
4				X		Possible right-of-way constraints
4				X		Possible elevated structure constraints
5		X	X	X	X	Possible noise and vibration constraints
5				X		Possible right-of-way constraints
5				X		Possible elevated structure constraints
6		X	X	X	X	Possible noise and vibration constraints
6				X		Possible park and recreation constraints
6				X		Possible right-of-way constraints
6				X		Possible cultural resource constraints
6				X		Possible visual constraints
7			X	X		Possible noise and vibration constraints
7				X		Possible right-of-way constraints
7				X		Possible elevated structure constraints
7			X	X		Possible safety constraints
8			X	X		Possible noise and vibration constraints
8				X		Possible right-of-way constraints
9				X		Possible right-of-way constraints
9				X		Possible elevated structure constraints
10				X		Possible elevated structure constraints
11		X	X	X	X	Possible noise and vibration constraints
11				X		Possible visual constraints
11	X	X	X		X	Possible safety constraints
12		X	X			Possible noise and vibration constraints
12		X	X			Possible visual constraints
12	X	X	X			Possible safety constraints
13		X	X			Possible noise and vibration constraints
13	X	X	X			Possible safety constraints

Chapter 3
POTENTIAL STATION LOCATION ANALYSIS

INTRODUCTION

This chapter evaluates 13 potential locations for transit service stations on the Harbor Subdivision. The evaluation is based on an assessment of specific qualities inherent in each location relative to transit. These locations represent a "universe" of potential station sites for the transit alternatives identified in Chapter 4 and analyzed in Chapter 5. The stations specific to the individual transit alternatives comprise a subset of this universe. For example, of two potential locations within a short distance of each other, only one would have been included in the assessment of potential modes in Chapter 5.

The following analysis evaluates specific street crossing areas as potential transit locations rather than specific station plans. In general, a simple station platform was assumed for all modes. The compatibility of platform-adjacent park-and-ride lots and connectivity with existing Metro bus service were not specifically assessed. Neither environmental assessments of the locations nor detailed discussions with the relevant jurisdictions were undertaken. Informal discussions with the City of Torrance disclosed that Sepulveda Boulevard may not be a suitable location for a transit station.

As noted previously, the BRT alternative assumes a terminus at Sepulveda Boulevard and Hawthorne Boulevard, approximately three miles west of the Harbor Subdivision, and the FRA Compliant DMU alternatives assumed a northern terminus at LAUS. This analysis focused only on stations along the Harbor Subdivision.

METHODOLOGY

The initial stages of the location evaluation and mapping analysis aimed to achieve an overall picture of the corridor as well as within a quarter mile buffer zone. The research drew upon existing data, internet searches and aerial imaging. In some cases, telephoning schools, hospitals and community amenities was necessary to confirm that the information presented was up-to-date. This research provided land use information enabling comparison between the various cities and segments through which the Subdivision passes. A wide variety of land uses were found: agricultural, commercial, industrial, residential, open space, recreational, public facilities, transit oriented etc. In addition, connections to the existing Metro rail system and other major transport connections (freeways, etc.) were noted.

Members of the analysis team completed a drive/walk of the entire subdivision. The focus was a closer examination of the segments of the Harbor Subdivision aimed at gathering relevant data for deciding on possible station locations. Follow-up visits were made to a range of crossings to assess more detailed localized qualities. Sketches, notes and photographs were made of the crossing sites and their surrounding areas in order to identify local characteristics. From this site analysis, a description of each of the possible stations locations was drawn. Each station was looked at within the following framework:

- *General* – Gives a general description of the crossing area and surrounding vicinity. Qualities such as the amount of retail, pedestrian activity, or whether there was any redevelopment visible in the area were noted.
- *Concerns* – Describes issues or problems foreseen which might arise from use of the right-of-way for transit use in the future. For example, if there were environmental issues found which would be

a potential constraint to future use of the right-of-way (such as noise, vibration, visibility, safety or residential proximity).

- *Amenities* – Highlights services in the area. Because some areas through which the right-of-way passes are primarily industrial, "amenities" was interpreted in general terms as that which provides a service or convenience to the local area. Proximity to major transportation facilities such as a freeway or Metro line in an area which had little other public transport was seen as an amenity.
- *Residential* – Describes the type of housing in that area, the level of density and if new residential development was visible. Where proximity of housing to the right-of-way was such that noise or safety issues were raised this was mentioned under "concerns".
- *Business* – Describes the amount of business, office space or retail in the area and mentions, where known, whether the office space is purpose built or is re-use of buildings.
- *Potential* – Suggests whether there would be space for a platform, and other supporting issues (such as opportunities to enhance the local area) which might be the potential result of a transit line.

All of the potential station areas covered have real potential for future use with the exception of the station on Sepulveda Boulevard. Land uses south of Sepulveda Boulevard become increasingly industrial and residential land uses decline correspondingly. Thus, the station at Sepulveda Boulevard has been included for costing purposes only.

A map showing the station locations analyzed appears as Figure 3-1 on the following page. All are on the Harbor Subdivision. A site for a BRT station at Hawthorne Boulevard and Sepulveda Boulevard, a location off the Harbor Subdivision, was not part of this analysis.

STATION LOCATION ANALYSIS

Station at Slauson Avenue and Long Beach Avenue

General – Industrial land uses exist along Slauson Avenue. The buildings which run along the north and south sides of Slauson Avenue are mainly industrial and storage oriented, and have mainly blank walls to the street. Trucks park on the north side of Slauson Avenue on both sides of the rail tracks, 15-20 feet from the track. Miramonte Center Department of Water and Power is on the southwest corner.

Concerns – Very little business or retail is visible along Slauson Avenue. The Harbor Subdivision is on the north side of Slauson Avenue and the elevator access to the Metro Blue Line station (elevated) is on the south side of Slauson Avenue. Thus, transitioning from the Harbor Subdivision to the Metro Blue Line would require crossing the four traffic lanes of Slauson Avenue.

Amenities – A station here would have access to the Metro Blue Line, which provides direct access to downtown. The Metro Blue Line runs in the median of Long Beach Avenue and has an elevated station on Slauson Avenue.

Residential – Medium density residential land uses exist in the area, more visibly to the west of Long Beach Avenue. Single family housing exists one block north and south of Slauson Avenue.

Business – Little or no retail is visible along Slauson Avenue. Land uses are primarily industrial.

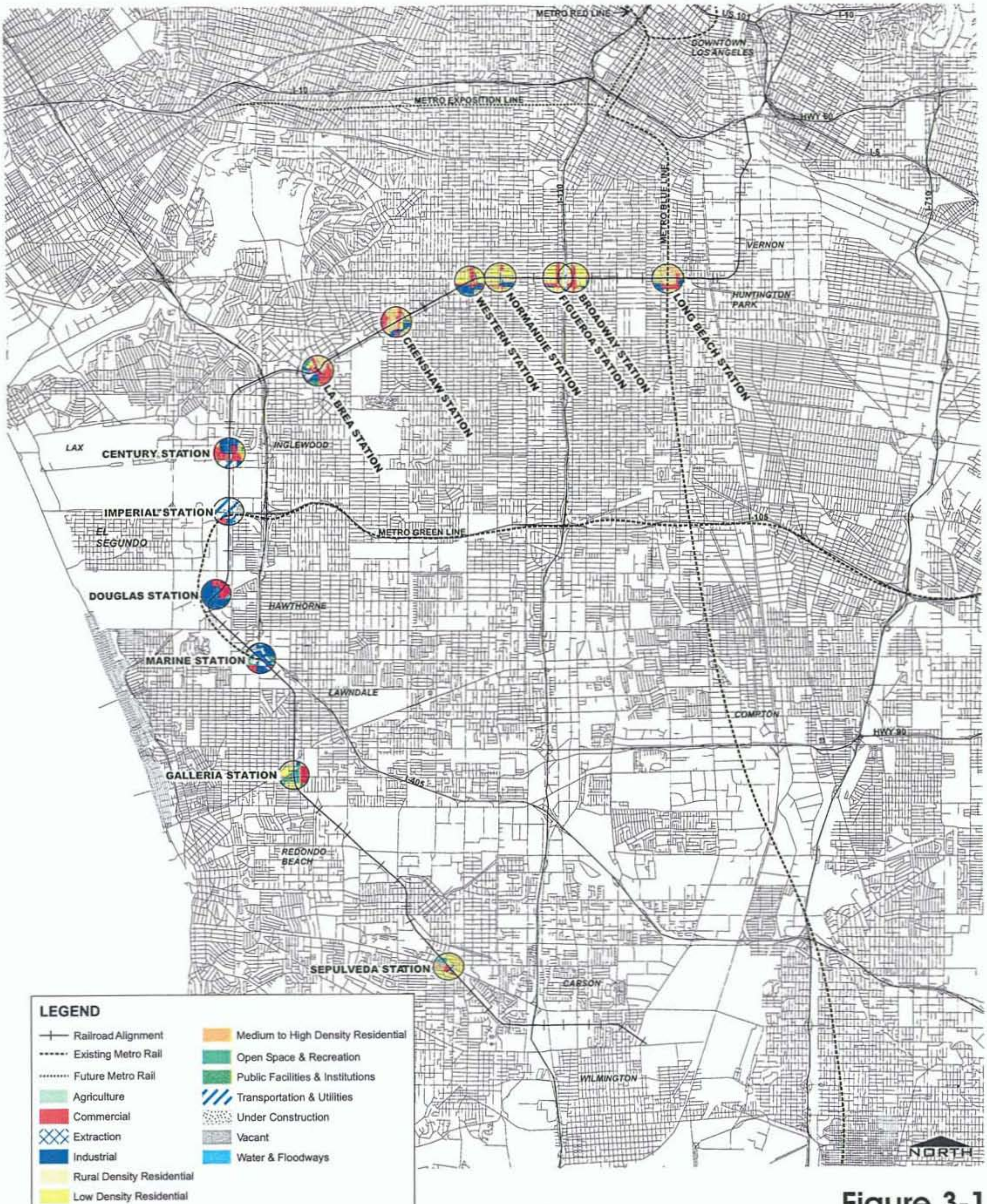


Figure 3-1
Potential Station Areas

Potential – The Metro Blue Line connection on Slauson Avenue at Long Beach gives access to the Metro light rail system. There is sufficient space on the north side of Slauson Avenue for a possible station platform. The possibility exists for a landscaped pedestrian/bicycle link from a new station (and the existing Metro Blue Line station) to Augustus Hawkins Park, a distance of approximately a quarter of a mile.

Station at Slauson Avenue and Broadway

General – This is a lively intersection with a good deal of pedestrian traffic.

Concerns – The I-110 Freeway is one block west. Delays to freeway access could be caused by an active passenger transit system. There are potential noise and vibration issues due to residential areas being adjacent to the rail line north of Slauson Avenue between South Broadway and South Main Street.

Amenities – There is nearby access to the I-110 Freeway. There are mixed-use buildings (retail at ground level with apartments above) one block north of Slauson Avenue and additional retail an additional one block north. There is a Mobil gas station and a church on the southeast corner of the intersection, with an auto shop on the southwest corner. A Community Assessment Service Center lies one block north on Broadway.

Residential – There are some residential land uses nearby the intersection, with single family housing starting one block north and south of Slauson Avenue.

Business – There is a mix of small scale business in the area, along with retail and community services. Some new retail (for example Urban Legends sports store) has opened further up on Broadway at 84th Street.

Potential – There is an architecturally significant building on the northwest corner (a disused Architectural Salvage Building) which has potential for re-use as a mixed-use building and/or possibly a new station development.

Station at Slauson Avenue and Figueroa Street

General – There is a lively feel to the area which has some sizable older buildings as well as mature trees and palms. More retail is visible on the south side of Slauson Avenue (west of Figueroa Street) than on intersections to the east with, for example, tiling and plumbing outlets.

Concerns – A station could potentially cause delays to access the I-110 Freeway. There are potential noise and vibration issues due to residential areas being adjacent to the rail line west of Figueroa Street.

Amenities – There is a strip mall on the southwest corner and a dental office on the northwest corner.

Residential – There are residential developments on both sides of Figueroa Street, north of 56th Street. Medium density single family housing lies one block north and south of the intersection.

Business – There are no businesses or professional offices visible in the area.

Potential – There is sufficient space for a station platform on both the northeast (a vacant lot adjacent to the Water and Power Building) and northwest (lawn area adjacent to the dental office) corners. The former is the larger of the two. There are also architecturally significant buildings in the area: the Water and Power Building on the northeast corner and a large church one block to the north.

Station at Slauson Avenue and Normandie Avenue

General – Industrial land uses exist along Slauson Avenue. Blank walls and the rear of industrial/storage buildings line both the north and south sides of Slauson Avenue. A great deal of graffiti is visible on industrial buildings on the northeast corner of the intersection.

Concerns – There are potential noise and vibration issues due to residential areas adjacent to the rail line between Normandie and Denker Avenue (½ mile to the west).

Amenities – Land uses are primarily industrial. There are few stores or public amenities visible.

Residential – Light and medium density single family homes can be found one block north and south of Slauson Avenue. While industrial and warehouse buildings line Slauson Avenue on the north and south sides, residential areas are to the south.

Business – There is little or no retail visible along Slauson Avenue. Land uses are primarily industrial. Office furniture workshops, welding shops and auto yards can be seen on the south side of Slauson Avenue.

Potential – There is sufficient space both east and west of the crossing for a possible platform on the north side of Slauson Avenue.

Station at Slauson Avenue and Western Avenue

General - The rail line crosses Western Avenue one block south of Slauson Avenue. The Slauson/Western intersection is very active with a good deal of pedestrian activity. There is a more up-market feel here compared to intersections further east on Slauson Avenue. Recent redevelopment is apparent in the area, for example a new residential development just west of the intersection and a newly painted church on the south side of the rail line.

Concerns – The rail track is one block south of Slauson Avenue, so it is slightly removed from the main areas of pedestrian activity. There are potential noise and vibration issues in this area as the rail track turns southwest and passes through primarily residential areas. In particular, some residences are located less than 100 feet from the rail line at Wilton Street.

Amenities – Southwest of the intersection is a large, relatively new, shopping center with a variety of stores and food outlets. There is also a large parking area. There is an auto shop and gas station on the northeast corner of the Slauson Avenue/Western Avenue intersection. The L.A. Design Center, which is the recipient of many national design awards, is southwest of the rail crossing and includes the newly opened Maestro Café.

Residential – There are no residential land uses immediately adjacent to the rail crossing, but residential areas can be found approximately one block from the rail line. There is also a new residential development of single family homes and condominiums just west of the Slauson Avenue/Western Avenue intersection.

Business – There is a great deal of retail in the area. There are few businesses or professional offices visible.

Potential – On the south east corner of the rail crossing there is a large car park (adjacent to a church) that is used mainly by the nearby 'Super Mall'. There is sufficient space here for a potential platform.

Station at Crenshaw Boulevard and 67th Street

General - There are primarily industrial land uses adjacent to the rail track on both sides of the crossing at Crenshaw Boulevard. The north and south sides of the track are lined with the backs of industrial and storage buildings.

Concerns - There are potential noise and vibration issues due to residential areas being adjacent to the rail line. In particular, these include residences located adjacent to the rail line at 66th Place and 11th Avenue. Hyde Park Elementary School (near Hyde Park and 8th Avenue) also presents potential noise and vibration issues.

Amenities – There is a small strip mall on the northwest corner of Crenshaw Boulevard and 67th Street, with auto and truck repair (with parking) on the southeast corner of the crossing.

Residential – Medium density single family homes are one or two blocks north and south of the rail track outside the industrial areas.

Business – There are a variety of professional offices and services along with mixed retail and fast food establishments on both sides of Crenshaw Boulevard from the crossing south to Florence Avenue.

Potential – There is sufficient space on both southern corners of Crenshaw Boulevard and 67th Street for a possible platform. A station would provide improved access to the future Crenshaw Transit Corridor i.e. the existing Metro Rapid service with BRT-LRT possibilities.

Station at La Brea Avenue and Florence Avenue

General – This area is the northern gateway to Downtown Inglewood. The area accommodates commercial and city/county civic center functions, with Municipal and Superior Court buildings as well as local community center buildings.

La Brea Avenue and Florence Avenue is a busy traffic intersection, with pedestrian activity along adjacent streets. An industrial area continues west from the rail crossing to the I-405 Freeway.

New development is visible in the area. For example, the lot to the southeast of the rail crossing is to be a 45,000 square foot retail/restaurant/entertainment development. The adjacent Duckett-Wilson Shopping Center will also undergo a major renovation as this new development is finalized.

Concerns – There are potentially noise and vibration issues due to the presence of Edward Vincent Park (formerly Centinela Park) at Centinela Avenue and Florence Avenue, and also Inglewood Park Cemetery, located south of Florence Avenue.

Amenities – Centinela Freeman Regional Medical Center, four blocks east, has a variety of medical facilities, including the Daniel Freeman Memorial Hospital and the Southern California Cardiovascular Center. Inglewood Park Cemetery is five to six blocks east. Edward Vincent Park is to the northeast (½ mile), and Rogers Park is to the northwest (¼ mile).

Residential – In the immediate vicinity of the rail crossing are primarily civic/community/retail buildings. Medium density residential land uses including single family homes are two to three blocks southeast and north of the rail crossing.

Business – New retail developments will enhance the viability of the site as a transit oriented development area. A new station will be nearby recent redevelopment on Market Street which included façade, street and sidewalk improvements.

Potential – There is sufficient space for a possible platform on the northwest corner of the crossing. There is also space for a platform on the northeast corner. However, this may be compromised by a 'drive through' for the new Walgreens store.

Station at Century Boulevard and Aviation Boulevard

General – West of the crossing on Century Boulevard is one of the main approaches to Los Angeles International Airport (which is approximately one mile to the west) with a variety of hotels on the north side. East of the crossing is a variety of fast food restaurants and other airport-related business such as car rental offices and hotels. There is also a large number of parking lots/structures in the vicinity.

Concerns – Because the Century Boulevard overcrossing is only single-track, the non-DMU alternatives would require construction which would cause temporary noise and vibration issues. LRT would require below-grade construction nearby the airport runways.

Amenities – Access to the I-405 Freeway is only half a mile east and access to the I-105 Freeway is one mile south.

Residential – Light/medium density residential housing exists northeast of the crossing, with apartment buildings along Aviation Boulevard and houses behind (to the east of) them. The main residential areas are east of the I-405 Freeway.

Business – The majority of business in the area is airport services-related. There is little retail visible in the area. A range of car rental centers line the north end of Bellanca Avenue and Airport Boulevard (the first and second streets west respectively, parallel to the rail track). Hotels line Century Boulevard.

Potential – Sufficient space exists on the northwest side of the crossing for a possible platform. However, the station would be above street level at the intersection and so there would be costs involved in a raised platform. Alternatively, situating the platform to the north would allow an at-grade platform.

Station at Imperial Highway and Aviation Boulevard

General – Predominantly airport services and depots exist in the immediate area of the crossing. Very little pedestrian activity exists in the area.

Concerns – The escalator access to the Metro Green Line station (raised level) lies to the east of Aviation Boulevard. Thus, transitioning from the Harbor Subdivision to the Metro Green Line would require crossing the street (Aviation Boulevard).

Amenities – No schools or hospitals lie within a quarter mile of the rail line. A station here would have access to the Metro Green Line.

Residential – Medium density residential land use exists south of the I-105 Freeway on the southeast corner. Apartments and condominiums are adjacent to Aviation Boulevard and have single family housing behind (to the east of) them.

Business – There are no professional or business offices in the immediate area.

Potential – Sufficient space exists southwest of the crossing for a possible station platform. At present, the vacant land adjacent to the rail line is being used as a large parking area for local airport services buildings as well as 'Park and Ride' access to the Metro Green Line and airport shuttle on the other side of Aviation Boulevard.

Station at Douglas Street

General – This lively upscale area is located along Rosecrans Avenue. The City of El Segundo is presently completing a grade separation project to join the two parts of Douglas Street (currently split by the Harbor Subdivision and the Metro Green Line) to provide one additional north-south arterial. The City is also completing a fourth westbound/eastbound lane on Rosecrans Avenue from the I-405 Freeway to Douglas Street. Both projects will increase traffic on/around a possible station on Douglas Street. A heavy industrial area lies to the west of the Harbor Subdivision and continues to the ocean.

Concerns – Land uses are primarily industrial and transportation-related. The Rosecrans Avenue and Aviation Boulevard underpass lies between Douglas and Marine stations and could be a potential constraint to both.

Amenities – A number of small malls with professional offices and retail run along Rosecrans Avenue west of Aviation Boulevard. New hotels, wine bars and restaurants are at the south end of Douglas Street. An upscale sports club and hotel are close to the rail crossing. The Manhattan Gateway Shopping Center (with a large parking provision) is on the southwest corner of Rosecrans Avenue and Aviation Boulevard. South of Rosecrans Avenue is the Marriott Manhattan Beach Golf Course and Club, as well as the Manhattan Village Shopping Center and the Marine Avenue Park. A station would have access to the Metro Green Line.

Residential – There is very little residential visible in the area.

Business – There is a good deal of business and professional office space in the area on the north side of Rosecrans.

Potential – The Harbor Subdivision runs parallel (at ground level) to the Metro Green Line (above ground level) at Douglas Street. There would be both sufficient space as well as a convenient connection from a new station at Douglas to the Metro Green Line station via existing escalators.

Station at Marine Avenue

General – An electrical power plant is adjacent (northwest) to the station park-and-ride. A large Volkswagen car dealership exists between the north side of the rail line and the I-405 Freeway. Primarily industrial and Information Technology (IT) related buildings are in the area. These extend approximately half a mile south of Marine Avenue with medium density residential to the south.

Concerns – Land uses in this area are primarily light industrial and transportation-related. The Rosecrans Avenue and Aviation Boulevard underpass lies between Douglas and Marine stations and could be a potential constraint to both.

Amenities – Aviation Park is nearby on Aviation Boulevard and Manhattan Beach Boulevard. This is a 14-acre recreation facility, which is home to the Redondo Beach Performing Arts Center, the Aviation Gymnasium, and the Aviation Track and Field Center. A station would have access to the Metro Green Line.

Residential – Medium density single family homes are south of Manhattan Beach Boulevard, about half a mile to the southeast.

Business – There is no retail visible in the area. Land uses are primarily light industrial and Information Technology (I.T.) related (e.g. Northrop Grumman, a global IT/ defense systems company). There are also many multi-purpose office buildings in the area.

Potential – The Harbor Subdivision runs parallel (at ground level) to the Metro Green Line (above ground level) at Marine. There would be both sufficient space as well as a convenient connection from a new station at Marine to the Metro Green Line above, via existing escalators. The present Metro station at Marine Avenue is well landscaped with drought tolerant planting.

Station at The Galleria at South Bay

General - This area is a busy retail center with The Galleria at South Bay and other retail centers along Artesia Boulevard (e.g. the Westgate Shopping Center just east of Hawthorne Boulevard). Traffic is busy along Artesia Boulevard, which serves these retail centers. Two new developments are being built adjacent to the rail track just south of the crossing on Ruxton Avenue. One is a 27-unit condominium building; the other is a 19-unit condominium building for seniors.

Concerns – There are potential noise and vibration issues in this area due to residences adjacent to the rail line. Single family housing is adjacent to the rail track north and south of the Artesia Boulevard crossing: on the north up to Manhattan Beach Boulevard and on the south along El Nido Park to Hawthorne Boulevard. Other potential constraints are the Pacific Crest Cemetery (located on Grant Avenue and Inglewood Avenue) and El Nido Park (located at 182nd Street and Kingsdale Avenue). In addition, there is a medical building located at Hawthorne Boulevard and 190th Street.

Amenities – There is a wealth of retail outlets and professional services in the area. El Nido Park provides a large green community space nearby.

Residential – Medium density single family homes are located primarily north of Artesia Boulevard and then again south of the Galleria from El Nido Park, approximately half a mile south of Artesia Boulevard. Residential density in the immediate area will increase with the completion of the two residential developments mentioned above. A new station will provide residents with a convenient transport option.

Business – A number of smaller strip malls with retail outlets, professional services, offices and fast food restaurants line Artesia Boulevard.

Potential – Proximity to a major retail center and new residential developments nearby enhance the possibilities of the site as a transport link. There is sufficient space for a platform on the south west corner of the crossing area.

Station at Sepulveda Boulevard

General – The Harbor Subdivision crosses Sepulveda Boulevard on a severe angle. Sepulveda Boulevard is a major east-west arterial for traffic between South Bay cities and Long Beach. Commercial and office buildings, strip malls, and residential development exist in the area of the rail line/Sepulveda Boulevard intersection. The intersection is near Western Avenue, a major north-south arterial, which provides access to the City of Lomita and San Pedro to the south.

Concerns – The crossing is a very busy intersection. More train traffic may increase the potential for traffic congestion on Sepulveda Boulevard. There are potential noise and vibration constraints due to residences adjacent to the rail line, as well as to Torrance Elementary School and Torrance Park nearby. Possible safety constraints also exist due to the fact that residents cross the tracks on foot on a frequent basis.

Amenities – Torrance Park is northwest of the crossing and has a children's playground. The Harbor UCLA Medical Center is approximately two miles northeast of the crossing. There are strip malls on the northeast and southeast corners of the Sepulveda Boulevard and Western Avenue intersection. These provide a variety of retail outlets, fast food restaurants and professional services nearby the crossing.

Residential – Single family housing exists north and south of the crossing and along the rail line southeast to Western Avenue. Many residences along Sepulveda Boulevard have walls to provide a buffer from the traffic and noise. There is a large amount of new residential development visible to the west of the crossing on both sides of Border Avenue, south of the Harbor Subdivision. The development on the east side of Border Avenue is gated.

Business – There is a large commercial/office development on the southeast quadrant of the crossing. Similar development exists on the southeast corner of Sepulveda Boulevard and Western Avenue adjacent the strip mall. Warehousing lies behind the retail on the northeast corner of that intersection.

Potential – Sufficient space for a platform exists south of Sepulveda Boulevard on both the northeast and southwest sides of the rail line. There is also an auto shop/yard on the northwest quadrant of the crossing, adjacent to the rail line, which could be a possible station location.

SUMMARY OBSERVATIONS

This evaluation generated some overarching findings. While some crossings of the Harbor Subdivision are more suitable than others as station locations, it is clear that all crossings presented have characteristics which would justify their consideration as possible station locations. This may be because a crossing already has a dynamic retail character with a large amount of pedestrian activity, or because it would provide a convenient connection to the existing Metro systems.

In addition, the station locations discussed here would provide a relatively consistent coverage of the Harbor Subdivision, with the exception of the southernmost section in Wilmington.

Appendix D
LITERATURE REVIEW

INTRODUCTION

The purpose of this appendix is to present a review of the available transportation planning literature and operating agreements pertaining to the Harbor Subdivision.

Most of the documents discussed below were cited in the Scope of Work Section 2.2 for the *Harbor Subdivision Passenger Transportation Operations Technical Feasibility Study*. Metro provided the analysis team with most of the documents. The analysis team had some documents in its possession already.

Both Metro and the analysis team have provided additional documents and information sources to the scope's literature review list. These documents are reviewed below as well.

The analysis team used this review to help identify potential public transportation uses of the Subdivision, as well as to identify potential constraints for implementing various public transportation modes in the Subdivision's right of way. The attempt in this appendix was to present a summary of contents relevant to determining the feasibility of future transit improvements on the Harbor Subdivision.

LITERATURE REVIEW

California Public Utilities Commission
General Order No. 135 Effective Nov. 1, 1974

This order directs that public grade crossings not be blocked by a train for more than 10 minutes except in case of emergency. It also directs that cars or trains not be left standing where they would cause automatic gates to remain down.

The Metro Green Line
http://www.westworld.com/~elson/larail/green.html

This is an Internet site describing the Metro Green Line route, fares, hours of service, station information, and railcar equipment.

The Metro Blue Line
http//www.westworld.com/~elson/larail/blue.html

This is an Internet site describing the Metro Blue Line route, fares, hours of service, station information, and railcar equipment.

Federal Railroad Administration Regulations
Title 49 (Transportation) Part 213 - Track Safety Standards

These regulations established by the FRA to govern track standards and safety requirements for track that is a part of the general railroad system. They set the responsibility of the track owner to bring the track into compliance with regulations, or to halt or restrict operations. They require designation of qualified persons to supervise track maintenance. They establish track classifications with allowable freight and passenger operating speeds, and set track geometry requirements for each classification. They require maintenance of drainage-ways and control of vegetation. Track geometry requirements govern gage, surface alignment, super-elevation, and operating speeds on curves. Track structure requirements govern ballast, crossties, and rail condition.

Section 213.233 specifies the track inspections required per week for different train speeds.

Southern California Association of Governments (SCAG)
Patronage Forecasts for an Extensive Regional Rail Network, April 24, 1993

Ridership forecasts for a series of commuter and urban rail (LRT or equivalent) routes throughout the SCAG service area. Projections are for year 2010, with a regional population of about 20.5 million persons.

An urban rail line was postulated between downtown Los Angeles and LAX, following the Harbor Subdivision on the western end and Exposition Boulevard to the Metro Blue Line into downtown. The line was projected to carry about 32,700 riders per day.

An urban rail line along the Harbor Subdivision from Vernon to Inglewood was projected to carry about 15,500 riders per day.

An urban rail line between Santa Monica and Redondo Beach, partially following the Harbor Subdivision and serving LAX, was projected to carry about 16,700 riders on the north end and 4,100 riders on the Redondo Beach end.

There were no commuter or urban rail lines modeled that would use the full length of the Harbor Subdivision between downtown Los Angeles and LAX.

Harbor Subdivision Shared Use Agreement
ATSF Railway and LACTC, October 30, 1992

This agreement spells out the rights of the railroad, formerly the ATSF Railway but now BNSF, to operate over the Harbor Subdivision trackage that it sold to the agency, formerly LACTC but now Metro. Basically, it retains for BNSF the right to operate freight service over the Harbor Subdivision, sharing the trackage with any trains (presumably passenger trains) that Metro might operate on the line. It provides that Metro is limited to two passenger train round trips per day until it constructs capital improvements that will permit BNSF to maintain freight service at its July 1992 level. The agreement requires that any Metro passenger service is to have priority over remaining local freight service. The agreement spells out the provisions for maintenance and dispatching of the Harbor Subdivision, and the responsibilities of both BNSF and Metro with respect to train operations and ownership of the route.

Other key elements of the agreement include:

- The railroad grants property to the agency pursuant to grant deeds. In each deed, the railroad reserves a permanent and exclusive freight service easement.
- The railroad shall have all obligations arising under the Interstate Commerce Act and similar California law to serve existing and future rail freight shippers.
- The railroad shall not have the right to operate trains over property with respect to which the railroad has abandoned its common carrier freight obligations.

- There shall be no fees for the railroad's use of the freight service easement.
- Agency can restrict the times for operation of freight service.
- Agency (or Amtrak) can operate passenger trains.
- After the harbor shift date (when the Alameda Corridor opens), the railroad pays a maintenance and repair fee to the agency.
- Agency can remove or relocate track, but if used for freight service, must provide alternate arrangement for service by the railroad.
- There does not appear to be anything in the agreement limiting the time period for freight service easements. The presumption is they are permanent until the railroad abandons any rights.
- If on or prior to the 10th anniversary of the date the Harbor Subdivision was acquired by the agency the railroad has not shifted its port-related traffic or "overhead" traffic to the Alameda Corridor, the agency may have the option of requiring the railroad to buy back the line.

<u>Alameda Corridor Use and Operating Agreement</u>
<u>ACTA, BNSF, and UP, October 12, 1998</u>

This agreement is the basic agreement between the ports, the Alameda Corridor Transportation Authority (ACTA), and the railroads regarding joint use of the Alameda Corridor for through freight movements between Los Angeles and the rail facilities in the harbor area. The agreement specified that the Harbor Subdivision route is available as a detour route only through June 29, 2003. Thus, the BNSF's detour route now is the UP's San Pedro Branch.

<u>2001 Regional Transportation Plan (Chapter V, Strategic Investments)</u>
<u>SCAG (date not identified in papers provided by Metro)</u>

This Regional Transportation Plan (RTP) identified a series of regional transit corridor projects intended to facilitate and increase transit usage. The Exposition Line, a combination of light rail and busway between downtown Los Angeles and Santa Monica, is listed as a baseline corridor project. While this line does not traverse the Harbor Subdivision, it is geographically closest to it and could meet transit needs of those along the northwestern edge of the Harbor Subdivision corridor. The plan's listing of constrained transit corridor projects that could connect with or serve areas in the Harbor Subdivision corridor include:

- A fixed guideway/busway in the Crenshaw corridor, connecting with the Metro Green Line.
- A rapid bus service in the Hawthorne corridor.
- A rapid bus service in the Vermont Corridor, connecting with the Metro Green Line.
- A rapid bus service in the Atlantic corridor, connecting with the Metro Blue Line.
- A Metro Green Line light rail extension to LAX.

In addition to these transit corridors, the RTP anticipated an initial high speed rail (Maglev technology) line from LAX, through Union Station, and terminating in San Bernardino/Riverside. Other subsequent lines would join LAX and Palmdale, and Los Angeles and San Bernardino via Orange County. Intermediate stations were not indicated.

The RTP included other projects to facilitate the movement of people and goods by highway and rail freight, but these were not directly related to transit options along the Harbor Subdivision, except to the extent that the existing Alameda Corridor project enabled movement of through freight away from the Harbor Subdivision and thus made its use for transit more enticing.

Los Angeles County Transportation Commission
Coastal Corridor Rail Transit Project, North Segment, 1988

This report identified three alternative routings through the LAX area for a Metro Green Line extension from the Century Freeway at Aviation Boulevard north and west to an interim terminal at Culver Boulevard in Marina Del Rey. At the time, the extension would require a grade separated guideway to accommodate the planned automated operation of the Metro Green Line.

The route was proposed to share the Harbor Subdivision right of way from the Century Freeway (I-105) north to Century Boulevard. It would require removal of the BNSF siding at this location to provide sufficient width for the double track transit guideway.

Los Angeles County Transportation Commission
Coastal Corridor Rail Transit Project, North Segment
Final Environmental Impact Report, 1989

Daily station boardings at all stations on the extension to Marina Del Rey were estimated at about 14,200 riders. Assuming an equal number of passengers getting off the system, daily ridership would be about 28,400. If the system were only built to Parking Lot C at LAX, total daily ridership would be about 20,200. Projections were done by SCAG using the Caltrans LARTS model.

Cost of the extension was estimated at $88 million from the Metro Green Line to LAX Lot C; $137 million to the Westchester Station; and $329 million for the full length to the Marina Del Rey Station. These costs equate to about $40 million per mile for the shortest segment only to LAX, or about $55 million per mile for the entire 5.95 miles to Marina Del Rey. Costs included stations and right of way, with a mix of aerial, surface, and subway construction.

Los Angeles County Transportation Commission
Coastal Corridor Rail Transit Project, South Segment
Route Refinement Study, 1990

The study contained preliminary engineering drawings for a southerly extension of the Metro Green Line from the existing southern terminus (the Marine/Redondo station at Freeman Boulevard and Marine Avenue) south to Torrance/Rolling Hills Estates. The proposed extension would utilize the Harbor Subdivision right of way for approximately two-thirds of a mile at the northern end of the southern extension. Most of the line would be located in the median of Hawthorne Boulevard. Several alternative terminals for the southern end of the line were identified.

The report indicated that an alternate routing, following the Harbor Subdivision southerly on its alignment more easterly of Hawthorne Boulevard, had been examined earlier. The Hawthorne alignment was selected because of better transit opportunities and favorable land use.

Los Angeles County Metropolitan Transportation Authority
Crenshaw-Prairie Corridor MIS
BNSF Right of Way Evaluation, 2003

A Major Investment Study (MIS) was prepared for transit options in the Crenshaw-Prairie Corridor. That study looked at both bus and light rail service from Wilshire Boulevard, southerly to the Inglewood/LAX area, generally paralleling Crenshaw Boulevard and Prairie Avenue. The BNSF Right of Way Evaluation was conducted at the same time, to evaluate the use of the BNSF Harbor Subdivision as an alternative or starter option.

This study concentrated on the section of the Harbor Subdivision between the Metro Blue Line at Slauson Avenue and the Metro Green Line southeast of LAX.

The study considered differing service levels that might be provided with two types of rail vehicles: self-powered FRA non-compliant vehicles and self-powered FRA compliant vehicles (these vehicles are often called DMUs for diesel multiple vehicles; FRA compliance and non-compliance has to do with FRA crashworthiness standards). The service assumed for the route would cover a short distance with frequent stops, so locomotive-hauled trains such as Metrolink were not considered.

The report evaluated track and tie condition, right of way width, railroad operations, and grade crossing conditions then current (2003). It discussed necessary track and signal upgrades that would support passenger service.

The report identified a maintenance yard site near Van Ness Avenue that could accommodate light mechanical work and daily servicing. Heavy repairs would have to be performed at rail shops beyond the passenger study corridor.

Conceptual capital and operating costs were listed. For service from the Metro Blue Line at Slauson station to the Metro Green Line Aviation station, capital costs would range from $63 to $85 million, with annual operating and maintenance costs ranging from $9 to $13 million. The differences represent differing headways and types of vehicles. There was no ridership forecast; operating costs were based on an assumed cost of $50 per train mile and a 40% fare box recovery.

The study expanded upon an earlier 2002 "White Paper" analysis by the same authors of the potential for using DMU or Diesel LRT equipment on the Harbor Subdivision.

Los Angeles County Metropolitan Transportation Authority
Crenshaw-Prairie Transit Corridor Major Investment Study, 2003

This study analyzed alternative transportation systems in the north-south Crenshaw-Prairie Corridor. Alternatives would connect the Metro Red Line Subway on Wilshire Boulevard and the planned Exposition LRT Line at the north end of the corridor with the Metro Green Line LRT in the southern portion of the corridor. Some transit options would serve a transportation center at LAX, where a people mover system would take riders to the airport terminals. The alternatives included:

- No build, consisting of current bus service and committed regional extensions.
- Metro Rapid (Bus) with a variety of possible routes and terminals. One potential route ran south on Crenshaw Boulevard, then traversed Florence Avenue and Aviation Boulevard south to a Metro Green Line connection. This route parallels, but does not utilize, the Harbor Subdivision right of way.

- Bus Rapid Transit (BRT), with one potential route for a busway along the Harbor Subdivision from Crenshaw Boulevard to a Metro Green Line connection.
- Light Rail Transit (LRT), with one alternative following the Harbor Subdivision from Crenshaw Boulevard to a Metro Green Line connection.

The study found that the BRT and LRT options would attract more riders than Metro Rapid, but at a significantly higher cost. Ridership and costs are summarized below:

Alternative	Length (Miles)	Daily Boardings	Capital Cost (Millions)	Cost/Mile (Millions)
Metro Rapid	28.2	37,000	$17-$28	$0.6-$0.9
BRT	13.5	46,900	$336-$410	$2.5-$3.0
LRT	11.4	43,400	$775	$6.8

The study found that either BRT or LRT could share the Harbor Subdivision right of way. Improvements in intersection signal systems and grade crossing protection devices would be necessary, and grade separations were suggested for Centinela Avenue, La Cienega Boulevard, and La Brea Avenue. The study further suggested that a number of minor streets now crossing the BNSF tracks could be closed to reduce the number of grade crossings along the route.

<u>SCAG/SBCCOG</u>
<u>South Bay Cities Railroad Study (BNSF Harbor Subdivision), 2002</u>

This study was completed just prior to the opening of the Alameda Corridor in mid-2002. The study evaluated current and future freight service on the Harbor Subdivision, and assessed the impact of lower freight train volumes on grade crossings and local traffic. Recommendations were provided for improvement of some of the grade crossings despite the anticipation of lower freight volumes on the line.

The study also explored alternative uses for the Harbor Subdivision, either with or without local freight rail services along the line. These included Metro Green Line extensions to LAX and to Torrance; high speed or conventional rail service to Los Angeles Union Station; light rail or bus rapid transit routes; and rail shuttle service to the South Bay cities. Other options explored include using portions of the right of way to widen adjacent streets, to expand adjacent land uses, additional utility services, or to develop linear parkways or trails along the right of way.

<u>Metro Green Line Northern Extension</u>
<u>Supplemental Environmental Impact Report, 1994</u>

This study identified various ways to connect the existing Metro Green Line Aviation/Imperial station with LAX. The options included an all-bus route, an extension of the Metro Green Line along Aviation Boulevard to either Lot C or a Westchester station, and a People Mover option. The extension of the Metro Green Line from the Aviation/Imperial station involved an aerial structure to 111th Street, thence a subway segment past the 25L and 25R runways, thence an aerial structure again to Lot C or the Westchester station. There were no ridership or cost figures assigned to the options in this document.

The remainder of the document cited comments on these options and responses by Metro. In response to one comment as to why the Metro Green Line extension along Aviation could not be at-grade and built cheaper, Metro cited Federal Aviation Administration concerns of electromagnetic interference of the Metro Green Line's overhead contact system (OCS) with airport navigational aids and intrusion of the rail guideway and OCS into the runway protection zones for runways 25L and 25R. To avoid these potential conflicts, the at-grade alignment was changed to a subway.

Chapter 4
TRANSIT SERVICE ALTERNATIVES

INTRODUCTION

This chapter defines the alternatives for potential transit operation on the Harbor Subdivision. Based on the assessment of surface environmental factors in Chapter 2, four transit modes were selected for further analysis. The analysis required development of specific transit service alternatives, with routes, headways, stations and other items, defined. Each of two modes - FRA Compliant DMUs and Non FRA Compliant DMUs - had two alternatives with different peak period headways. Accordingly, a total of six transit service alternatives were evaluated in Chapter 5. The alternatives would operate on the Harbor Subdivision from a northern terminus located at Los Angeles Union Station, the Downtown 7th Street/Metro Center Station, or the Metro Blue Line crossing at Long Beach Avenue. Their southern termini would be in the City of Torrance.

Each of the alternatives defined below assumes the continuation of BNSF freight rail service on the Harbor Subdivision. On the northern portion of the Subdivision, between the Metro Blue Line crossing and the Metro Green Line crossing at Imperial Highway, BNSF service would be pushed to a late night/early morning operating window. South of the Green Line crossing, the freight operation would continue its current daily, day-and-night service pattern, since the rail traffic there appears to be too frequent to be pushed into a late night/early morning window.

TRANSIT SERVICE ALTERNATIVES

FRA Compliant DMUs 30"

This alternative assumed the use of self-propelled rail cars, also known as Diesel Multiple Units (DMUs), which comply with the crashworthiness requirements of the Federal Railroad Administration (FRA) for operation on track shared with freight trains and conventional passenger trains. (The FRA is the federal agency charged with oversight of safety on railroads.) The DMUs would operate with 30-minute headways in both directions during the peak commute periods between Los Angeles Union Station (LAUS) and the City of Torrance. Off-peak and weekend headways would be hourly.

This level of service is comparable to that offered by the SCRRA Metrolink commuter rail operation on several of its lines through the Los Angeles Basin. To cross the Alameda Corridor, Washington Boulevard and the BNSF Transcon, this alternative assumed a flyover to the Metrolink-controlled trackage accessing LAUS. Metrolink trains operate on such a flyover today in the same area.

While a station further southeast on the Subdivision might serve as a terminus, a Torrance station, potentially at Sepulveda Boulevard, would have arterial access to beach communities to the west, Lomita and San Pedro to the south, and Long Beach to the east. Accordingly, for this analysis, a Torrance rail terminus was assumed. Figure 4-1 illustrates this and other transit service alternatives.

NOTE: Torrance transit termini are indicated for illustrative purposes only.

Wilbur Smith Associates
ENGINEERS PLANNERS ECONOMISTS

Figure 4-1
TRANSIT ALTERNATIVES - HARBOR SUBDIVISION

100011/FIGURE - 11/27/06

Intermediate stations would include Long Beach Avenue (a connection to the Metro Blue Line); Normandie Avenue; Crenshaw Boulevard (a connection to any potential transit improvements on that corridor); La Brea Avenue; Century Boulevard (a connection to LAX); Imperial Highway (a connection to the Metro Green Line); Marine Avenue (a connection to the Green Line); and The Galleria.

As this alternative can operate on tracks shared with freight and conventional trains, the DMUs conceptually could be operated by Metrolink and maintained at Metrolink's Taylor Yard facility in Los Angeles, provided Metrolink and Metro could agree to the requisite terms and conditions.

The 2002 "South Bay Cities Rail Study"[1] suggested that the Harbor Subdivision could be linked to LAUS for Metrolink commuter rail service via the Union Pacific Railroad's Wilmington Subdivision (which runs along both the Alameda Corridor and Long Beach Avenue) and a new connection between the Wilmington Subdivision and the Harbor Subdivision at Slauson Avenue. Challenges include daily UP operations on this track segment, as well as a potential reconfiguration of the Metro Blue Line overcrossing of the Harbor Subdivision and Slauson Avenue. Because of these challenges, this option for FRA Compliant DMU operations was not considered in this analysis.

FRA Compliant DMUs 15"

A variation of the aforesaid alternative assumed 15-minute frequencies in each direction during the peak commuting period. Off-peak and weekend frequencies would also be hourly. Station stops would be the same.

Non FRA Compliant DMUs 30"

This alternative assumes the use of DMUs which do not comply with FRA crashworthiness requirements for operation on track shared with freight trains and conventional passenger trains. If operated on track also used by freight and passenger trains, the DMUs and other trains must operate on a time-separated basis. In this alternative, the DMUs would operate with 30-minute headways all day (i.e. 6 a.m. to 12 a.m.) weekdays in both directions between the Metro Blue Line crossing (the connection with the Metro Blue Line) and Torrance. Weekend headways would be hourly. West of the Metro Blue Line, stations would be the same as for the FRA Compliant DMU 30" alternative.

Major challenges include: (1) sharing the narrow and busy Metrolink-controlled rail right-of-way north of the Alameda Corridor, BNSF Transcon and Washington Boulevard and (2) gaining access to the already crowded LAUS. These challenges point to a Metro Blue Line connection at Long Beach Avenue as the logical northern terminus for this option[2].

BNSF freight traffic between the Metro Blue Line crossing and the Metro Green Line crossing would be pushed to a late night/early morning window.

South of the Metro Green Line crossing, the service would require its own track, as moving freight traffic to a late night/early morning window may not be practical due to its volume. Furthermore, the extent of switching trackage on both sides of the mainline in Alcoa Yard likely would require that the Non FRA Compliant DMU facility be elevated at points through the yard.

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[1] South Bay Cities Rail Study, 2002, page 3-15.

[2] A Metro Blue Line connection was also identified as the northern terminus for a conceptual DMU service operating on the Harbor Subdivision, as described in the "White Paper on Harbor Subdivision Diesel Multiple Unit (DMU) or Diesel Light Rail Transit (DLRT) from the Blue Line at Slauson to the Green Line at Aviation", 2002, which was part of the Crenshaw-Prairie Corridor MIS.

As this alternative cannot operate on tracks shared with freight and conventional trains, this analysis assumes the trains would be maintained in a facility located along the Harbor Subdivision. A potential location for such a facility is adjacent to the Alcoa Yard, which is surrounded by industrial land uses.

Non FRA Compliant DMUs 15"

A variation of the aforesaid alternative assumed 15-minute headways in each direction during the peak commuting period. Off-peak headways would be half hourly. Weekend headways would be hourly.

Light Rail Transit 15"

This alternative assumed the use of the electrified LRT technology of the Metro Blue Line. If operated on track also used by freight trains, LRT trains and freight rail trains must operate on a time-separated basis. LRT would operate with 15-minute headways in both directions all day between the 7th Street/Metro Center station in Downtown Los Angeles and Torrance. Weekend headways would be half hourly. A station would exist at Long Beach Avenue. West of the Metro Blue Line, stations would be the same as for the FRA Compliant DMU 30" alternative.

LRT would share the track with the Metro Blue Line north of Slauson Avenue, and require a connection from the Metro Blue Line to the Harbor Subdivision. BNSF freight traffic between the Metro Blue Line crossing and the Metro Green Line crossing would be pushed to a late night/early morning window. Through the narrowest parts of the right-of-way, freight rail would use one of the LRT's two tracks. While this arrangement would not provide the ideal separation from an adjacent property (business or residence), it would provide sufficient clearance for a low-speed freight operation.

South of the Metro Green Line crossing, the service would require its own track, as moving freight traffic to a late night window may not be practical due to its volume. Furthermore, the extent of switching trackage on both sides of the mainline in Alcoa Yard likely would require that the LRT facility be elevated through the yard.

This analysis assumed that the rolling stock would be maintained at the Metro Blue Line maintenance facility in Carson.

Bus Rapid Transit 15"

BRT would operate with 15-minute headways all day in both directions between the Metro Blue Line crossing and Torrance. Weekend headways would be half hourly. West of the Metro Blue Line, stations would include Normandie Avenue, Crenshaw Boulevard, La Brea Avenue, a future intermodal center assumed for Century Boulevard and Aviation Boulevard, Imperial Highway, Rosecrans Avenue, Marine Avenue, The Galleria, and various stops on Hawthorne Boulevard ending at Sepulveda Boulevard.

Like the Non FRA Compliant DMU option, this option would run between the Metro Blue Line crossing and Torrance, but it would not be limited to the use of only the Harbor Subdivision. BRT would run on its own busways built on the Subdivision between the Blue Line crossing and Manchester Boulevard. BRT would then leave the Subdivision right-of-way and proceed south on Aviation Boulevard[3]. The buses would reenter the Harbor Subdivision right-of-way at Rosecrans Avenue and run south to 182nd Street. At this point, the buses would leave the rail right-of-way to reach Hawthorne Boulevard for continuance to Torrance.

[3] A variant of this concept could have some buses serve LAX terminals directly.

BNSF freight traffic between the Metro Blue Line crossing and the Metro Green Line crossing would be pushed to a late night/early morning window. Through the narrowest parts of the right-of-way between the Metro Blue Line crossing and Manchester Boulevard, a single freight rail track would be located within the pavement of the two-lane busway.

South of Rosecrans Avenue, the service would require exclusive busway, as moving freight traffic to a late night/early morning window may not be practical due to its volume. Sufficient right-of-way width exists between Rosecrans Avenue and 182nd Street to accommodate both a freight rail and BRT facility within the right-of-way.

Buses would be maintained at existing Metro maintenance facilities.

Chapter 5
TRANSIT SERVICE ALTERNATIVE COMPARISON

INTRODUCTION

The chapter compares the six transit service alternatives considered for deployment on Metro's Harbor Subdivision rail line. The alternative service concepts are defined in Chapter 4. Representing low to high service levels, the alternatives included:

- ***FRA Compliant DMUs 30"***, operating bi-directionally with 30-minute headways during the weekday peak period, tapering off to hourly headways in the off-peak and on weekends. The northern terminus would be LAUS and the southern terminus would be in Torrance.
- ***FRA Compliant DMUs 15"***, operating bi-directionally with 15-minute headways during the weekday peak period, tapering off to hourly headways in the off-peak and on weekends. The northern terminus would be LAUS and the southern terminus would be in Torrance.
- ***Non FRA Compliant DMUs 30"***, operating bi-directionally with 30-minute headways all day (from early in the morning to latter evening) on weekdays, tapering off to hourly headways on weekends. The northern terminus would be the Metro Blue Line crossing and the southern terminus would be in Torrance.
- ***Non FRA Compliant DMUs 15"***, operating bi-directionally with 15-minute headways during the weekday peak period, tapering off to 30-minute headways during the off-peak and hourly headways on weekends. The northern terminus would be the Metro Blue Line crossing and the southern terminus would be Torrance.
- ***Light Rail Transit (LRT) 15"***, operating bi-directionally with 15-minute headways all day on weekdays, tapering off to 30-minute headways on weekends. The northern terminus would be the Downtown Los Angeles 7th Street/Metro Center station and the southern terminus would be in Torrance.
- ***Bus Rapid Transit (BRT) 15"***, operating bi-directionally with 15-minutes headways all day on weekdays, tapering off to 30-minute headways on weekends. Little over half of the route would be on the Harbor Subdivision. The rest of the route would use city streets. The northern terminus would be the Metro Blue Line crossing and the southern terminus would be Torrance.

The summary performance numbers for each service alternative appear in Table 5-1, a comparison matrix. A narrative description of the findings appears below. Environmental issues relative to the alternatives were derived from the assessment of surface environmental constraints in Chapter 2. The major assumptions for building, equipping, and operating each alternative are discussed in Appendix A. Rough order-of-magnitude cost estimate detail for building and operating the alternatives appears in Appendix B.

COMPARISON

Route Miles

Of the scenarios, those with the longest routes (26.7 miles) are the FRA Compliant DMUs. These have their northern terminus at Los Angeles Union Station (LAUS). The DMUs can share track with freight and conventional passenger services like Metrolink commuter trains and Amtrak intercity services.

Table 5-1: Harbor Subdivision Transit Service Alternatives Matrix

	FRA Compliant DMU 30"	*FRA Complaint DMU 15"*	*Non FRA Compl. DMU 30"*	*Non FRA Compl. DMU 15"*	*LRT 15"*	*BRT 15"*
Total Route Miles	26.7	26.7	20.0	20.0	25.2	20.0[1]
Miles on Harbor Sub.	23.0	23.0	20.0	20.0	20.0	11.3
Total Capital Cost (2006$)	$306.2 million	$376.9 million	$326.9 million	$353.8 million	$667.8 million $1.4 billion[2]	$260.9 million
Operator	Metrolink	Metrolink	Metro	Metro	Metro	Metro
Annual Operating Cost (2006$)	$14.5 million	$18.5 million	$12.4 million	$15.2 million	$14.5 million	$10.9 million
Avg. Weekday Boardings[3]	4,000	5,000	10,000	12,000	40,000	15,000
Headways Peak	30 minutes	15 minutes	30 minutes	15 minutes	15 minutes	15 minutes
Headways Off-peak	1 hour	1 hour	30 minutes	30 minutes	15 minutes	15 minutes
Headways Weekends	1 hour	1 hour	1 hour	1 hour	30 minutes	30 minutes
Travel Time	Approx. 57"	Approx. 58"	Approx. 42"	Approx. 42"	Approx. 57"	Approx. 40-45"[4]
Major Surface Environmental Constraints	Safety impact in Torrance	Safety impact in Torrance	Noise from nighttime freight rail operation on northern portion; visual/safety impact in Torrance	Noise from nighttime freight rail operation on northern portion; visual/safety impact in Torrance	Noise from nighttime freight rail operation on northern portion; visual/safety impact in Torrance	Noise from nighttime freight rail operation on northern portion
Pros - Total Capital Cost - Operating Cost - Ridership - Environmental Impacts	Lower capital cost; moderate operating costs; fewer environmental impacts	Moderate capital cost; fewer environmental impacts	Lower capital cost; moderate operating cost; higher ridership	Moderate capital cost; higher ridership	Highest ridership	Lowest capital and operating costs; higher ridership; fewer environmental impacts
Cons - Total Capital Cost - Operating Cost - Ridership - Environmental Impacts	Lower ridership	Lower ridership; highest operating cost	More environmental impacts	Higher operating cost; more environmental impacts	Highest total capital cost; higher operating cost; more environmental impacts	Variability in travel time due to the use of city streets for almost half of the route

[1] Overall route mileage depends on the assumption of a loop at Hawthorne and Sepulveda; the Metro Orange Line has such a loop.
[2] The range of costs shows the difference between the consultant's cost estimate and typical Metro costs.
[3] Ridership was not modeled; figures based upon services with similar operating characteristics and density/demographics.
[4] Variance depends on traffic conditions on Aviation Blvd. and Hawthorne Blvd.

The DMUs would access Metrolink-controlled track south of LAUS via a flyover of the Alameda Corridor and BNSF Transcon mainline tracks and Washington Boulevard. For costing purposes, the southern terminus is Sepulveda Boulevard in Torrance.

LRT is the next longest (25.2 miles). This option has a northern terminus at the 7th Street/Metro Center station in Downtown Los Angeles. It runs on the Subdivision from the Metro Blue Line crossing at Long Beach Avenue to a southern terminus at Sepulveda Boulevard.

Non FRA Compliant DMUs only run on the Subdivision (20.0 miles), from the Metro Blue Line crossing to Sepulveda Boulevard.

Like the Non FRA Compliant DMUs, BRT (20.0 miles) has a northern terminus at the Metro Blue Line crossing. However, it has lower miles on the Harbor Subdivision, as it utilizes Aviation Boulevard between Manchester Boulevard and Rosecrans Avenue and Hawthorne Boulevard south of the South Bay Galleria to Sepulveda Boulevard.

Total Capital Costs

The rough order-of-magnitude capital costs include costs to be incurred in building and equipping the service, from right-of-way acquisition to vehicles to stations to support facilities for the vehicles. These costs are detailed in Appendix B and are summarized in Table 5-1 in 2006 dollars. The appendix also shows capital costs for the physical improvements (not including rolling stock) of the modes by segment. The three segments are:

- LAUS to the Metro Blue Line crossing
- The Metro Blue Line crossing to the Metro Green Line crossing
- The Metro Green Line crossing to Torrance

This breakout of capital costs allows the understanding of what costs would be if the options were built partially in phases. For example, if the FRA Compliant DMU 30" service were to operate just between LAUS and Century Boulevard/LAX as an initial phase, then $71.8 million in construction costs could be postponed.

The capital costs include costs for contingencies, engineering design and environmental assessments, plus support costs including engineering design. They do not include "soft costs" such as public outreach and other agency costs that are typical for this sort of project. As shown in Table 5-1, the most expensive option to build is LRT, and the least expensive is BRT. Specific assumptions for each alternative are cited in Appendix A. These include, among other things, a flyover of the Alameda Corridor/BNSF Transcon/Washington Boulevard for the FRA Compliant DMU alternatives, allowing access to LAUS; and a trench along the eastern end of LAX runways and parallel to Aviation Boulevard for LRT, a likely requirement of the Federal Aviation Administration for safety assurance (per Chapter 2). Should Metro decide to pursue further analysis of transit alternatives for the Harbor Subdivision, more detailed cost analyses would need to be performed.

Operator

As Metrolink operates commuter trains on track shared with freight railroads, Metrolink is the logical operator for the FRA Compliant DMU services. For these scenarios, BNSF freight operations on any part of the Harbor Subdivision would not to be restricted by temporal separation of passenger and freight trains.

All other service scenarios - Non FRA Complaint DMUs, LRT and BRT - assume temporal separation of freight train and transit operations between the Metro Blue Line crossing and the Metro Green Line crossing. Freight trains could only operate during a late night/early morning window in this segment. South of the Metro Green Line crossing, the options assume spatial separation from freight trains: the transit options would have their own facilities. As a result, Metrolink's expertise in operating passenger trains on track shared with freight trains is not required. Thus, Metro is the candidate for operator.

Annual Operating Costs

Operating costs are the costs for running and maintaining the service. They include the costs for operators, power (fuel or electricity), maintenance of way, maintenance of equipment, maintenance of stations, insurance, and general and administrative expenses.

FRA Compliant DMUs would have the highest operating costs considering the number of trains run. The basis of the estimate was Metrolink's per train mile cost for operations on its own trackage. Metrolink typically runs longer and heavier train sets longer than the three-car DMU assumed here. However, reliable operating cost data for DMUs do not exist at this point, as so few of these vehicles are in revenue service. Still, there should be some savings, specifically in fuel, operator expense, and equipment maintenance. Accordingly, for illustrative purposes, the operating cost shown is 90 percent of Metrolink's cost per train-mile for operations on its own lines. Even with this reduction, the FRA Compliant DMUs' operating cost per service mile is much more than that of any other alternative, and this fact keeps the alternatives' operating costs high relative to the other alternatives.

Non FRA Compliant DMU operating costs per train mile were derived from input provided by North County Transit District (NCTD), which will begin operations of a Non FRA Compliant DMU two-car train set (the Sprinter) on its Oceanside-Escondido Line in 2008, if not late 2007.

LRT and BRT costs per vehicle mile were based on Metro's adopted 2007 budget. The figure used for the LRT alternative was an average of Metro Blue Line and Metro Green Line revenue service mile costs. The figure used for BRT was an average Metro Orange Line and local/Metro Rapid costs, weighted per the miles of fixed guideway and city streets assumed for the route.

Buses typically require less intensive support than do trains, and are thus less expensive than trains to operate and maintain. This analysis predicts that BRT would be the least expensive mode to operate.

Average Weekday Boardings

These preliminary ridership estimates were sensitive to the length of headways and the convenience of access to Downtown Los Angeles. That is, the shorter the headways and the more direct the access to downtown, the higher the ridership estimate.

The highest ridership forecasted is for LRT, which would have a direct access into Downtown Los Angeles and comparatively short headways all-day compared to most other alternatives. LRT on the Harbor Subdivision would run through the same sort of land uses as do the Metro Blue Line and Green Line today. These are mostly low density residential land uses. Like the Metro Blue Line, it would access downtown Los Angeles. Like the Metro Green Line, it would have more miles between stations, and thus provide less access for potential riders. This analysis predicts that LRT running on the Harbor Subdivision and Metro Blue Line trackage to/from 7th Street/Metro Center could generate average weekday boardings closer to the average weekday boardings of the Metro Green Line (37,487 for June 2006).

A model for BRT on the Harbor Subdivision is the Metro Orange Line. This is because the Harbor Subdivision BRT alternative would connect with a high frequency, high capacity rail transit mode reaching downtown Los Angeles, just like the Metro Orange Line does today (the Metro Orange Line connects with the Metro Red Line at North Hollywood). However, there is about a mile on average between stations on the Metro Orange Line, whereas there would be two miles on average between stations on the Harbor Subdivision BRT. With more miles between stations, the Harbor Subdivision BRT service should have fewer average weekday boardings than the Metro Orange Line. This analysis assumes that BRT on the Harbor Subdivision would generate 75 percent of the Metro Orange Line's average weekday boardings (20,844 for June 2006). BRT would offer the same level of service during the peak period along mostly the same route as the Non FRA Compliant DMU 15" scenario, but would have higher service levels in the off-peak periods and on weekends. Accordingly, its ridership would be higher.

The FRA Compliant DMU options generate the least average weekday boardings - a result of longer headways relative to the other alternatives. FRA Compliant DMUs operating at 30-minute headways during the peak hour would have the fewest boardings. This level of service is similar to what Metrolink's Ventura County Line offers today in the peak direction (inbound to LAUS). That noted, service on the Harbor Subdivision would have less mileage than the Ventura County Line, but it would run peak service levels in both directions. On balance, it seems reasonable that the Harbor Subdivision would have average weekday boardings similar to Metrolink's Ventura County Line boardings. Like that line, the DMUs would run through light density residential and industrial land uses before reaching LAUS.

Headways

The modes are listed in the Table 5-1 comparison matrix from left to right in order of ascending levels of service. The lowest service level is FRA Compliant DMU 30". The highest are LRT 15" and BRT 15". The purpose here was to represent a range of service levels along with technology.

Travel Time

Travel times are assumed to be the time to travel between the northern and southern termini of the services, whether or not the termini are actually on the Harbor Subdivision. The FRA Compliant DMU alternatives have a northern terminus off of the Subdivision, i.e. Los Angeles Union Station. So does LRT, i.e. the 7th Street/Metro Center station. The Non FRA Compliant DMU and BRT alternatives have the Blue Line crossing at Long Beach and Slauson Avenues as a northern terminus. All options have Sepulveda Boulevard in Torrance as a southern terminus, although BRT's southern terminus is off the Subdivision at Hawthorne Boulevard. All told, the FRA Compliant DMU and LRT alternatives have longer travel distances than the Non FRA Compliant DMU and BRT alternatives, and thus have longer travel times.

Major Surface Environmental Constraints

As discussed in Chapter 2, Non FRA Compliant DMUs, LRT and BRT options would push BNSF freight operations to a late night/early morning window between the Metro Blue Line crossing and the Metro Green Line crossing. The result would be increased nighttime noise for residents living near the northern portion of the Harbor Subdivision. DMU and LRT modes would also likely have negative visual and safety impacts on residents living close to the Subdivision in Torrance, as noted in Chapter 2.

Alternative Service Pros and Cons

The pros and cons evident from each service scenario appear at the bottom of Table 5-1. In general, there is a correlation between ridership and total capital costs: the alternative with the highest ridership (LRT) comes with the highest total capital cost; those with lower total capital costs (the DMU alternatives) come with lower ridership. The one exception is BRT, which outperforms the DMU scenarios on ridership, while offering the lowest total capital cost. The comparatively low capital cost is due in large part to the assumption of using city streets for almost half of the route. BRT also has a small fraction of the DMU operating costs. All alternatives would generate environmental impacts. FRA Compliant DMUs and BRT, however, would generate fewer of them.

Chapter 6
SUMMARY AND NEXT STEPS

SUMMARY OF ALTERNATIVES

This analysis investigated the majority of the Harbor Subdivision for transit use. That is, between Los Angeles and Torrance, where there are extensive residential and commercial land uses that could be served by transit. South of Torrance, residential land use densities decrease and industrial land uses increase. Therefore, it would probably not be cost effective to operate south of Torrance.

Range of Alternatives

Chapter 5 looked at six transit service alternatives: four DMU alternatives, one LRT alternative, and one BRT alternative. The purpose of analyzing such a range was to bracket the range of benefits and cost of potential transit implementation. Peak-period-oriented FRA Compliant DMUs with limited off-peak service may be the least expensive to build, but it is likely to attract the least ridership. On the other hand, LRT would likely generate the highest ridership, but would be the most expensive to build. Most alternatives may trigger community concern over noise impacts. The alternatives which would restrict BNSF to a late night/early morning operating window between the Metro Blue Line crossing at Long Beach Avenue and the Metro Green Line crossing at Imperial Highway may trigger concern by BNSF.

Engineering Challenges and Solutions

Implementation of all six transit alternatives appears feasible. There are no obvious environmental, operational, or engineering fatal flaws which would preclude construction. Their use of the existing rail rights of way for transportation purposes would be exempt from environmental review. Proposed station locations appear to be consistent with existing land uses; to the extent that stations would be outside the right-of-way, they would require environmental clearance. Transit and freight rail services can share the right-of-way, although doing so for some transit alternatives would require the construction of a separate facility. Also, sufficient right-of-way width exists to permit construction of all requisite facilities along the proposed routes. Only the Non FRA Compliant DMU alternatives assumed a new maintenance facility; an appropriate site for such a facility appears to exist west of Alcoa Yard.

There are three primary engineering challenges, however, facing the implementation of the transit alternatives. The first pertains to the FRA Compliant DMU alternatives. The challenge is gaining access to Los Angeles Union Station. There is no link today between the Subdivision and LAUS (a link existed in the past, but it was eliminated with the construction of the Alameda Corridor). This will require a double track 2,400-foot flyover of the Alameda Corridor, the BNSF Transcon east-west mainline, and Washington Boulevard, reaching Metro-owned trackage leading to LAUS. A similar flyover exists today between the Metro-owned trackage north of the Alameda Corridor and the BNSF Transcon. This bridge is used by Metrolink, Amtrak long distance, and the Pacific Surfliner trains.

The second challenge is presented by narrow sections of Subdivision right-of-way between the Metro Blue Line crossing and the Metro Green Line crossing. In order for Non FRA Compliant, LRT and BRT alternatives to run on the right-of-way without triggering the need for substantial and disruptive property acquisitions, BNSF freight operations must be shifted to a late night/early morning window, when the transit alternatives would not be operating. This assumption appears realistic, as BNSF operations in this segment is thrice weekly or even less. However, further discussions would need to take place with BNSF.

The third challenge is presented by likely Federal Aviation Administration (FAA) insistence on a trench for LRT operations east of the LAX runways. This section of the Subdivision is south of Century Boulevard and parallel to Aviation Boulevard. The FAA's concern is with potential electromagnetic interference with airplane navigational systems triggered by the LRT overhead contact (catenary) system. Accordingly, capital costing included a trench for LRT, with the BNSF freight train offset to one side, between the south end of Century Boulevard viaduct and 111th Street.

Land Use Compatibility

While there is nothing inconsistent about rail and/or BRT transit improvements on the Harbor Subdivision and adjacent land uses, there are at least two areas of potential significant concern. One is between the Metro Blue Line crossing and the Metro Green Line crossing, where BNSF freight service would be pushed to a late night/early morning window for various transit alternatives. Wherever on this segment there is freight traffic today, the shift in freight train operating patterns would generate increased noise levels at night for residents nearby.

The other area is in Torrance. Between Crenshaw Boulevard and Sepulveda Boulevard, where homes are located very close to the Harbor Subdivision, new rail transit services likely will mean more noise for residents there. Also, during the course of this analysis, people were seen walking the right-of-way. As noted, a pedestrian crossing of the Subdivision exists in this area. Thus, new passenger trains may trigger concern for safety there.

The extent of community concerns in these areas, as well as others, could be heard during the public outreach process preliminary to further any implementation of new transit service.

BNSF Concerns and Solutions

In August, the analysis team discussed with BNSF the various transit alternatives in order to understand any railroad concerns. BNSF's major concern was with the requirement for the temporal separation of BNSF freight trains and the Non FRA Compliant, LRT, and BRT alternatives between the Metro Blue Line crossing and the Metro Green Line crossing.

BNSF service in this segment of the Harbor Subdivision is less frequent than elsewhere, and it is conceivable that BNSF freight trains could be relegated to a late night/early morning operating window. A precedent is the operating agreement that North County Transit District (NCTD) has with BNSF regarding the Escondido Branch line, which NCTD owns. As with the Harbor Subdivision, BNSF retains the right to operate freight trains on that line. However, with the advent of pending Sprinter Non FRA Compliant DMU service, BNSF will do so only when the Sprinter is not running, i.e. during a late night/early morning window. Nevertheless, it is true that restricting BNSF freight trains to a late night/early morning window would impose on BNSF an operating constraint it does not have today. Should Metro desire to restrict BNSF operations in this track segment to such a window, it would likely need to address BNSF's concern through further discussion and/or negotiation.

BNSF voiced a lesser concern of transit options potentially displacing "bare table" (unloaded) intermodal cars that are stored regularly on the Subdivision main track between 111th Street (east of LAX runways) and El Segundo Boulevard. The solution assuming the DMU alternatives would be to rebuild an unused siding in this area, west of the existing line, where the cars could be stored. The LRT alternative assumed that the freight track would be shifted to the west, thereby providing the storage capacity that BNSF enjoys today. Alternatively, car storage could occur elsewhere on BNSF owned lines.

Regulatory Issues

Any transit operations on the Harbor Subdivision would be subject to three levels of regulatory authority - federal, state, and local. These regulatory issues pertain to operational and at-grade crossing safety, law enforcement, engineering, and planning. The specific roles of these authorities are cited in Appendix C.

NEXT STEPS

Deployment of any of the six transit service alternatives profiled in Chapter 5 appears feasible between Los Angeles and Torrance on the Harbor Subdivision. However, given the narrow right-of-way width restrictions in various segments, deployment of only one alternative is practical, assuming continuing freight rail use of the corridor. No one alternative stands out as clearly superior through the length of corridor. Each has advantages and disadvantages relative to the others. To further refine which alternative makes the most sense for the corridor, further analysis is recommended.

Elements of further analysis should include a traditional travel demand forecast for each alternative. The forecasts appearing in this analysis were based on what Metro and the SCRRA's Metrolink commuter rail service are generating on services running with comparable headways though comparable land uses.

Another element may include phasing of a transit alternative. For example, it might make sense to implement an alternative in just one segment of the route, where the ridership potential is high and implementation costs are low. If the service proves itself by steadily gaining substantial numbers of riders, the service could be expanded as funding becomes available. Such phasing would maximize the benefits while minimizing the costs.

Other elements to be included in additional analysis would be:

- A formal environmental assessment, inclusive of community and city concerns relative to potential noise, visual and safety impacts that may be triggered by the transit alternatives.
- Additional discussions with the BNSF for implementation of alternatives which may require temporal separation of freight and transit modes on a shared Harbor Subdivision right-of-way.
- More detailed assessments of station locations, including development of conceptual station plans with parking and/or connecting transit access. Included would be an assessment of capacity at the Downtown 7th Street/Metro Center station, which would service at a northern terminus for the LRT alternative, as well as at LAUS, the northern terminus for the FRA Compliant alternatives.
- Detailed assessments of maintenance facility options. Specifically assessed would be Metrolink's ability to maintain FRA Compliant DMUs at Taylor Yard; Metro's ability to accommodate additional rolling stock at its Carson LRT maintenance facility; and potential construction of a Non FRA Compliant maintenance facility west of Alcoa Yard.
- More detailed capital cost estimates.

Appendix A
TRANSIT SERVICE ALTERNATIVE ASSUMPTIONS

INTRODUCTION

This appendix describes the assumptions underlying the cost and ridership calculations for six Harbor Subdivision transit alternatives that are compared in Chapter 5.

ASSUMPTIONS

Appearing below are the assumptions for the two FRA Compliant Diesel Multiple Unit (DMU) alternatives; the two Non FRA Compliant DMU alternatives; the Light Rail Transit (LRT) alternative; and the Bus Rapid Transit (BRT) alternative.

FRA Compliant DMUs

FRA Compliant DMUs are self propelled rail cars that comply with crashworthiness standards of the Federal Railroad Administration (FRA) for operation on track shared with freight trains and conventional passenger trains. There are two alternatives for this equipment type. One assumes half hourly peak period headways in both directions; the other assumes 15-minute peak period headways in both directions. Both have hourly off-peak headways on weekdays. Weekend headways are also hourly.

Track Configuration

The route mileage of the two alternatives is 26.7 miles. This mileage runs from Los Angeles Union Station (LAUS) to Sepulveda Boulevard in Torrance. The route includes a portion of the Metrolink trackage south of LAUS to a point adjacent to the Amtrak service facility, just north of the Alameda Corridor and the BNSF Transcon mainline. A flyover of the Alameda Corridor and the BNSF mainline is assumed, reaching the Harbor Subdivision just north of 25th Street. The alternatives assume use of the Harbor Subdivision from that point to Sepulveda Boulevard – a distance of 23 miles.

FRA Compliant DMUs can share track with freight trains. Because freight operations exist on various portions of the Harbor Subdivision, these alternatives assume passing siding improvements to allow for reliable freight and passenger train operations. For the 30-minute peak period service level alternative, the cost calculation for Chapter 5 assumed one new siding between Slauson Avenue and Crenshaw Boulevard, an extension of the Lairport Siding to the north, and conversion of Alcoa Yard trackage to a siding. For the 15-minute peak period service level, additional sidings were assumed between Central Avenue and Broadway and between La Brea Avenue and La Cienega Boulevard.

Capital costs in Chapter 5 assumed upgrading of all track less the 115 per linear yard, the minimum for passenger operations. In those areas where existing track is retained, Chapter 5 assumed that 60 percent of ties would be replaced.

Stations

Stations assumed for this alternative would be at LAUS, the Metro Blue Line crossing (Long Beach Avenue), Normandie Avenue, Crenshaw Boulevard, La Brea Avenue, Century Boulevard, the Green Line crossing (Imperial Highway), Marine Avenue, The Galleria, and Sepulveda Boulevard (the capacity of LAUS to accommodate a Harbor Subdivision DMU service was not specifically analyzed). The DMUs would use existing platforms at LAUS. There would be eight side-running stations along the route, and one center-running station at the Sepulveda terminus.

Alcoa Yard

Alcoa Yard, south of 190th Street in Torrance, is the major freight rail activity center on the Harbor Subdivision. Four BNSF freight trains a day run through the yard. Trains are assembled and disassembled in the yard. Also, there are shippers adjacent to the yard; BNSF delivers and picks up carloads at the shippers from the yard. The yard has activity throughout the day.

To ensure reliable freight and passenger operations through Alcoa Yard, Chapter 5 assumed that the passenger operation would have prioritized use of one through track at the yard (use of a through track at the yard would have to be negotiated with BNSF). Also, yard trackage would be converted to a passenger rail siding. To replace the yard capacity for freight operations, Chapter 5 included the construction of a freight siding. This siding would be located on the existing dirt access road running on the east side of the yard. Accordingly, Chapter 5 assumed land acquisition and construction on the east side to replace the access road. Sufficient vacant industrial land for an access road exists at the site.

Grade Crossing Protection

Given the age of existing systems, the capital costs in Chapter 5 assumed replacement of all grade crossing panels and warning devices along the DMU route.

Equipment

Chapter 5 assumed use of Colorado Railcar single level, three-car DMUs. An operations simulation of the alternative indicated the number of train sets required to support the service levels of both alternatives. Prices for the FRA Compliant DMUs were obtained from the manufacturer, Colorado Railcar.

- For the FRA Compliant DMUs 30" alternative, there were 5 three-car trainsets and 1 spare trainset, totaling $58.8 million in 2006 dollars.
- For the FRA Compliant DMUs 15" alternative, there were 10 three-car trainsets and 2 spares, totaling $117.6 million.

Maintenance

These alternatives assumed operations and maintenance of equipment performed by Metrolink. More specifically, Metrolink's operations contractor would provide the crews, and Metrolink's maintenance contractor would maintenance the vehicles at Metrolink's Taylor Yard facility. The feasibility and capacity of Taylor Yard to accommodate a Harbor Subdivision DMU maintenance operation was not specifically analyzed.

Operating Cost

The DMU operating cost estimate was a function of two inputs: train miles and a cost per train mile based on Metrolink's current operating cost per train mile on its own trackage, i.e. $41.31. Since DMU would consume less fuel than a typical Metrolink train set and would run with smaller crew (a single driver), 90 percent of the Metrolink per train mile cost was assumed for the DMU operating cost calculation.

Weekday Boardings

Chapter 5 did not include any traditional ridership forecasting per Metro's direction. Rather, Chapter 5 employed a comparative analysis methodology to estimate a ridership level which transit services on the Harbor Subdivision could reasonably be expected to achieve.

The DMU ridership estimate was based on the ridership of a Metrolink service running through similar land uses with a similar level of service, i.e. the Ventura County Line. That service is longer than the assumed DMU service on the Harbor Subdivision. However, the DMU service would be bi-directional, and thus would serve a reverse commute market which the Ventura County Line does not. Like the Ventura County Line, the DMU service would reach LAUS, and would serve an airport, i.e. Los Angeles International Airport (LAX). Therefore, on balance, a ridership level similar to the Ventura County Line appears reasonable.

Non FRA Compliant DMUs

These are DMUs which do not comply with crashworthiness standards specified by the FRA for operation on track shared with freight trains and conventional passenger trains. Such equipment can only operate on tracks shared with freight and conventional passenger rail services on a time-separated basis. That is, the DMUs and freight and conventional passenger trains must operate at different times.

There are two alternatives for this equipment type. One assumes half hourly peak period headways in both directions, and the other assumes 15 minute peak period headways in both directions. Both assume half hourly off-peak headways and hourly weekend headways.

Track Configuration

These alternatives assume operation between the Metro Blue Line crossing at Long Beach Avenue and Sepulveda Boulevard in Torrance - a distances of 20 miles.

As these DMUs cannot share track with freight trains except on a time-separated basis, these alternatives assume that freight rail services on any portion of the Harbor Subdivision between the Metro Blue Line crossing at Long Beach Avenue and the Metro Green Line crossing at Imperial Highway would occur in a late night/early morning window, when the DMUs are not operating. South of the Metro Green Line crossing to Sepulveda Boulevard, the DMUs would operate on its own tracks, i.e. a facility totally separated from the freight rail operations which are too frequent to be pushed into a late night/early morning window.

As in the FRA Compliant DMU alternatives, various sidings improvements were assumed to ensure the capacity required for reliable operations.

Between the Metro Blue Line crossing and the Metro Green Line crossing, where the DMUs would make use of the existing track alignment, Chapter 5 assumed upgrading of all track less than 115 lbs. per linear yard, the minimum for passenger operations. In those areas where existing track is retained, Chapter 5 assumed that 60 percent of ties would be replaced.

Stations

Stations assumed for this alternative would be at the Metro Blue Line crossing (Long Beach Avenue, Normandie Avenue, Crenshaw Boulevard, La Brea Avenue, Century Boulevard, the Metro Green Line crossing (Imperial Highway), Marine Avenue, The Galleria, and Sepulveda Boulevard. There would be two center-running stations at the termini, and seven side-running stations at the intermediate stations.

Alcoa Yard

Chapter 5 assumed a separate facility for the DMUs through Alcoa Yard. Two flyovers of BNSF industry spurs were assumed in the yard area.

Grade Crossings

Chapter 5 assumed replacement of all grade crossing panels and warning devices along the DMU route.

Equipment

Chapter 5 assumed use of the two-car, articulated Non FRA Compliant vehicles which are being deployed on the North County Transit District (NCTD) Sprinter service to operate between Escondido and Oceanside in 2008, if not sooner. Prices for the equipment, manufactured by Siemens AG of Germany, were obtained from NCTD.

- For the Non FRA Compliant DMUs 30" alternative, there were 4 single-vehicle trainsets plus 1 spare, totaling $21 million.
- For the Non FRA Compliant DMUs 15" alternative, there were 7 single-vehicle trainsets plus 1 spare, totaling $33.6 million.

Maintenance

These alternatives assumed the construction of a maintenance facility adjacent to Alcoa Yard, which is near the south end of the route (a specific site for the maintenance facility was not assessed). The cost estimate for the facility was based on that estimated for the NCTD Sprinter service.

Operating Cost

The operating cost estimate was also based on what NCTD calculated the Sprinter will cost to run and maintain, inclusive of agency costs. The figure was $30 per train mile.

Weekday Boardings

The ridership forecast was pivoted off of what was estimated for the Bus Rapid Transit alternative. Ridership was reduced somewhat, to reflect lower service levels during the off-peak periods.

Light Rail Transit

This alternative assumed that LRT operations on the Harbor Subdivision would be integrated with the existing Metro Blue Line service. Trains would run at 15-minute headways from early in the morning until late at night on weekdays. Weekend headways would be half hourly.

Track Configuration

The connection between the Metro Blue Line and the Harbor Subdivision would be along Long Beach Avenue. The connection would run from the at-grade Metro Blue Line alignment north of the Slauson Avenue station, along Long Beach Avenue and onto the Harbor Subdivision. The northern terminus of the service would be the 7th Street/Metro Center station (capacity of this station to accommodate a Harbor Subdivision LRT service was not specifically analyzed). The southern terminus would be at Sepulveda Boulevard. The total route mileage of this service would be 25.2 miles.

The LRT service would run on double track. Between the Metro Blue Line crossing and the Metro Green Line crossing, where the right-of-way width is not sufficient to provide for LRT double track and a separate freight rail track, freight rail service would use one of the two tracks; freight service would be restricted to a late night/early morning window. South of the Metro Green Line crossing, LRT would have its own facility separate from the freight rail track.

Wherever freight rail track was shifted to provide room for LRT double track, the existing freight track was assumed to be rebuilt.

Stations

Stations assumed for a Harbor Subdivision LRT service would be at the Metro Blue Line crossing (Long Beach Avenue), Normandie Avenue, Crenshaw Boulevard, La Brea Avenue, Century Boulevard, the Green

Line crossing (Imperial Highway), Marine Avenue, The Galleria, and Sepulveda Boulevard. There would be center-running stations at the termini and Century Boulevard; and side-running stations at all other points.

Alcoa Yard

Chapter 5 assumed a separate facility for the LRT through Alcoa Yard. Two flyovers of BNSF industry spurs were assumed in the yard area.

Grade Crossings

The capital costs in Chapter 5 assumed replacement of all grade crossing panels and warning devices along the route.

Equipment

Chapter 5 assumed use of the three car LRT train sets. Costs were based on recent LRT equipment acquisitions by Metro. The service would require 7 three-car trainsets plus 1 spare, totaling $66.2 million.

Maintenance

Chapter 5 assumed that the equipment would be interchangeable with Metro Blue Line equipment and thus maintained at the Metro Blue Line maintenance facility in Carson (the capacity of the Carson facility to maintain additional cars was not specifically analyzed).

Operating Cost

Chapter 5 assumed operating costs based on Metro's budgeted costs per revenue service mile for both the Metro Blue Line and Metro Green Line for 2007. The figure used, $13.58, was an average of these costs.

Weekday Boardings

The ridership forecast was based on June 2006 figures for the Metro Green Line and Metro Blue Line LRT services. Like the Metro Blue Line, LRT on the Harbor Subdivision would have access to Downtown Los Angeles (7th Street/Metro Center). Though it would run through the same sort of low density land uses as the Metro Blue Line, the Harbor Subdivision LRT alternative would have longer weekday peak period headways (15 minutes versus 5 minutes). Also, average distance between stations would be longer (1.6 miles as opposed to 1 mile). With longer peak period headways and longer distances between stations, it is reasonable to assume LRT ridership on the Harbor Subdivision would be less than on the Metro Blue Line.

Though it would run through the same sort of low density land uses as the Metro Green Line, the Harbor Subdivision LRT alternative would have longer weekday peak period headways (15 minutes versus 7 minutes). The average distance between stations would be only slightly longer than the Metro Green Line (1.6 miles versus 1.5 miles). However, unlike the Metro Green Line, the Harbor Subdivision LRT alternative would reach Downtown Los Angeles (7th Street/Metro Center) and come closer to LAX (Century Boulevard). On balance, it is reasonable to assume that LRT ridership on the Harbor Subdivision would be more or less that of the Green Line.

Bus Rapid Transit

This alternative assumed that BRT operations would run on city streets as well as on busways constructed on the Harbor Subdivision. Buses would run at 15-minute headways from early in the morning until late at night on weekdays. Weekend headways would be half-hourly.

Alignment

The BRT alternative would run from the Metro Blue Line crossing in the north to approximately Hawthorne Boulevard and Sepulveda Boulevard in Torrance in the south - a distance of 20 miles. Busways would be constructed on the Harbor Subdivision between Metro Blue Line crossing and Manchester

Boulevard/Aviation Boulevard and between Rosecrans Avenue and 182nd Street. Buses would use Aviation Boulevard between Manchester Boulevard/Aviation Boulevard and Rosecrans Avenue, and would use Hawthorne Boulevard between 182nd Street and Sepulveda Boulevard.

Between the Metro Blue Line crossing and Manchester Boulevard/Aviation Boulevard, where the right-of-way width is not sufficient to provide for a two-lane busway and a separate freight rail track, a freight track would be embedded in the busway. Between Rosecrans Avenue and 182nd Street, BRT would have its own facility separate from the freight rail track.

Wherever freight rail track was shifted to provide room for the BRT busways, the existing freight track rebuilt.

Stations

Stations assumed for the BRT alternative would be at the Metro Blue Line crossing (Long Beach Avenue), Normandie Avenue, Crenshaw Boulevard, La Brea Avenue, the Metro Green Line crossing (Imperial Highway), Marine Avenue, The Galleria, and Sepulveda Boulevard at Hawthorne Boulevard. There would be center-running stations at the termini, and side-running stations at intermediate points. The cost calculation assumed that BRT would make use of a proposed intermodal center at Aviation Boulevard and Century Boulevard, which is under consideration by Los Angeles World Airports. It would also make use of existing and proposed Metro Rapid bus stops on Hawthorne Boulevard.

Grade Crossing Protection

Chapter 5 assumed replacement of all grade crossing panels and warning devices on the portions of the Harbor Subdivision used by BRT.

Equipment

Chapter 5 assumed the same sort of rolling stock as is deployed on the Metro Orange Line. Prices paid for Metro Orange Line equipment were obtained from Metro and modified to account for increases. The service would require 7 buses and 1 spare, totaling $8 million.

Maintenance

Chapter 5 assumed that the buses would be maintained at existing Metro maintenance facilities.

Operating Cost

Chapter 5 assumed operating costs based on Metro's 2007 budgeted cost per revenue service mile for both the Metro Orange Line and local/Metro Rapid service 2007. The figure used, $12.62, was a weighted average of these costs. Weighting was derived by the percent of miles of fixed guideway (57%) and city streets (43%) used in the 20-mile route.

Weekday Boardings

Like the Metro Orange Line, the BRT alternative using the Harbor Subdivision for part of its route between the Metro Blue Line crossing and Torrance would run through low density residential and commercial land uses. Also like the Metro Orange Line, it would also connect with a high frequency, high capacity rail transit service (the Metro Blue Line) running to Downtown Los Angeles. However, its weekday peak period headways would be longer than the Metro Orange Line (15 minutes versus 5 minutes). Still, it would provide direct access to terminals at LAX. On balance, it appears reasonable to assume a ridership level similar to that achieved by the Metro Orange Line.

Other Assumptions

Chapter 5 did not assume utility relocation. There is a fiber optic cable in the corridor, which appears to be offset to one side of the right-of-way. Accordingly, Chapter 5 did not assume the cable would need to be relocated.

Chapter 5 assumed 15 percent of the total project cost for engineering design and environmental review, and 30 percent for contingencies. Construction administration was assumed as another 15 percent. These percentages are typical for feasibility studies. Other support costs are cited in Table 5-1.

Appendix B
CAPITAL COST SUMMARY

The following pages contain the rough order-of-magnitude cost estimates for the six transit alternatives analyzed for deployment on the Harbor Subdivision in Chapter 5. Included are: a summary capital cost table (track, grade crossing protection, stations, etc.); three tables each showing the estimated costs for the six transit alternatives; and a description of unit costs. Costs for equipment were estimated apart from these tables. Costs are in 2006 dollars.

TABLE B-1: OPINION OF PROBABLE CONSTRUCTION COSTS FOR TRANSIT OPTIONS

Last Updated on 10/11/06
Prepared by GLT

Total Miles: *22.99* FRA Compliant DMU'
Total Miles: *19.97 Lt.DMU, LRT, BRT*
10.00 Actual BRT Route w/i

Item Description	FRA Compliant DMU's (30" at Peak)	FRA Compliant DMU's (15" at Peak)	Non-FRA Compliant DMU's (30" All Day)	Non-FRA Compliant DMU's (15" All Day)	Light Rail Transit (15" All Day)	Bus Rapid Transit (15" All Day)
ROW Acquisition						
Station ROW	$ -	$ -	$ 405,000	$ 405,000	$ 1,012,500	$ 675,000
Corridor ROW	$ 6,420,480	$ 6,420,480	$ 6,420,480	$ 6,420,480	$ 15,796,752	$ 6,420,480
SUBTOTAL II	**$ 6,420,480**	**$ 6,420,480**	**$ 6,825,480**	**$ 6,825,480**	**$ 16,809,252**	**$ 7,095,480**
Contingencies (30% of Subtotal II)	$ 1,926,144	$ 1,926,144	$ 2,047,644	$ 2,047,644	$ 5,042,776	$ 2,128,644
SUBTOTAL III	**$ 8,346,624**	**$ 8,346,624**	**$ 8,873,124**	**$ 8,873,124**	**$ 21,852,028**	**$ 9,224,124**
ROW Preparation						
Prep ROW for Rail Station	$ 810,000	$ 810,000	$ 810,000	$ 810,000	$ 810,000	$ 211,980
Prep ROW for Rail Alignment	$ 353,775	$ 353,775	$ 3,002,565	$ 3,142,485	$ 9,065,760	$ 6,791,400
Remove Exist. Freight Track	$ 1,268,470	$ 1,268,470	$ 1,115,450	$ 1,115,450	$ 1,513,876	$ 1,084,412
Remove Exist. Freight Bridge	$ -	$ -	$ -	$ -	$ 2,383,500	$ 988,500
SUBTOTAL I	**$ 2,432,245**	**$ 2,432,245**	**$ 4,928,015**	**$ 5,067,935**	**$ 13,773,136**	**$ 9,076,292**
Mobilization (10% of Subtotal I)	$ 243,225	$ 243,225	$ 492,802	$ 506,794	$ 1,377,314	$ 907,629
Traffic Control (3% of Subtotal I)	$ 72,967	$ 72,967	$ 147,840	$ 152,038	$ 413,194	$ 272,289
Landscaping (1% of Subtotal I)	$ 24,322	$ 24,322	$ 49,280	$ 50,679	$ 137,731	$ 90,763
SUBTOTAL II	**$ 2,772,759**	**$ 2,772,759**	**$ 5,617,937**	**$ 5,777,446**	**$ 15,701,375**	**$ 10,346,973**
Contingencies (30% of Subtotal II)	$ 831,828	$ 831,828	$ 1,685,381	$ 1,733,234	$ 4,710,413	$ 3,104,092
SUBTOTAL III	**$ 3,604,587**	**$ 3,604,587**	**$ 7,303,318**	**$ 7,510,680**	**$ 20,411,788**	**$ 13,451,065**
Structures and Trackwork						
Railroad Bridge	$ 27,250,000	$ 27,250,000	$ 12,260,000	$ 13,430,000	$ 28,481,250	$ 17,756,250
Retaining Wall	$ -	$ -	$ 828,000	$ 828,000	$ 14,376,000	$ 3,780,000
Track: Embedded	$ -	$ -	$ -	$ -	$ 300,000	$ 8,265,000
Track: Ballasted	$ 26,964,000	$ 26,964,000	$ 38,682,000	$ 39,424,000	$ 71,568,000	$ 12,824,000
New Ties & Ballast	$ 1,274,400	$ 1,274,400	$ 1,004,400	$ 1,004,400	$ -	$ -
Sidings	$ 4,841,285	$ 8,745,000	$ 4,351,565	$ 7,555,680	$ 1,315,195	$ 2,238,720
Turnout (#20)	$ 500,000	$ 1,200,000	$ 800,000	$ 1,500,000	$ 800,000	$ 200,000
SUBTOTAL I	**$ 60,829,685**	**$ 65,433,400**	**$ 57,925,965**	**$ 63,742,080**	**$ 116,840,445**	**$ 45,063,970**
Mobilization (10% of Subtotal I)	$ 6,082,969	$ 6,543,340	$ 5,792,597	$ 6,374,208	$ 11,684,045	$ 4,506,397
Traffic Control (3% of Subtotal I)	$ 1,824,891	$ 1,963,002	$ 1,737,779	$ 1,912,262	$ 3,505,213	$ 1,351,919
Landscaping (1% of Subtotal I)	$ 608,297	$ 654,334	$ 579,260	$ 637,421	$ 1,168,404	$ 450,640
SUBTOTAL II	**$ 69,345,841**	**$ 74,594,076**	**$ 66,035,600**	**$ 72,665,971**	**$ 133,198,107**	**$ 51,372,926**
Contingencies (30% of Subtotal II)	$ 20,803,752	$ 22,378,223	$ 19,810,680	$ 21,799,791	$ 39,959,432	$ 15,411,878
SUBTOTAL III	**$ 90,149,593**	**$ 96,972,299**	**$ 85,846,280**	**$ 94,465,763**	**$ 173,157,539**	**$ 66,784,804**
Earthwork						
Excavation	$ 187,740	$ 187,740	$ 187,740	$ 187,740	$ 4,761,870	$ 6,460,950
Embankment	$ -	$ -	$ 4,620,000	$ 4,620,000	$ 7,810,000	$ 6,072,000
SUBTOTAL I	**$ 187,740**	**$ 187,740**	**$ 4,807,740**	**$ 4,807,740**	**$ 12,571,870**	**$ 12,532,950**
Mobilization (10% of Subtotal I)	$ 18,774	$ 18,774	$ 480,774	$ 480,774	$ 1,257,187	$ 1,253,295
Traffic Control (3% of Subtotal I)	$ 5,632	$ 5,632	$ 144,232	$ 144,232	$ 377,156	$ 375,989
SUBTOTAL II	**$ 212,146**	**$ 212,146**	**$ 5,432,746**	**$ 5,432,746**	**$ 14,206,213**	**$ 14,162,234**
Contingencies (30% of Subtotal II)	$ 63,644	$ 63,644	$ 1,629,824	$ 1,629,824	$ 4,261,864	$ 4,248,670
SUBTOTAL III	**$ 275,790**	**$ 275,790**	**$ 7,062,570**	**$ 7,062,570**	**$ 18,468,077**	**$ 18,410,904**
Pavement, Signals, Warning Devices						
Asphalt Pavement	$ -	$ -	$ -	$ -	$ 56,000	$ 6,460,960
Transit Corridor Signal/Communication System	$ 5,950,550	$ 5,950,550	$ 5,272,050	$ 5,272,050	$ 5,272,050	$ 4,456,300
At-Grade X-ing Signal/Warning Devices	$ 22,000,000	$ 22,000,000	$ 17,000,000	$ 17,000,000	$ 17,000,000	$ 13,500,000
Grade Xing Panels	$ 1,320,000	$ 1,320,000	$ 1,470,000	$ 1,470,000	$ 2,400,000	$ 795,000
SUBTOTAL I	**$ 29,270,550**	**$ 29,270,550**	**$ 23,742,050**	**$ 23,742,050**	**$ 24,728,050**	**$ 25,212,260**
Mobilization (10% of Subtotal I)	$ 2,927,055	$ 2,927,055	$ 2,374,205	$ 2,374,205	$ 2,472,805	$ 2,521,226
Traffic Control (3% of Subtotal I)	$ 878,117	$ 878,117	$ 712,262	$ 712,262	$ 741,842	$ 756,368
SUBTOTAL II	**$ 33,075,722**	**$ 33,075,722**	**$ 26,828,517**	**$ 26,828,517**	**$ 27,942,697**	**$ 28,489,854**
Contingencies (30% of Subtotal II)	$ 9,922,716	$ 9,922,716	$ 8,048,555	$ 8,048,555	$ 8,382,809	$ 8,546,956
SUBTOTAL III	**$ 42,998,438**	**$ 42,998,438**	**$ 34,877,071**	**$ 34,877,071**	**$ 36,325,505**	**$ 37,036,810**
Drainage						
Drainage System	$ 1,617,200	$ 2,990,000	$ 6,214,000	$ 7,404,800	$ 10,384,400	$ 7,628,400
SUBTOTAL I	**$ 1,617,200**	**$ 2,990,000**	**$ 6,214,000**	**$ 7,404,800**	**$ 10,384,400**	**$ 7,628,400**
Mobilization (10% of Subtotal I)	$ 161,720	$ 299,000	$ 621,400	$ 740,480	$ 1,038,440	$ 762,840
Traffic Control (3% of Subtotal I)	$ 48,516	$ 89,700	$ 186,420	$ 222,144	$ 311,532	$ 228,852
SUBTOTAL II	**$ 1,827,436**	**$ 3,378,700**	**$ 7,021,820**	**$ 8,367,424**	**$ 11,734,372**	**$ 8,620,092**
Contingencies (30% of Subtotal II)	$ 548,231	$ 1,013,610	$ 2,106,546	$ 2,510,227	$ 3,520,312	$ 2,586,028
SUBTOTAL III	**$ 2,375,667**	**$ 4,392,310**	**$ 9,128,366**	**$ 10,877,651**	**$ 15,254,684**	**$ 11,206,120**
Other						
Maintance Facility Yard	$ -	$ -	$ 25,000,000	$ 25,000,000	$ -	$ -
Side-Running Station	$ 12,000,000	$ 12,000,000	$ 10,500,000	$ 10,500,000	$ 18,000,000	$ 8,000,000
Center-Running Station	$ 2,500,000	$ 2,500,000	$ 5,000,000	$ 5,000,000	$ 7,500,000	$ 3,600,000
Overhead Catenary System	$ -	$ -	$ -	$ -	$ 68,536,650	$ -
Substation	$ -	$ -	$ -	$ -	$ 6,000,000	$ -
SUBTOTAL I	**$ 14,500,000**	**$ 14,500,000**	**$ 40,500,000**	**$ 40,500,000**	**$ 100,036,650**	**$ 11,600,000**
Mobilization (10% of Subtotal I)	$ 1,450,000	$ 1,450,000	$ 4,050,000	$ 4,050,000	$ 10,003,665	$ 1,160,000
Traffic Control (3% of Subtotal I)	$ 435,000	$ 435,000	$ 1,215,000	$ 1,215,000	$ 3,001,100	$ 348,000
SUBTOTAL II	**$ 16,385,000**	**$ 16,385,000**	**$ 45,765,000**	**$ 45,765,000**	**$ 113,041,415**	**$ 13,108,000**
Contingencies (30% of Subtotal II)	$ 4,915,500	$ 4,915,500	$ 13,729,500	$ 13,729,500	$ 33,912,424	$ 3,932,400
SUBTOTAL III	**$ 21,300,500**	**$ 21,300,500**	**$ 59,494,500**	**$ 59,494,500**	**$ 146,953,839**	**$ 17,040,400**
TOTAL CAPITAL COSTS	**$ 169,051,199**	**$ 177,890,548**	**$ 212,585,230**	**$ 223,161,359**	**$ 432,423,460**	**$ 173,154,225**
Support Costs						
Planning/Pre-Design (5%)	$ 8,452,560	$ 8,894,527	$ 10,629,261	$ 11,158,068	$ 21,621,173	$ 8,657,711
Final Design (10%)	$ 16,905,120	$ 17,789,055	$ 21,258,523	$ 22,316,136	$ 43,242,346	$ 17,315,423
Environmental Document & Mitigation (8%)	$ 13,524,096	$ 14,231,244	$ 17,006,818	$ 17,852,909	$ 34,593,877	$ 13,852,338
Construction Admin. (10%)	$ 16,905,120	$ 17,789,055	$ 21,258,523	$ 22,316,136	$ 43,242,346	$ 17,315,423
Insurance (1.5%)	$ 2,535,768	$ 2,668,358	$ 3,188,778	$ 3,347,420	$ 6,486,352	$ 2,597,313
Master Cooperative Agreement	$ 20,000,000	$ 20,000,000	$ 20,000,000	$ 20,000,000	$ 20,000,000	$ 20,000,000
SUBTOTAL I	**$ 78,322,664**	**$ 81,372,239**	**$ 93,341,904**	**$ 96,990,669**	**$ 169,186,094**	**$ 79,738,208**
GRAND TOTAL (Rounded to the nearest $10,000)	**$ 247,370,000**	**$ 259,260,000**	**$ 305,930,000**	**$ 320,150,000**	**$ 601,610,000**	**$ 252,890,000**

TABLE B-2: OPINION OF PROBABLE CONSTRUCTION COSTS FOR TRANSIT OPTIONS

Union Station to the Blue Line Station Segment Milepost: -0.21 to 2.81

Total Miles: 3.02

Last Updated on 10/11/06
Prepared by GLT

Item Description	FRA Compliant DMU's (30" at Peak)			FRA Compliant DMU's (15" at Peak)			Non-FRA Compliant DMU's (30" All Day)			Non-FRA Compliant DMU's (15" All Day)			Light Rail Transit (15" All Day)			Bus Rapid Transit (15" All Day)		
	Quantity	Units	Cost	Quantity	Units	Cost	Quantity	Units	Cost	Quantity	Units	Cost	Quantity	Units	Cost	Quantity	Units	Cost
ROW Acquisition																		
Station ROW		SF	$ -		SF	$ -		SF	$ -		SF	$ -		SF	$ -		SF	$ -
Corridor ROW		SF	$ -		SF	$ -		SF	$ -		SF	$ -		SF	$ -		SF	$ -
SUBTOTAL II			$ -			$ -			$ -			$ -			$ -			$ -
Contingencies (30% of Subtotal II)			$ -			$ -			$ -			$ -			$ -			$ -
SUBTOTAL III			$ -			$ -			$ -			$ -			$ -			$ -
ROW Preparation																		
Prep ROW for Rail Station		SY	$ -		SY	$ -		SY	$ -		SY	$ -		SY	$ -		SY	$ -
Prep ROW for Rail Alignment		SY	$ -		SY	$ -		SY	$ -		SY	$ -		SY	$ -		SY	$ -
Remove Exist. Freight Track	10,930.00	TF	$ 153,020	10,930.00	TF	$ 153,020.00		TF	$ -		TF	$ -		TF	$ -		TF	$ -
Remove Exist. Freight Bridge		SF	$ -		SF	$ -		SF	$ -		SF	$ -		SF	$ -		SF	$ -
SUBTOTAL I			$ 153,020			$ 153,020			$ -			$ -			$ -			$ -
Mobilization (10% of Subtotal I)			$ 15,302			$ 15,302			$ -			$ -			$ -			$ -
Traffic Control (3% of Subtotal I)			$ 4,591			$ 4,591			$ -			$ -			$ -			$ -
Landscaping (1% of Subtotal I)			$ 1,530			$ 1,530			$ -			$ -			$ -			$ -
SUBTOTAL II			$ 174,443			$ 174,443			$ -			$ -			$ -			$ -
Contingencies (30% of Subtotal II)			$ 52,333			$ 52,333			$ -			$ -			$ -			$ -
SUBTOTAL III			$ 226,776			$ 226,776			$ -			$ -			$ -			$ -
Structures and Trackwork																		
Railroad Bridge	107,000	SF	$ 26,750,000	107,000	SF	$ 26,750,000		SF	$ -		SF	$ -		SF	$ -		SF	$ -
Retaining Wall		SF	$ -		SF	$ -		SF	$ -		SF	$ -		SF	$ -		SF	$ -
Track: Embedded		MI	$ -		MI	$ -		MI	$ -		MI	$ -		MI	$ -		MI	$ -
Track: Ballasted	2.07	MI	$ 2,898,000	2.07	MI	$ 2,898,000		MI	$ -		MI	$ -		MI	$ -		MI	$ -
New Ties & Ballast	0.50	MI	$ 270,000	0.50	MI	$ 270,000		MI	$ -		MI	$ -		MI	$ -		MI	$ -
Sidings		TF	$ -		TF	$ -		TF	$ -		TF	$ -		TF	$ -		TF	$ -
Turnout (#20)		EA	$ -		EA	$ -		EA	$ -		EA	$ -		EA	$ -		EA	$ -
SUBTOTAL I			$ 29,918,000			$ 29,918,000			$ -			$ -			$ -			$ -
Mobilization (10% of Subtotal I)			$ 2,991,800			$ 2,991,800			$ -			$ -			$ -			$ -
Traffic Control (3% of Subtotal I)			$ 897,540			$ 897,540			$ -			$ -			$ -			$ -
Landscaping (1% of Subtotal I)			$ 299,180			$ 299,180			$ -			$ -			$ -			$ -
SUBTOTAL II			$ 34,106,520			$ 34,106,520			$ -			$ -			$ -			$ -
Contingencies (30% of Subtotal II)			$ 10,231,956			$ 10,231,956			$ -			$ -			$ -			$ -
SUBTOTAL III			$ 44,338,476			$ 44,338,476			$ -			$ -			$ -			$ -
Earthwork																		
Excavation		CY	$ -		CY	$ -		CY	$ -		CY	$ -		CY	$ -		CY	$ -
Embankment		CY	$ -		CY	$ -		CY	$ -		CY	$ -		CY	$ -		CY	$ -
SUBTOTAL I			$ -			$ -			$ -			$ -			$ -			$ -
Mobilization (10% of Subtotal I)			$ -			$ -			$ -			$ -			$ -			$ -
Traffic Control (3% of Subtotal I)			$ -			$ -			$ -			$ -			$ -			$ -
SUBTOTAL II			$ -			$ -			$ -			$ -			$ -			$ -
Contingencies (30% of Subtotal II)			$ -			$ -			$ -			$ -			$ -			$ -
SUBTOTAL III			$ -			$ -			$ -			$ -			$ -			$ -
Pavement, Signals, Warning Devices																		
Asphalt Pavement		SY	$ -		SY	$ -		SY	$ -		SY	$ -		SY	$ -		SY	$ -
Transit Corridor Signal/Communication System	13,570	LF	$ 678,500	13,570	LF	$ 678,500		LF	$ -		LF	$ -		LF	$ -		LF	$ -
At-Grade X-ing Signal/Warning Devices	20	EA	$ 5,000,000	20	EA	$ 5,000,000		EA	$ -		EA	$ -		EA	$ -		EA	$ -
Grade Xing Panels	20	EA	$ 300,000	20	EA	$ 300,000		EA	$ -		EA	$ -		EA	$ -		EA	$ -
SUBTOTAL I			$ 5,978,500			$ 5,978,500			$ -			$ -			$ -			$ -
Mobilization (10% of Subtotal I)			$ 597,850			$ 597,850			$ -			$ -			$ -			$ -
Traffic Control (3% of Subtotal I)			$ 179,355			$ 179,355			$ -			$ -			$ -			$ -
SUBTOTAL II			$ 6,755,705			$ 6,755,705			$ -			$ -			$ -			$ -
Contingencies (30% of Subtotal II)			$ 2,026,712			$ 2,026,712			$ -			$ -			$ -			$ -
SUBTOTAL III			$ 8,782,417			$ 8,782,417			$ -			$ -			$ -			$ -
Drainage																		
Drainage System		MI	$ -		MI	$ -		MI	$ -		MI	$ -		MI	$ -		MI	$ -
SUBTOTAL I			$ -			$ -			$ -			$ -			$ -			$ -
Mobilization (10% of Subtotal I)			$ -			$ -			$ -			$ -			$ -			$ -
Traffic Control (3% of Subtotal I)			$ -			$ -			$ -			$ -			$ -			$ -
SUBTOTAL II			$ -			$ -			$ -			$ -			$ -			$ -
Contingencies (30% of Subtotal II)			$ -			$ -			$ -			$ -			$ -			$ -
SUBTOTAL III			$ -			$ -			$ -			$ -			$ -			$ -
Other																		
Maintance Facility Yard		EA	$ -		EA	$ -		EA	$ -		EA	$ -		EA	$ -		EA	$ -
Side-Running Station		EA	$ -		EA	$ -		EA	$ -		EA	$ -		EA	$ -		EA	$ -
Center-Running Station		EA	$ -		EA	$ -		EA	$ -		EA	$ -		EA	$ -		EA	$ -
Overhead Catenary System		LF	$ -		LF	$ -		LF	$ -		LF	$ -		LF	$ -		LF	$ -
Substation		EA	$ -		EA	$ -		EA	$ -		EA	$ -		EA	$ -		EA	$ -
SUBTOTAL I			$ -			$ -			$ -			$ -			$ -			$ -
Mobilization (10% of Subtotal I)			$ -			$ -			$ -			$ -			$ -			$ -
Traffic Control (3% of Subtotal I)			$ -			$ -			$ -			$ -			$ -			$ -
SUBTOTAL II			$ -			$ -			$ -			$ -			$ -			$ -
Contingencies (30% of Subtotal II)			$ -			$ -			$ -			$ -			$ -			$ -
SUBTOTAL III			$ -			$ -			$ -			$ -			$ -			$ -
TOTAL CAPITAL COSTS			$ 53,347,669			$ 53,347,669			$ -			$ -			$ -			$ -
Support Costs																		
Planning/Pre-Design (5%)			$ 2,667,383			$ 2,667,383												
Final Design (10%)			$ 5,334,767			$ 5,334,767												
Environmental Document & Mitigation (8%)			$ 4,267,814			$ 4,267,814												
Construction Admin. (10%)			$ 5,334,767			$ 5,334,767												
Insurance (1.5%)			$ 800,215			$ 800,215												
Master Cooperative Agreement			$ -			$ -												
SUBTOTAL I			$ 18,404,946			$ 18,404,946			$ -			$ -			$ -			$ -
GRAND TOTAL (Rounded to the nearest $10,000)			$ 71,750,000			$ 71,750,000			$ -			$ -			$ -			$ -

TABLE B-3: OPINION OF PROBABLE CONSTRUCTION COSTS FOR TRANSIT OPTIONS
Blue Line Station to Green Line Station Segment

Milepost: 2.81 to 13.2
Total Miles: 10.39

Last Updated on 10/11/06
Prepared by GLT

Item Description	FRA Compliant DMU's (30" at Peak)			FRA Compliant DMU's (15" at Peak)			Non-FRA Compliant DMU's (30" All Day)			Non-FRA Compliant DMU's (15" All Day)			Light Rail Transit (15" All Day)			Bus Rapid Transit (15" All Day)		
	Quantity	Units	Cost	Quantity	Units	Cost	Quantity	Units	Cost	Quantity	Units	Cost	Quantity	Units	Cost	Quantity	Units	Cost
ROW Acquisition																		
Station ROW		SF	$ -		SF	$ -	9,000	SF	$ 405,000	9,000	SF	$ 405,000	9,000	SF	$ 405,000	9,000	SF	$ 405,000
Corridor ROW		SF	$ -		SF	$ -		SF	$ -		SF	$ -	246,744	SF	$ 9,376,272		SF	$ -
SUBTOTAL II			$ -			$ -			$ 405,000			$ 405,000			$ 9,781,272			$ 405,000
Contingencies (30% of Subtotal II)			$ -			$ -			$ 121,500			$ 121,500			$ 2,934,382			$ 121,500
SUBTOTAL III			$ -			$ -			$ 526,500			$ 526,500			$ 12,715,654			$ 526,500
ROW Preparation																		
Prep ROW for Rail Station	9,000	SY	$ 540,000	9,000	SY	$ 540,000.00	9,000	SY	$ 540,000	9,000	SY	$ 540,000	9,000	SY	$ 540,000	1,333	SY	$ 79,980
Prep ROW for Rail Alignment	17,718	SY	$ 265,770	17,718	SY	$ 265,770.00	22,763	SY	$ 341,445	22,763	SY	$ 341,445	182,864	SY	$ 2,742,960	128,480	SY	$ 1,927,200
Remove Exist. Freight Track	46,939	TF	$ 657,146	46,939	TF	$ 657,146.00	46,939	TF	$ 657,146	46,939	TF	$ 657,146	57,552	TF	$ 805,728	38,544	TF	$ 539,616
Remove Exist. Freight Bridge		SF	$ -		SF	$ -		SF	$ -		SF	$ -		SF	$ -		SF	$ -
SUBTOTAL I			$ 1,462,916			$ 1,462,916			$ 1,538,591			$ 1,538,591			$ 4,088,688			$ 2,546,796
Mobilization (10% of Subtotal I)			$ 146,292			$ 146,292			$ 153,859			$ 153,859			$ 408,869			$ 254,680
Traffic Control (3% of Subtotal I)			$ 43,887			$ 43,887			$ 46,158			$ 46,158			$ 122,661			$ 76,404
Landscaping (1% of Subtotal I)			$ 14,629			$ 14,629			$ 15,386			$ 15,386			$ 40,887			$ 25,468
SUBTOTAL II			$ 1,667,724			$ 1,667,724			$ 1,753,994			$ 1,753,994			$ 4,661,105			$ 2,903,348
Contingencies (30% of Subtotal II)			$ 500,317			$ 500,317			$ 526,198			$ 526,198			$ 1,398,332			$ 871,004
SUBTOTAL III			$ 2,168,041			$ 2,168,041			$ 2,280,192			$ 2,280,192			$ 6,059,437			$ 3,774,352
Structures and Trackwork																		
Railroad Bridge	2,000	SF	$ 500,000	2,000	SF	$ 500,000	2,000	SF	$ 500,000	2,000	SF	$ 500,000	8,000	SF	$ 2,000,000	2,000	SF	$ 500,000
Retaining Wall		SF	$ -		SF	$ -		SF	$ -		SF	$ -	59,840	SF	$ 8,976,000		SF	$ -
Track: Embedded		MI	$ -		MI	$ -		MI	$ -		MI	$ -	0.20	MI	$ 300,000	5.51	MI	$ 8,265,000
Track: Ballasted	8.89	MI	$ 12,446,000	8.89	MI	$ 12,446,000	9.75	MI	$ 13,650,000	9.75	MI	$ 13,650,000	20.78	MI	$ 29,092,000	1.79	MI	$ 2,506,000
New Ties & Ballast	1.50	MI	$ 810,000	1.50	MI	$ 810,000	1.50	MI	$ 810,000	1.50	MI	$ 810,000		MI	$ -		MI	$ -
Sidings	9,821	TF	$ 2,602,565	21,912	TF	$ 5,806,680	7,973	TF	$ 2,112,845	20,064	TF	$ 5,316,960		TF	$ -		TF	$ -
Turnout (#20)	2	EA	$ 200,000	8	EA	$ 800,000	2	EA	$ 200,000	7	EA	$ 700,000	2	EA	$ 200,000		EA	$ -
SUBTOTAL I			$ 16,558,565			$ 20,362,680			$ 17,272,845			$ 20,976,960			$ 40,568,000			$ 11,271,000
Mobilization (10% of Subtotal I)			$ 1,655,857			$ 2,036,268			$ 1,727,285			$ 2,097,696			$ 4,056,800			$ 1,127,100
Traffic Control (3% of Subtotal I)			$ 496,757			$ 610,880			$ 518,185			$ 629,309			$ 1,217,040			$ 338,130
Landscaping (1% of Subtotal I)			$ 165,586			$ 203,627			$ 172,728			$ 209,770			$ 405,680			$ 112,710
SUBTOTAL II			$ 18,876,765			$ 23,213,455			$ 19,691,043			$ 23,913,735			$ 46,247,520			$ 12,848,940
Contingencies (30% of Subtotal II)			$ 5,663,030			$ 6,964,037			$ 5,907,313			$ 7,174,121			$ 13,874,256			$ 3,854,682
SUBTOTAL III			$ 24,539,795			$ 30,177,492			$ 25,598,356			$ 31,087,856			$ 60,121,776			$ 16,703,622
Earthwork																		
Excavation		CY	$ -		CY	$ -		CY	$ -		CY	$ -	87,615	CY	$ 2,628,450	85,653	CY	$ 2,569,590
Embankment		CY	$ -		CY	$ -		CY	$ -		CY	$ -		CY	$ -		CY	$ -
SUBTOTAL I			$ -			$ -			$ -			$ -			$ 2,628,450			$ 2,569,590
Mobilization (10% of Subtotal I)			$ -			$ -			$ -			$ -			$ 262,845			$ 256,959
Traffic Control (3% of Subtotal I)			$ -			$ -			$ -			$ -			$ 78,854			$ 77,088
SUBTOTAL II			$ -			$ -			$ -			$ -			$ 2,970,149			$ 2,903,637
Contingencies (30% of Subtotal II)			$ -			$ -			$ -			$ -			$ 891,045			$ 871,091
SUBTOTAL III			$ -			$ -			$ -			$ -			$ 3,861,194			$ 3,774,728
Pavement, Signals, Warning Devices																		
Asphalt Pavement		SY	$ -		SY	$ -		SY	$ -		SY	$ -	2,800	SY	$ 56,000	128,480	SY	$ 2,569,600
Transit Corridor Signal/Communication System	54,859	LF	$ 2,742,950	54,859	LF	$ 2,742,950	54,859	LF	$ 2,742,950	54,859	LF	$ 2,742,950	54,859	LF	$ 2,742,950	38,544	LF	$ 1,927,200
At-Grade X-ing Signal/Warning Devices	44	EA	$ 11,000,000	44	EA	$ 11,000,000	44	EA	$ 11,000,000	44	EA	$ 11,000,000	44	EA	$ 11,000,000	35	EA	$ 8,750,000
Grade Xing Panels	44	EA	$ 660,000	44	EA	$ 660,000	50	EA	$ 750,000	50	EA	$ 750,000	88	EA	$ 1,320,000	35	EA	$ 525,000
SUBTOTAL I			$ 14,402,950			$ 14,402,950			$ 14,492,950			$ 14,492,950			$ 15,118,950			$ 13,771,800
Mobilization (10% of Subtotal I)			$ 1,440,295			$ 1,440,295			$ 1,449,295			$ 1,449,295			$ 1,511,895			$ 1,377,180
Traffic Control (3% of Subtotal I)			$ 432,089			$ 432,089			$ 434,789			$ 434,789			$ 453,569			$ 413,154
SUBTOTAL II			$ 16,275,334			$ 16,275,334			$ 16,377,034			$ 16,377,034			$ 17,084,414			$ 15,562,134
Contingencies (30% of Subtotal II)			$ 4,882,600			$ 4,882,600			$ 4,913,110			$ 4,913,110			$ 5,125,324			$ 4,668,640
SUBTOTAL III			$ 21,157,934			$ 21,157,934			$ 21,290,144			$ 21,290,144			$ 22,209,738			$ 20,230,774
Drainage																		
Drainage System	1.51	MI	$ 785,200	4.15	MI	$ 2,158,000	2.37	MI	$ 1,232,400	4.66	MI	$ 2,423,200	10.39	MI	$ 5,402,800	7.30	MI	$ 3,796,000
SUBTOTAL I			$ 785,200			$ 2,158,000			$ 1,232,400			$ 2,423,200			$ 5,402,800			$ 3,796,000
Mobilization (10% of Subtotal I)			$ 78,520			$ 215,800			$ 123,240			$ 242,320			$ 540,280			$ 379,600
Traffic Control (3% of Subtotal I)			$ 23,556			$ 64,740			$ 36,972			$ 72,696			$ 162,084			$ 113,880
SUBTOTAL II			$ 887,276			$ 2,438,540			$ 1,392,612			$ 2,738,216			$ 6,105,164			$ 4,289,480
Contingencies (30% of Subtotal II)			$ 266,183			$ 731,562			$ 417,784			$ 821,465			$ 1,831,549			$ 1,286,844
SUBTOTAL III			$ 1,153,459			$ 3,170,102			$ 1,810,396			$ 3,559,681			$ 7,936,713			$ 5,576,324
Other																		
Maintance Facility Yard		EA	$ -		EA	$ -		EA	$ -		EA	$ -		EA	$ -		EA	$ -
Side-Running Station	6	EA	$ 9,000,000	6	EA	$ 9,000,000	5	EA	$ 7,500,000	5	EA	$ 7,500,000	8	EA	$ 12,000,000	6	EA	$ 4,800,000
Center-Running Station		EA	$ -		EA	$ -	1	EA	$ 2,500,000	1	EA	$ 2,500,000	2	EA	$ 5,000,000	2	EA	$ 2,400,000
Overhead Catenary System		LF	$ -		LF	$ -		LF	$ -		LF	$ -	54,859	LF	$ 35,658,350		LF	$ -
Substation		EA	$ -		EA	$ -		EA	$ -		EA	$ -	4	EA	$ 3,000,000		EA	$ -
SUBTOTAL I			$ 9,000,000			$ 9,000,000			$ 10,000,000			$ 10,000,000			$ 55,658,350			$ 7,200,000
Mobilization (10% of Subtotal I)			$ 900,000			$ 900,000			$ 1,000,000			$ 1,000,000			$ 5,565,835			$ 720,000
Traffic Control (3% of Subtotal I)			$ 270,000			$ 270,000			$ 300,000			$ 300,000			$ 1,669,751			$ 216,000
SUBTOTAL II			$ 10,170,000			$ 10,170,000			$ 11,300,000			$ 11,300,000			$ 62,893,936			$ 8,136,000
Contingencies (30% of Subtotal II)			$ 3,051,000			$ 3,051,000			$ 3,390,000			$ 3,390,000			$ 18,868,181			$ 2,440,800
SUBTOTAL III			$ 13,221,000			$ 13,221,000			$ 14,690,000			$ 14,690,000			$ 81,762,117			$ 10,576,800
TOTAL CAPITAL COSTS			$ 62,240,229			$ 69,894,569			$ 66,195,588			$ 73,434,373			$ 194,066,629			$ 61,163,100
Support Costs																		
Planning/Pre-Design (5%)			$ 3,112,011			$ 3,494,728			$ 3,309,779			$ 3,671,719			$ 9,733,331			$ 3,058,155
Final Design (10%)			$ 6,224,023			$ 6,989,457			$ 6,619,559			$ 7,343,437			$ 19,466,663			$ 6,116,310
Environmental Document & Mitigation (8%)			$ 4,979,218			$ 5,591,566			$ 5,295,647			$ 5,874,750			$ 15,573,330			$ 4,893,048
Construction Admin. (10%)			$ 6,224,023			$ 6,989,457			$ 6,619,559			$ 7,343,437			$ 19,466,663			$ 6,116,310
Insurance (1.5%)			$ 933,603			$ 1,048,419			$ 992,934			$ 1,101,516			$ 2,919,999			$ 917,447
Master Cooperative Agreement			$ 10,400,000			$ 10,400,000			$ 10,400,000			$ 10,400,000			$ 10,400,000			$ 10,400,000
SUBTOTAL I			$ 31,872,879			$ 34,513,626			$ 33,237,478			$ 35,734,859			$ 77,559,987			$ 31,501,270
GRAND TOTAL (Rounded to the nearest $10,000)			$ 94,110,000			$ 104,410,000			$ 99,430,000			$ 109,170,000			$ 272,230,000			$ 92,660,000

TABLE B-4: OPINION OF PROBABLE CONSTRUCTION COSTS FOR TRANSIT OPTIONS
Green Line Station to Torrance Segment

Milepost: 13.2 to 22.78
Total Miles: 9.58

Last Updated on 10/11/06
Prepared by GLT

Item Description	FRA Compliant DMU's (30" at Peak)			FRA Compliant DMU's (15" at Peak)			Non-FRA Compliant DMU's (30" All Day)			Non-FRA Compliant DMU's (15" All Day)			Light Rail Transit (15" All Day)			Bus Rapid Transit (15" All Day)		
	Quantity	Units	Cost	Quantity	Units	Cost	Quantity	Units	Cost	Quantity	Units	Cost	Quantity	Units	Cost	Quantity	Units	Cost
ROW Acquisition																		
Station ROW		SF	$ -		SF	$ -		SF	$ -		SF	$ -	13,500	SF	$ 607,500	6,000	SF	$ 270,000
Corridor ROW	168,960	SF	$ 6,420,480	168,960	SF	$ 6,420,480	168,960	SF	$ 6,420,480	168,960	SF	$ 6,420,480	168,960	SF	$ 6,420,480	168,960	SF	$ 6,420,480
SUBTOTAL II			**$ 6,420,480**			**$ 6,420,480**			**$ 6,420,480**			**$ 6,420,480**			**$ 7,027,980**			**$ 6,690,480**
Contingencies (30% of Subtotal II)			$ 1,926,144			$ 1,926,144			$ 1,926,144			$ 1,926,144			$ 2,108,394			$ 2,007,144
SUBTOTAL III			**$ 8,346,624**			**$ 8,346,624**			**$ 8,346,624**			**$ 8,346,624**			**$ 9,136,374**			**$ 8,697,624**
ROW Preparation																		
Prep ROW for Rail Station	4,500	SY	$ 270,000	4,500	SY	$ 270,000.00	4,500	SY	$ 270,000	4,500	SY	$ 270,000	4,500	SY	$ 270,000	2,200	SY	$ 132,000
Prep ROW for Rail Alignment	5,867	SY	$ 88,005	5,867	SY	$ 88,005.00	177,408	SY	$ 2,661,120	186,736	SY	$ 2,801,040	421,520	SY	$ 6,322,800	324,280	SY	$ 4,864,200
Remove Exist. Freight Track	32,736	TF	$ 458,304	32,736	TF	$ 458,304.00	32,736	TF	$ 458,304	32,736	TF	$ 458,304	50,582	TF	$ 708,148	38,914	TF	$ 544,796
Remove Exist. Freight Bridge		SF	$ -		SF	$ -		SF	$ -		SF	$ -	47,670	SF	$ 2,383,500	19,770	SF	$ 988,500
SUBTOTAL I			**$ 816,309**			**$ 816,309**			**$ 3,389,424**			**$ 3,529,344**			**$ 9,684,448**			**$ 6,529,496**
Mobilization (10% of Subtotal I)			$ 81,631			$ 81,631			$ 338,942			$ 352,934			$ 968,445			$ 652,950
Traffic Control (3% of Subtotal I)			$ 24,489			$ 24,489			$ 101,683			$ 105,880			$ 290,533			$ 195,885
Landscaping (1% of Subtotal I)			$ 8,163			$ 8,163			$ 33,894			$ 35,293			$ 96,844			$ 65,295
SUBTOTAL II			**$ 930,592**			**$ 930,592**			**$ 3,863,943**			**$ 4,023,451**			**$ 11,040,270**			**$ 7,443,626**
Contingencies (30% of Subtotal II)			$ 279,178			$ 279,178			$ 1,159,183			$ 1,207,035			$ 3,312,081			$ 2,233,088
SUBTOTAL III			**$ 1,209,770**			**$ 1,209,770**			**$ 5,023,126**			**$ 5,230,486**			**$ 14,352,351**			**$ 9,676,714**
Structures and Trackwork																		
Railroad Bridge		SF	$ -		SF	$ -	47,040	SF	$ 11,760,000	51,720	SF	$ 12,930,000	105,925	SF	$ 26,481,250	69,025	SF	$ 17,256,250
Retaining Wall		SF	$ -		SF	$ -	5,520	SF	$ 828,000	5,520	SF	$ 828,000	36,000	SF	$ 5,400,000	25,200	SF	$ 3,780,000
Track: Embedded		MI	$ -		MI	$ -		MI	$ -		MI	$ -		MI	$ -		MI	$ -
Track: Ballasted	8.30	MI	$ 11,620,000	8.30	MI	$ 11,620,000	17.88	MI	$ 25,032,000	18.41	MI	$ 25,774,000	30.34	MI	$ 42,476,000	7.37	MI	$ 10,318,000
New Ties & Ballast	0.36	MI	$ 194,400	0.36	MI	$ 194,400	0.36	MI	$ 194,400	0.36	MI	$ 194,400		MI	$ -		MI	$ -
Sidings	8,448	TF	$ 2,238,720	11088	TF	$ 2,938,320	8,448	TF	$ 2,238,720	8,448	TF	$ 2,238,720	4,963	TF	$ 1,315,195	8,448	TF	$ 2,238,720
Turnout (#20)	3	EA	$ 300,000	4	EA	$ 400,000	6	EA	$ 600,000	8	EA	$ 800,000	6	EA	$ 600,000	2	EA	$ 200,000
SUBTOTAL I			**$ 14,353,120**			**$ 15,152,720**			**$ 40,653,120**			**$ 42,765,120**			**$ 76,272,445**			**$ 33,792,970**
Mobilization (10% of Subtotal I)			$ 1,435,312			$ 1,515,272			$ 4,065,312			$ 4,276,512			$ 7,627,245			$ 3,379,297
Traffic Control (3% of Subtotal I)			$ 430,594			$ 454,582			$ 1,219,594			$ 1,282,954			$ 2,288,173			$ 1,013,789
Landscaping (1% of Subtotal I)			$ 143,531			$ 151,527			$ 406,531			$ 427,651			$ 762,724			$ 337,930
SUBTOTAL II			**$ 16,362,557**			**$ 17,274,101**			**$ 46,344,557**			**$ 48,752,237**			**$ 86,950,587**			**$ 38,523,986**
Contingencies (30% of Subtotal II)			$ 4,908,767			$ 5,182,230			$ 13,903,367			$ 14,625,671			$ 26,085,176			$ 11,557,196
SUBTOTAL III			**$ 21,271,324**			**$ 22,456,331**			**$ 60,247,924**			**$ 63,377,908**			**$ 113,035,763**			**$ 50,081,182**
Earthwork																		
Excavation	6,258	CY	$ 187,740	6,258	CY	$ 187,740	$ 6,258	CY	$ 187,740	6,258	CY	$ 187,740	71,114	CY	$ 2,133,420	129,712	CY	$ 3,891,360
Embankment		CY	$ -		CY	$ -	$ 84,000	CY	$ 4,620,000	84,000	CY	$ 4,620,000	142,000	CY	$ 7,810,000	110,400	CY	$ 6,072,000
SUBTOTAL I			**$ 187,740**			**$ 187,740**			**$ 4,807,740**			**$ 4,807,740**			**$ 9,943,420**			**$ 9,963,360**
Mobilization (10% of Subtotal I)			$ 18,774			$ 18,774			$ 480,774			$ 480,774			$ 994,342			$ 996,336
Traffic Control (3% of Subtotal I)			$ 5,632			$ 5,632			$ 144,232			$ 144,232			$ 298,303			$ 298,901
SUBTOTAL II			**$ 212,146**			**$ 212,146**			**$ 5,432,746**			**$ 5,432,746**			**$ 11,236,065**			**$ 11,258,597**
Contingencies (30% of Subtotal II)			$ 63,644			$ 63,644			$ 1,629,824			$ 1,629,824			$ 3,370,820			$ 3,377,579
SUBTOTAL III			**$ 275,790**			**$ 275,790**			**$ 7,062,570**			**$ 7,062,570**			**$ 14,606,885**			**$ 14,636,176**
Pavement, Signals, Warning Devices																		
Asphalt Pavement		SY	$ -		SY	$ -		SY	$ -		SY	$ -		SY	$ -	194,568	SY	$ 3,891,360
Transit Corridor Signal/Communication System	50,582	LF	$ 2,529,100	50,582	LF	$ 2,529,100	50,582	LF	$ 2,529,100	50,582	LF	$ 2,529,100	50,582	LF	$ 2,529,100	50,582	LF	$ 2,529,100
At-Grade X-ing Signal/Warning Devices	24	EA	$ 6,000,000	24	EA	$ 6,000,000	24	EA	$ 6,000,000	24	EA	$ 6,000,000	24	EA	$ 6,000,000	19	EA	$ 4,750,000
Grade Xing Panels	24	EA	$ 360,000	24	EA	$ 360,000	48	EA	$ 720,000	48	EA	$ 720,000	72	EA	$ 1,080,000	18	EA	$ 270,000
SUBTOTAL I			**$ 8,889,100**			**$ 8,889,100**			**$ 9,249,100**			**$ 9,249,100**			**$ 9,609,100**			**$ 11,440,460**
Mobilization (10% of Subtotal I)			$ 888,910			$ 888,910			$ 924,910			$ 924,910			$ 960,910			$ 1,144,046
Traffic Control (3% of Subtotal I)			$ 266,673			$ 266,673			$ 277,473			$ 277,473			$ 288,273			$ 343,214
SUBTOTAL II			**$ 10,044,683**			**$ 10,044,683**			**$ 10,451,483**			**$ 10,451,483**			**$ 10,858,283**			**$ 12,927,720**
Contingencies (30% of Subtotal II)			$ 3,013,405			$ 3,013,405			$ 3,135,445			$ 3,135,445			$ 3,257,485			$ 3,878,316
SUBTOTAL III			**$ 13,058,088**			**$ 13,058,088**			**$ 13,586,928**			**$ 13,586,928**			**$ 14,115,768**			**$ 16,806,036**
Drainage																		
Drainage System	1.60	MI	$ 832,000	1.60	MI	$ 832,000	9.58	MI	$ 4,981,600	9.58	MI	$ 4,981,600	9.58	MI	$ 4,981,600	7.37	MI	$ 3,832,400
SUBTOTAL I			**$ 832,000**			**$ 832,000**			**$ 4,981,600**			**$ 4,981,600**			**$ 4,981,600**			**$ 3,832,400**
Mobilization (10% of Subtotal I)			$ 83,200			$ 83,200			$ 498,160			$ 498,160			$ 498,160			$ 383,240
Traffic Control (3% of Subtotal I)			$ 24,960			$ 24,960			$ 149,448			$ 149,448			$ 149,448			$ 114,972
SUBTOTAL II			**$ 940,160**			**$ 940,160**			**$ 5,629,208**			**$ 5,629,208**			**$ 5,629,208**			**$ 4,330,612**
Contingencies (30% of Subtotal II)			$ 282,048			$ 282,048			$ 1,688,762			$ 1,688,762			$ 1,688,762			$ 1,299,184
SUBTOTAL III			**$ 1,222,208**			**$ 1,222,208**			**$ 7,317,970**			**$ 7,317,970**			**$ 7,317,970**			**$ 5,629,796**
Other																		
Maintance Facility Yard		EA	$ -		EA	$ -	1	EA	$ 25,000,000	1	EA	$ 25,000,000		EA	$ -		EA	$ -
Side-Running Station	2	EA	$ 3,000,000	2	EA	$ 3,000,000	2	EA	$ 3,000,000	2	EA	$ 3,000,000	4	EA	$ 6,000,000	4	EA	$ 3,200,000
Center-Running Station	1	EA	$ 2,500,000	1	EA	$ 2,500,000	1	EA	$ 2,500,000	1	EA	$ 2,500,000	1	EA	$ 2,500,000	1	EA	$ 1,200,000
Overhead Catenary System		LF	$ -		LF	$ -		LF	$ -		LF	$ -	50,582	LF	$ 32,878,300		LF	$ -
Substation		EA	$ -		EA	$ -		EA	$ -		EA	$ -	4	EA	$ 3,000,000		EA	$ -
SUBTOTAL I			**$ 5,500,000**			**$ 5,500,000**			**$ 30,500,000**			**$ 30,500,000**			**$ 44,378,300**			**$ 4,400,000**
Mobilization (10% of Subtotal I)			$ 550,000			$ 550,000			$ 3,050,000			$ 3,050,000			$ 4,437,830			$ 440,000
Traffic Control (3% of Subtotal I)			$ 165,000			$ 165,000			$ 915,000			$ 915,000			$ 1,331,349			$ 132,000
SUBTOTAL II			**$ 6,215,000**			**$ 6,215,000**			**$ 34,465,000**			**$ 34,465,000**			**$ 50,147,479**			**$ 4,972,000**
Contingencies (30% of Subtotal II)			$ 1,864,500			$ 1,864,500			$ 10,339,500			$ 10,339,500			$ 15,044,244			$ 1,491,600
SUBTOTAL III			**$ 8,079,500**			**$ 8,079,500**			**$ 44,804,500**			**$ 44,804,500**			**$ 65,191,723**			**$ 6,463,600**
TOTAL CAPITAL COSTS			**$ 53,463,304**			**$ 54,648,311**			**$ 146,389,642**			**$ 149,720,986**			**$ 237,756,834**			**$ 111,091,128**
Support Costs																		
Planning/Pre-Design (5%)			$ 2,673,165			$ 2,732,416			$ 7,319,482			$ 7,486,349			$ 11,887,842			$ 5,599,556
Final Design (10%)			$ 5,346,330			$ 5,464,831			$ 14,638,964			$ 14,972,699			$ 23,775,683			$ 11,199,113
Environmental Document & Mitigation (8%)			$ 4,277,064			$ 4,371,865			$ 11,711,171			$ 11,978,159			$ 19,020,547			$ 8,959,290
Construction Admin. (10%)			$ 5,346,330			$ 5,464,831			$ 14,638,964			$ 14,972,699			$ 23,775,683			$ 11,199,113
Insurance (1.5%)			$ 801,950			$ 819,725			$ 2,195,846			$ 2,245,905			$ 3,566,353			$ 1,679,867
Master Cooperative Agreement			$ 9,600,000			$ 9,600,000			$ 9,600,000			$ 9,600,000			$ 9,600,000			$ 9,600,000
SUBTOTAL I			**$ 28,044,840**			**$ 28,453,667**			**$ 60,104,426**			**$ 61,255,810**			**$ 91,626,108**			**$ 48,236,939**
GRAND TOTAL (Rounded to the nearest $10,000)			**$ 81,510,000**			**$ 83,100,000**			**$ 206,490,000**			**$ 210,980,000**			**$ 329,380,000**			**$ 160,230,000**

TABLE B-5: UNIT COSTS - Harbor Subdivision

Item Description	Unit	Unit Cost	Source	Notes
ROW Acquisition				
Station ROW	SF	$ 45.00	Broker/real estate info.	
Corridor ROW	SF	$ 38.00	Broker/real estate info.	
ROW Preparation				
Prep ROW for Rail Station	SY	$ 60.00	UTA Yard, 900 S., 9400 S. TRAX Stations	
Prep ROW for Rail Alignment	SY	$ 15.00	UTA Yard, clear/grub costs	
Remove Exist. Freight Track	TF	$ 14.00	Project estimate	
Remove Exist. Freight Bridge	SF	$ 50.00	Roadway Bridge Removal estimate	
Structures and Trackwork				
Railroad Bridge	SF	$ 250	State DOT / I-215 bridge	
Retaining Wall	SF	$ 150	State DOT / UTA yard expansion	
Track: Embedded	Mi	$ 1,500,000	past rail projects	Single Track, Rail embedded in roadway
Track: Ballasted	Mi	$ 1,400,000	UTA Yard / past rail projects	Single Track, rail and ballast
New Ties & Ballast	Mi	$ 540,000	Project estimate	
Sidings	TF	$ 265	Project estimate	
Turnout (#20 - Commuter)	EA	$ 100,000	Project estimate	
Earthwork				
Excavation	CY	30	DOT Roadway estimate	
Embankment	CY	55	DOT Roadway estimate	
Pavement, Signals, Warning Devices				
Asphalt Pavement	SY	20	I-215 Bridge, DOT	4" Asphalt w/ 8" UTBC
Transit Corridor Signal/Communication System	LF	50	V-T, Commuter Rail	
At-Grade X-ing Signal/Warning Devices	EA	250,000	V-T, Crenshaw MIS	Signal & arms at each grade xing
Grade Xing Panels	EA	$ 15,000	9400 South, V-T estimate	3 concrete panels per track/roadway xing (both sides of track and middle)
Drainage				
Drainage System	Mi	$ 520,000	V-T, HS, DOT prices	underdrain, fabric, catch basins, ditches, discharge permits, detention
Other: Option Specific				
FRA Compliant DMU's				
Side-Running Station	EA	$ 1,500,000	900 S. & 9400 S.	
Center-Running Station	EA	$ 2,500,000	900 S. & 9400 S.	
Non-Compliant DMU's				
Maintance Facility Yard	EA	$ 25,000,000	Project Estimate	
Side-Running Station	EA	$ 1,500,000	900 S. & 9400 S.	
Center-Running Station	EA	$ 2,500,000	900 S. & 9400 S.	
LIGHT RAIL				
Overhead Catenary System	LF	$ 650	V-T Study	double track
Substation	EA	$ 750,000	Project Estimate	
Side-Running Station	EA	$ 1,500,000	900 S. & 9400 S.	
Center-Running Station	EA	$ 2,500,000	900 S. & 9400 S.	
Bus Rapid Transit				
Side-Running Station	EA	$ 800,000	900 S. & 9400 S.	
Center-Running Station	EA	$ 1,200,000	900 S. & 9400 S.	

Appendix C
REGULATORY AUTHORITIES

FEDERAL

Because all transit options would operate on a right-of-way having tracks connected to the national rail system, federal oversight of the Harbor Subdivision transit options would rest with the Federal Railroad Administration (FRA).

According to the FRA's Web site, "The Federal Railroad Administration (FRA) was created by the Department of Transportation Act of 1966 (49 U.S.C. 103, Section 3(e)(1)). The purpose of the FRA is to: promulgate and enforce rail safety regulations; administer railroad assistance programs; conduct research and development in support of improved railroad safety and national rail transportation policy; provide for the rehabilitation of Northeast Corridor rail passenger service; and consolidate government support of rail transportation activities. Today, the FRA is one of ten agencies within the U.S. Department of Transportation concerned with intermodal transportation. It operates through seven divisions under the offices of the Administrator and Deputy Administrator.

"The Office of Safety promotes and regulates safety throughout the Nation's railroad industry. It employs more than 415 Federal safety inspectors, who operate out of eight regional offices nationally. FRA inspectors specialize in five safety disciplines and numerous grade crossing and trespass-prevention initiatives: Track, Signal and Train Control, Motive Power and Equipment, Operating Practices, Hazardous Materials, and Highway-Rail Grade Crossing Safety. The Office trains and certifies State safety inspectors to enforce Federal rail safety regulations. Central to the success of the rail safety effort is the ability to understand the nature of rail-related accidents and to analyze trends in railroad safety. To do this, the Office of Safety collects rail accident/incident data from the railroads and converts this information into meaningful statistical tables, charts, and reports."

The FRA accident report database maintains records of rail-motor vehicle accidents occurring at rail-highway at-grade crossings in California, including the Harbor Subdivision.

In California, the FRA coordinates its rail oversight with the California Public Utilities Commission, which has oversight at public grade crossings.

STATE

In California, safety issues on railroads and at crossings are within the purview of the California Public Utilities Commission (PUC). Specific PUC rail safety roles are sited in the Public Utilities Code Sections 1201-1205. Particular relevant sections are underlined below:

- *1201.* No public road, highway, or street shall be constructed cross the track of any railroad corporation at grade, nor shall the track of any railroad corporation be constructed across a public road, highway, or street at grade, or shall the track of any railroad corporation be constructed across the track of any other railroad or street railroad corporation at grade, nor shall the track of a street railroad corporation be constructed across the track of a railroad corporation at grade, without having first secured the permission of the commission. This section shall not apply to the replacement of lawfully existing tracks. The commission may refuse its permission or grant it upon such terms and conditions as it prescribes.

- *1202.* The commission has the exclusive power: (a) To determine and prescribe the manner, including the particular point of crossing, and the terms of installation, operation, maintenance, use, and protection of each crossing of one railroad by another railroad or street railroad, and of a street railroad by a railroad, and of each crossing of a public or publicly used road or highway by a railroad or street railroad, and of a street by a railroad or of a railroad by a street. (b) To alter, relocate, or abolish by physical closing any crossing set forth in subdivision (a). (c) To require, where in its judgment it would be practicable, a separation of grades at any crossing established and to prescribe the terms upon which the separation shall be made and the proportions in which the expense of the construction, alteration, relocation, or abolition of crossings or the separation of grades shall be divided between the railroad or street railroad corporations affected or between these corporations and the state, county, city, or other political subdivision affected.

According to the PUC Web site, "The PUC employs federally certified staff inspectors and coordinates with the Federal Railroad Administration (FRA) and is the largest participating state agency in the nation to ensure that railroads comply with federal railroad safety regulations. The Commission investigates railroad accidents and responds to safety related inquiries made by community officials, the general public, and railroad labor organizations. The Commission is an active participant in Operation Lifesaver, a grade crossing awareness training program."

The CPUC also has regulatory authority pertaining to rail transit. According to the Web site, "Rail Transit covers light rail, rapid rail, and cable cars. These are distinguished from railroads in that they do not share tracks with other trains and are powered by an outside source, such as electricity, which might run through a third rail or overhead wires, or a cable. The Commission's authority over transit agencies is based in state law and delegated by the Federal Transit Administration. The six major transit systems regulated by the Commission are:

- San Francisco Bay Area Rapid Transit (BART)
- ***Los Angeles County Metropolitan Transportation Authority (LACMTA)***
- San Diego Trolley, Inc. (SDTI)
- San Francisco Municipal Railway (SF Muni)
- Sacramento Regional Transit District (SRT), and;
- Santa Clara Valley Transportation Authority (VTA)"

LOCAL JURISDICTIONS

Beyond railroad operational and crossing safety oversight, which is in the hands of the FRA and PUC, the jurisdictions along the Harbor Subdivision retain authority for law enforcement and compliance with local engineering and planning requirements. Authority over signal preemption for BRT would rest with the cities.