CRENSHAW-PRAIRIE CORRIDOR
MAJOR INVESTMENT STUDY

Burlington Northern/Santa Fe
Railroad Right-of-way
Evaluation of Passenger Rail Service

Draft Final Report

Prepared for the:

Los Angeles County Metropolitan
Transportation Authority

By:

KORVE/RAW, A Joint Venture

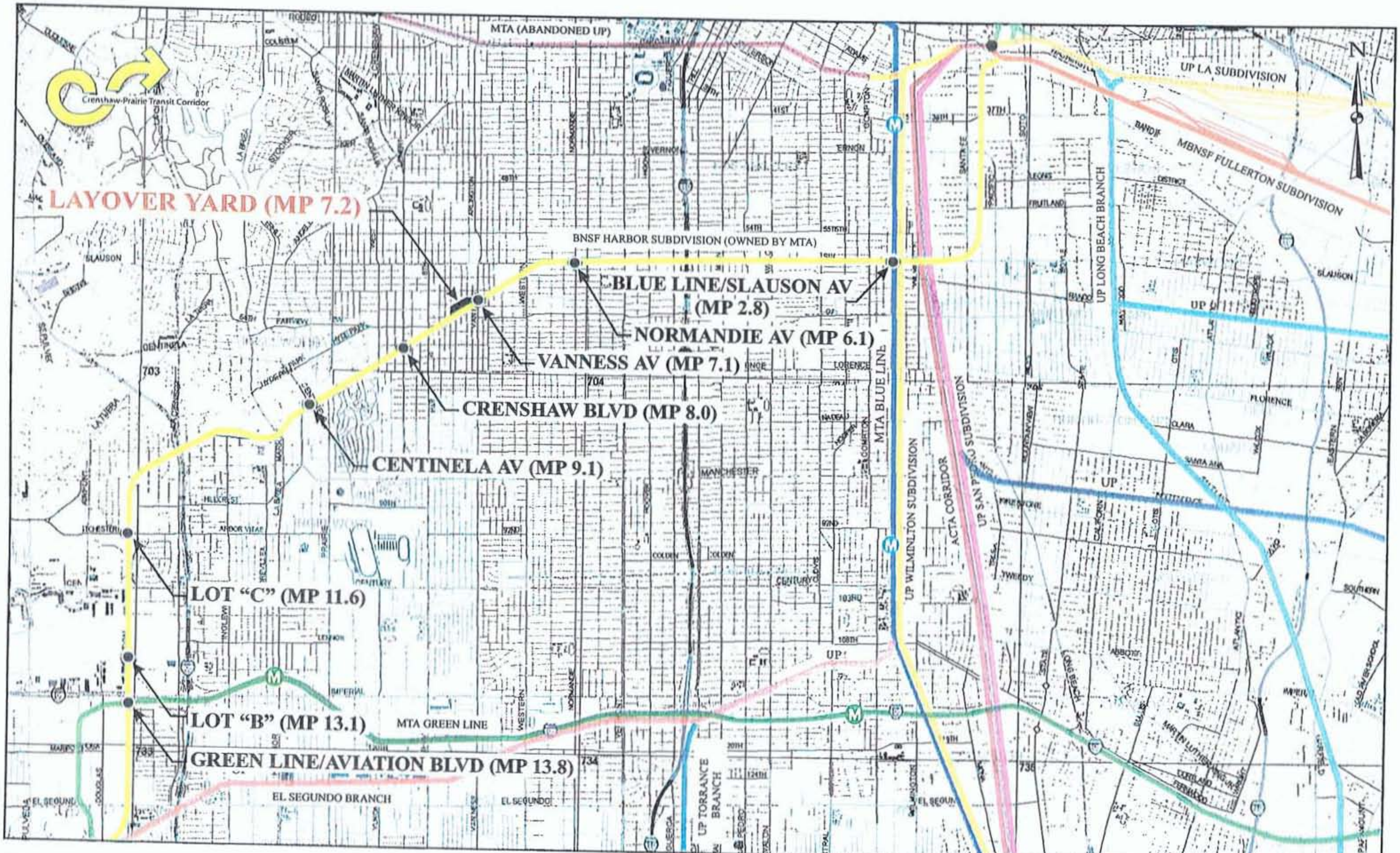
January 2003

LIST OF TABLES

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF MAPS



Stations and Layover Yard Map

Crenshaw - Prairie Corridor MIS

METRO

KORVE ENGINEERING

RAW INTERNATIONAL

1.0 STUDY BACKGROUND

The Los Angeles County Metropolitan Transportation Authority (MTA) has undertaken a Major Investment Study (MIS) for the Crenshaw-Prairie Corridor, a north-south oriented travel corridor that covers portions of four cities within Los Angeles County. The purpose of the Crenshaw-Prairie Corridor MIS process was to conduct a thorough and comprehensive analysis of future transportation system improvements for this constrained and congested Study Corridor. The results of this MIS planning process will assist decision makers in selecting the most effective transportation improvement strategy, or phasing of strategies, to the mobility problems identified in the Corridor.

Concurrent with the preparation of the MIS, MTA sought to evaluate an alternative that may provide passenger rail service along a Study Corridor portion of the former Burlington Northern-Santa Fe (BN/SF) Railroad right-of-way now owned by the MTA. Improvements to this rail right-of-way may provide passenger rail service within a short timeframe, while creating the foundation for future implementation of rail service north along Crenshaw Boulevard. This study effort discusses the feasibility of implementing passenger rail service within the Harbor Subdivision portion of the BN/SF Railroad right-of-way, with a focus on the mid-corridor segment between Crenshaw Boulevard and the Metro Green Line Aviation Station. The following discussion presents an overview of existing Corridor conditions, discusses a range of passenger rail service alternatives, presents an order of magnitude capital and operating costs for the alternatives, and defines the parameters for further evaluation.

1.1 Study Purpose

The opening of the Alameda Corridor in April 2002 permitted the shifting of all through rail freight traffic from the former Harbor Subdivision of the Burlington Northern and Santa Fe Railroad (BN/SF) to a consolidated line running north from the Ports of Los Angeles and Long Beach to Downtown Los Angeles. The Harbor Subdivision was acquired by the Los Angeles County Transportation Commission (LACTC now MTA) from the predecessor of the BN/SF – the Atchison, Topeka and Santa Fe Railway Company – in 1992. As a result, there now exists a well-maintained, underutilized rail corridor extending from Downtown Los Angeles crossing the Metro Blue Line at Slauson Avenue, then continuing through Downtown Inglewood to the eastern boundary of Los Angeles World Airport (LAX), and crossing under the Metro Green Line at Aviation Boulevard. The purchase agreement[1] included provisions allowing the BN/SF to continue to use the route only for local originating and terminating traffic after the opening of the Alameda Corridor. Another agreement provision allows for the use of the Harbor Subdivision as an emergency detour route only until June 29, 2003.

This Study evaluates the opportunities and challenges associated with utilizing the section of the Harbor Subdivision between the Metro Blue Line crossing at Milepost (MP) 2.8[2] and the Metro Green Line overcrossing at Milepost (MP) 13.8 for passenger rail service as illustrated on the following page. The information presented in this report provides an initial framework for discussion of this rail service opportunity; further more detailed work would be required if the decision is made to proceed.

[1] Shared Use Agreement (Harbor Subdivision and Mission Tower Segment) October 30, 1992.

[2] Mileposts on the Harbor Subdivision are numbered from Redondo Junction, near the Washington Street crossing of the Los Angeles River.

2.0 EXISTING CORRIDOR CONDITIONS

This section presents an overview of existing Corridor conditions that would impact the provision of passenger rail service including the community context, track and tie conditions, right-of-way widths, current railroad operations and at-grade crossings. The evaluation of existing conditions focused on the portion of the right-of-way between the Metro Green Line Station (MP 13.6) and the Crenshaw (MP 8.0), with some review of extending service further east to the Metro Blue Line (MP 2.8).

Work in this effort was based on a review of previous studies that have been performed on the Study Corridor. In addition to the Crenshaw-Prairie Corridor Major Investment Study efforts, previous Corridor work has included: the *South Bay Cities Railroad Study* (Wilbur Smith and Associates, 2001) and the *Crenshaw-Prairie Corridor Route Refinement Study* (Korve/RAW, December 2000).

Existing Corridor information was obtained from field reconnaissance and a field tour of the Harbor Subdivision from Redondo Junction to the Metro Green Line El Segundo/Nash Station. Background information was provided through a review of the *Shared Use Agreement (Harbor Subdivision and Mission Tower Segment)* between the MTA and the Santa Fe Railroad dated October 30, 1992. Information regarding current freight operations was obtained from the local operating officer of the BN/SF[3]. Interviews were conducted with both Self-Powered Multiple Unit[4] and Self-Powered Light Rail Transit[5] vehicle suppliers, along with commuter rail operators, to evaluate the feasibility of the service alternatives and to develop order-of-magnitude cost estimates.

2.1 Community Context

The Study portion of the Harbor Subdivision passes through two cities – Los Angeles and Inglewood. The adjacent low-scale communities are built-out with a wide range of land uses. Proceeding north from the Metro Green Line to Century Boulevard, adjacent land uses are comprised primarily of airport, airport-related, industrial and vacant land uses. From Century Boulevard to Arbor Vitae, the area along the right-of-way transitions to hotels, commercial development and some housing. North through the City of Inglewood, adjacent land uses vary significantly and include industrial and warehousing uses, civic center facilities, commercial development, single- and multi-family housing, churches, a regional park and the Inglewood Park Cemetery. As the right-of-way approaches Crenshaw Boulevard and continues on to the Metro Blue Line, adjacent land uses primarily include single- and multi-family housing along with active and vacant industrial uses.

While the provision of passenger rail service with stations serving the adjacent communities would increase regional accessibility for residents, consideration should be given to possible community impacts such as pedestrian and vehicular safety as well as possible noise and air quality impacts. As discussed below, there are a significant number of at-grade crossings allowing travel across the right-of-way. There is an opportunity to cul-de-sac a large number of the cross streets improving pedestrian and vehicular safety, while improving the quality of life for surrounding neighborhoods.

2.2 Track and Tie Conditions

Based on field reconnaissance, the existing Corridor trackage is comprised of standard track construction of welded rail placed on wood crossties, with manually operated industry and passing track turnouts. The BN/SF has maintained the railroad in overall good condition to Federal Railroad Administration

[3] Rob Reilly, Assistant Trainmaster, BN/SF.
[4] Tom Janaky, Vice President Sales, Colorado Railcar.
[5] Raymond E. Metz, Vice President Sales, (Intercity and Regional Rail-US) Bombardier Transportation, Inc.

(FRA) Class 2 standards, which allows for speeds of 25 mph for freight and 30 mph for passenger rail service. The current single track is #112 continuous welded rail (CWR) that has been "cascaded." [6] In the future, the rail should be tested for internal flaws, but it appears that a large percentage of the existing material could be re-used for passenger service. The ties are in fair condition – with less than 25 percent appearing to require replacement. The last tie replacement program was undertaken by BN/SF in 1980 and 1981. A program of tie replacement would be included in any track rehabilitation required for the initiation of passenger rail service.

The "surface" [7] of the track is adequate for the slow speed freights that currently use the line, but would need to be upgraded for passenger rail service if a speed greater than 30 mph was desired. In order for passenger rail service to operate at speeds higher than 30 mph, and to provide a smooth ride for passengers, upgrading of the track structure would be required. The allowable speed on a section of rail track is primarily determined by the condition of the ties and the track surface. For the tracks along the Harbor Subdivision to accommodate high-speed transit service, it is estimated that a program of tie replacement, followed by a program of resurfacing the line would be required to bring the track up to the next service level – Class 3. This next level would allow for freight trains to operate at 40 mph and passenger trains at up to 60 mph. The cost estimate presented in Section 4.0 of this report assumed that only a small percentage of the rail would need to be replaced. It should be noted that the same amount of track rehabilitation would be required whether the passenger rail service operated at 40, 50 or 60 mph. While this report recommends that the passenger service be operated at 50 mph, service could begin at 30 mph with only minor surfacing work on the track.

Figure 2.1: Start of Harbor Subdivision by Washington Street and the Los Angeles River. The Metrolink flyover over the Alameda Corridor is visible in the background.

2.3 Right-of-Way Widths

Single-track operations require a minimum clearance of 8.5 feet (9.5 feet on curves) from the centerline to the edge of the track. Double-track operations would require 15 feet between the two track centerlines plus 8.5 feet on each side for a total of 32 feet absolute minimum right-of-way width. These minimum dimensions do not allow for maintenance roadways or signals which are typically required. The preferred

---

[6] "Cascaded" refers to the practice of taking rail from a heavily-used line and reusing it on a lighter activity route. The rail on the Harbor Subdivision predominately dates from 1944. The rail was rolled into 30 foot sections, then the bolthole was cropped out and welded into strings when it was transferred to the Harbor Subdivision.

[7] "Surface" refers to the alignment of the track and the cross level of the rails. FRA regulations specify the amount of deviation on the alignment and cross-level that is allowed for each class of track.

Figure 2.3: View of constrained right-of-way and utility overcrossings near the I-405 freeway in the City of Inglewood.

It is important to note that the Corridor alignment is crossed by a significant number of utility lines. The utility companies have a terminable lease and license agreement with the MTA. The standard form of agreement includes a clause for the relocation or removal of the utility line if necessary for railroad operations. Existing Corridor utilities include underground water, sewer and natural gas lines crossing the right-of-way at a 90-degree angle, which must be protected if a second track is installed. There are also a number of easements for utilities to run along the Corridor, parallel to the tracks. These include pipelines as well as sewer, fiber optic and communication lines. As part of the rehabilitation of the line for passenger service, the utilities would need to be identified precisely and protected.

2.4 Railroad Operations

The Harbor Subdivision agreement allows for the continued use of the line only for local originating or terminating freight traffic. Local freight service delivers or picks up cars from local industries or team tracks, and then moves them to a yard where they are combined with other cars to create a through train. The through train moves the cars to another city in an average trip of approximately 850 miles.

The initial phase of the proposed passenger service would operate between the Crenshaw Corridor (MP 2.8) and the Metro Green Line Aviation Station (MP 13.8), with possible future service extending east to the Metro Blue Line Slauson Station (MP 2.8). Currently there are no active shippers on the line between 4th Avenue in Hyde Park at MP 7.4 and Douglas Street in El Segundo at MP 14.8 as illustrated on the following map. The existing weekday service level on the northern portion of the line consists of one train a day operating from the Malabar Yard (MP 1.5) west to approximately MP 7.0 and back. On the southern portion of the route, up to three local trains a day operate out of the Alcoa Yard (MP20.1). There is a morning and afternoon local train in the area, each of which may work up to 12 hours. However, none of these trains operate north of MP 14.5 and thus would not impact passenger rail service.

Field observations identified that the existing local freight service operates predominately during the daylight hours and is limited in length. The northern local was observed hauling five cars, while the southern local was observed operating with 14 cars. This limited amount of service could potentially be shifted to operate during a time window (temporal separation) when transit operations are not being provided.

Once a year, the Ringling Brothers, Barnum and Bailey circus train is parked for a few days at the Airport siding (MP 13.6) along Aviation Boulevard at LAX. Other than this train, there are no regular movements west of approximately MP 7.4 near Western Avenue.

right-of-way width is 45 feet to allow access for track maintenance vehicles and support systems. At stations, passenger platforms must be 5'- 4" from the track centerline and at least 16 feet wide if between tracks.

The Corridor's right-of-way is generally 50 feet or more in width; however, in some locations the width narrows to 25 feet. The two narrowest points within the MIS Study Area were identified as 24.5 feet between Arbor Vitae and Manchester Boulevard in the LAX area, and 35 feet within Inglewood generally between Ivy and Inglewood Avenues. In addition, within Downtown Inglewood north of Florence Avenue, parts of the right-of-way have been planted with shrubbery, which may need to be removed or relocated if a second track is desired. The bridge over the I-405 freeway at MP 10.58 was constructed to accommodate a second track, although only a single track was installed.

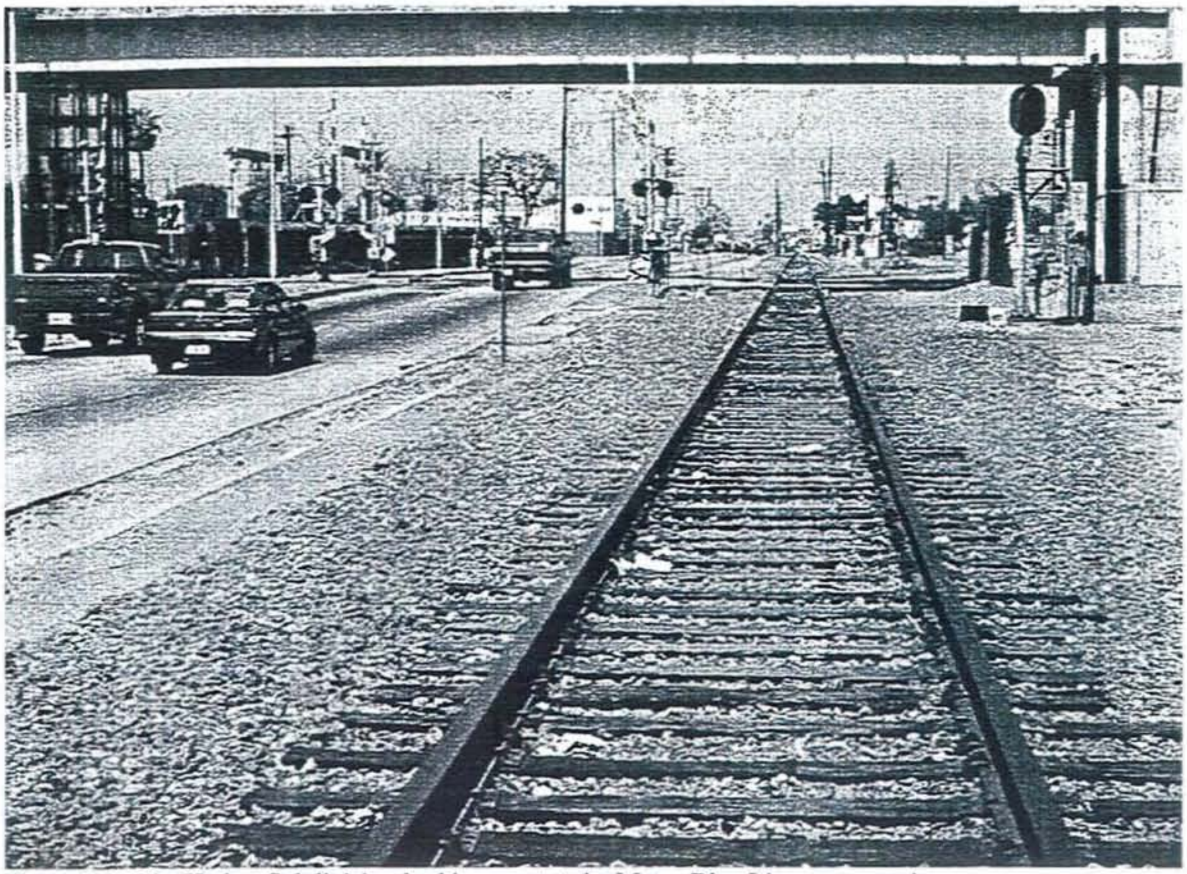
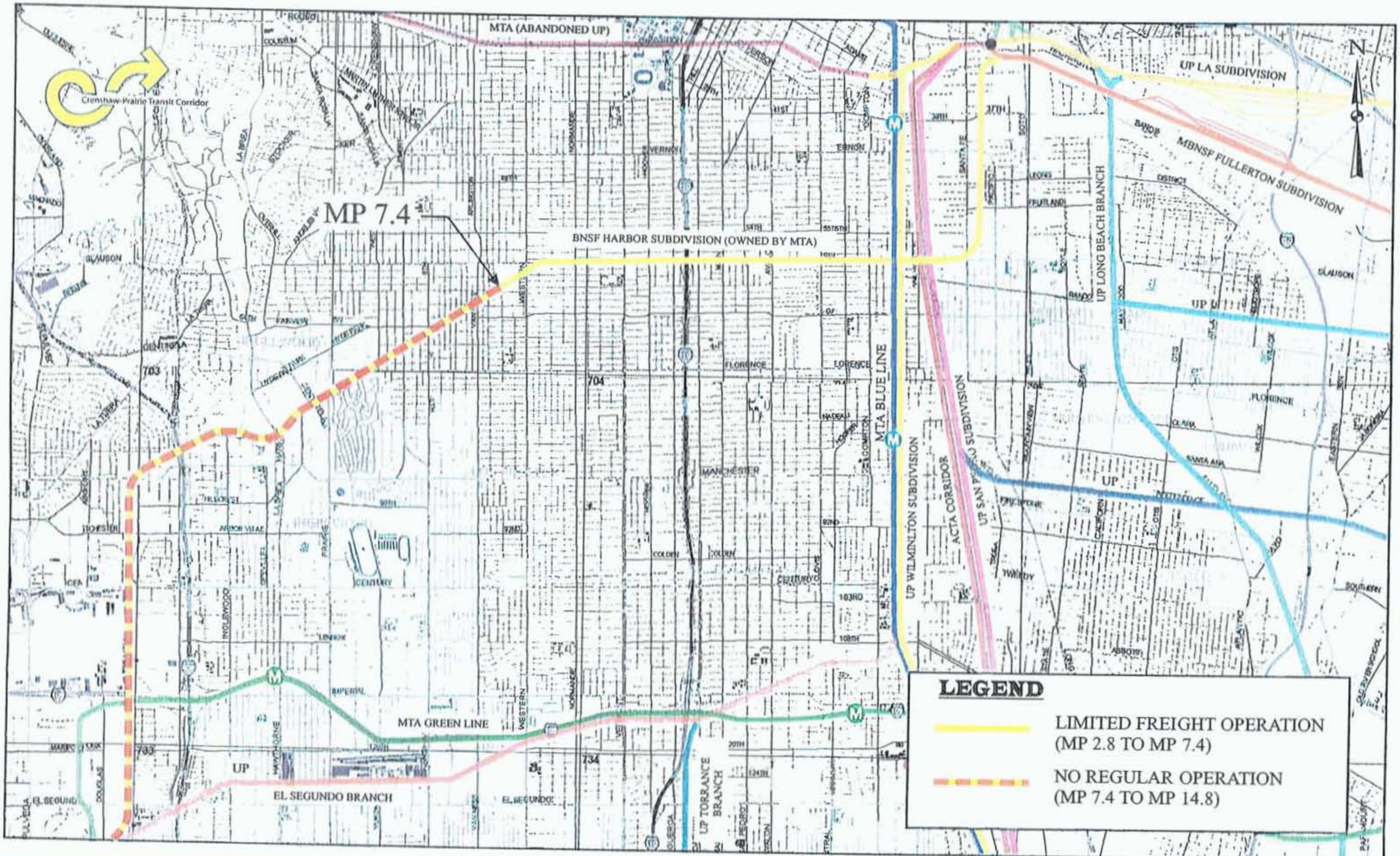


Figure 2.2: The Harbor Subdivision looking west at the Metro Blue Line overcrossing.



Freight Operations Map

Crenshaw - Prairie Corridor MIS

METRO

KORVE ENGINEERING

RAW INTERNATIONAL

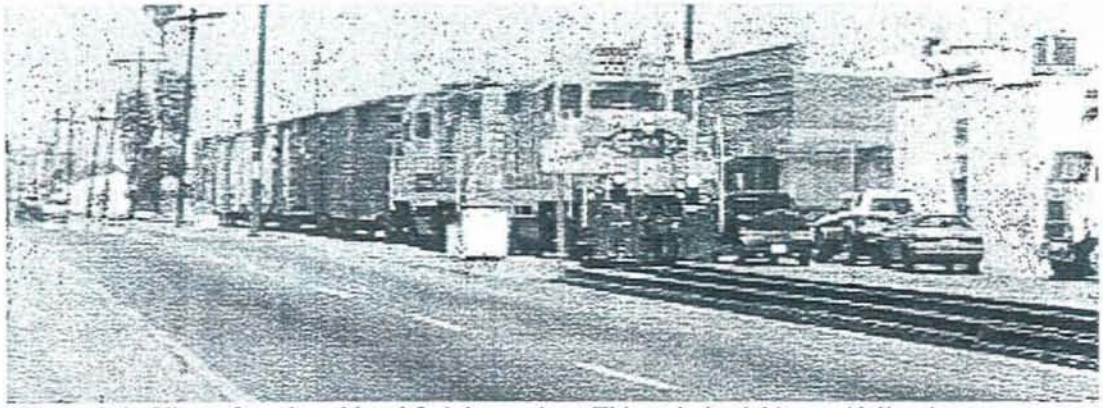


Figure 2.4: View of north end local freight service. This train is picking up/delivering cars to customers located along the line and operates as far west as Western Avenue.

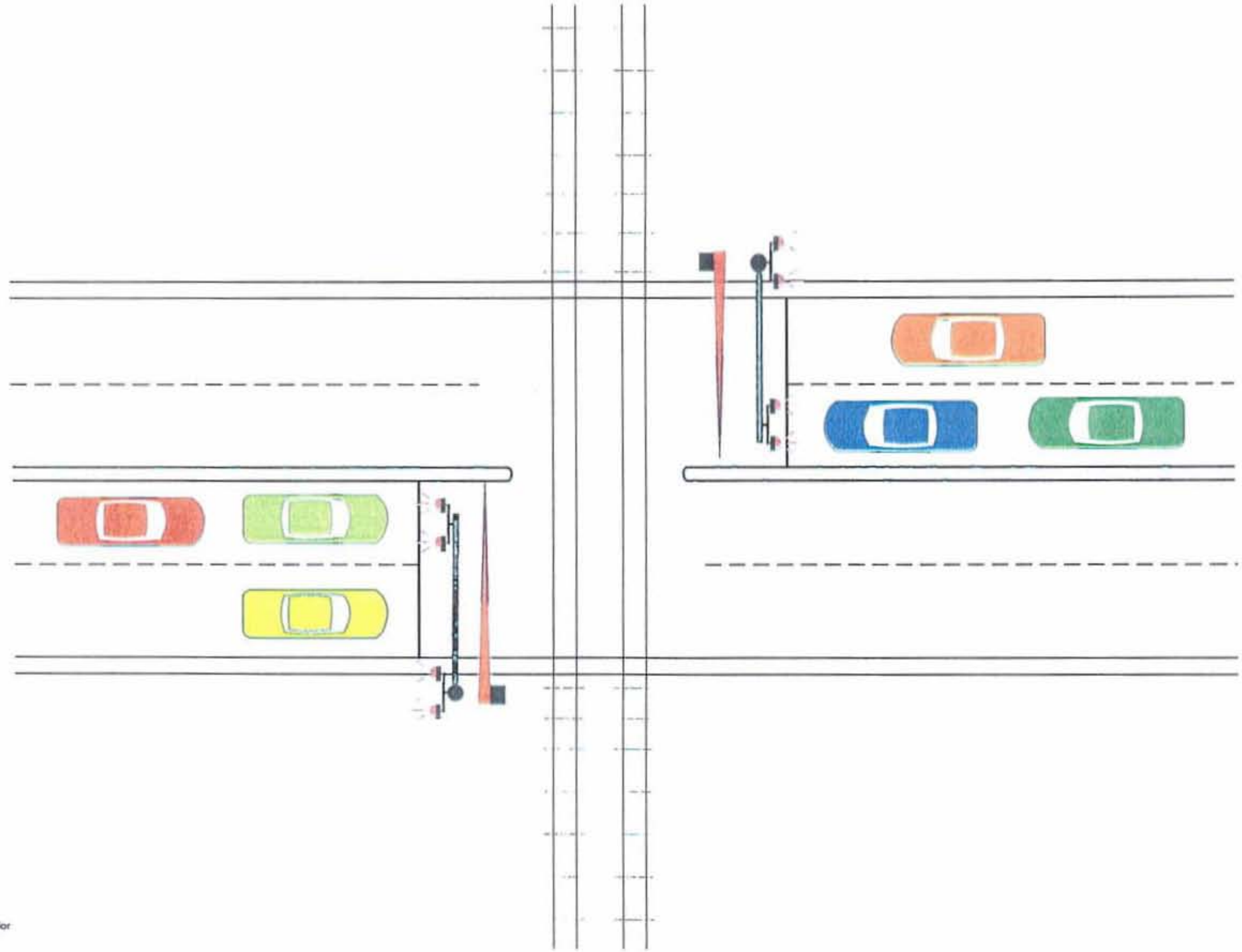
2.5 At-Grade Crossings

The Study Corridor is bisected with many at-grade crossings. In the 10.8 miles between the Metro Blue and Green Lines, there are 45 crossings. Between the Metro Blue Line (MP 2.8) and the I-405 Freeway overcrossing (MP 11.0), there are 40 crossings, or one approximately every 1,100 feet. Most of these crossings occur at minor residential streets and are equipped with gates, bells and flashing lights as warning devices. The implementation of more frequent and higher speed passenger service would require the upgrading of the control circuitry of the warning systems. Other improvements to enhance the visibility and safety of the Corridor's rail crossings could include additional flashing signals placed on cantilever arms over the travel ways and median islands, which would lessen the opportunity for drivers to drive around lowered warning gates. The cost for a complete up-grade of a double-tracked crossing to allow for more active rail service often exceeds $500,000. Improvements to single-track crossings typically cost approximately $220,000, but the cost may increase due to site-specific safety and operational issues. Possible warning system components for a typical rail crossing adjacent to a roadway intersection and at mid-block are illustrated on the following pages.

However, given the large number of crossings and the short distance between crossings, a program of crossing consolidation may be feasible. In order to enhance community safety and operational viability, a study of the traffic patterns, use of each crossing and adjacent sensitive land uses (such as schools or parks) would be performed and improvements and/or consolidation recommendations developed prior to the implementation of passenger service. Reducing the number of crossings and equipping the remaining crossings with the most current safety devices would reduce the potential for vehicle/train incidents along the Corridor. Reducing the number of at-grade crossings would also lower the estimated cost of implementing passenger service. As the Corridor rail operations have consisted of low speed freight service for decades, the residents of the surrounding communities have come to expect only infrequent, slow trains. Before passenger rail service is implemented, a program of public education on the more frequent and higher speed rail service would be highly recommended to reduce the possible number of pedestrian/train and vehicle/train incidents.

3.0 DEFINITION OF ALTERNATIVES

This section presents a discussion of possible passenger rail service alternatives as described by speed and frequency of service, along with passenger vehicle type. Elements common to all alternatives are also identified including stations, passing sidings, maintenance and storage facilities, and signal and train control needs.



Crenshaw-Prairie Transit Corridor

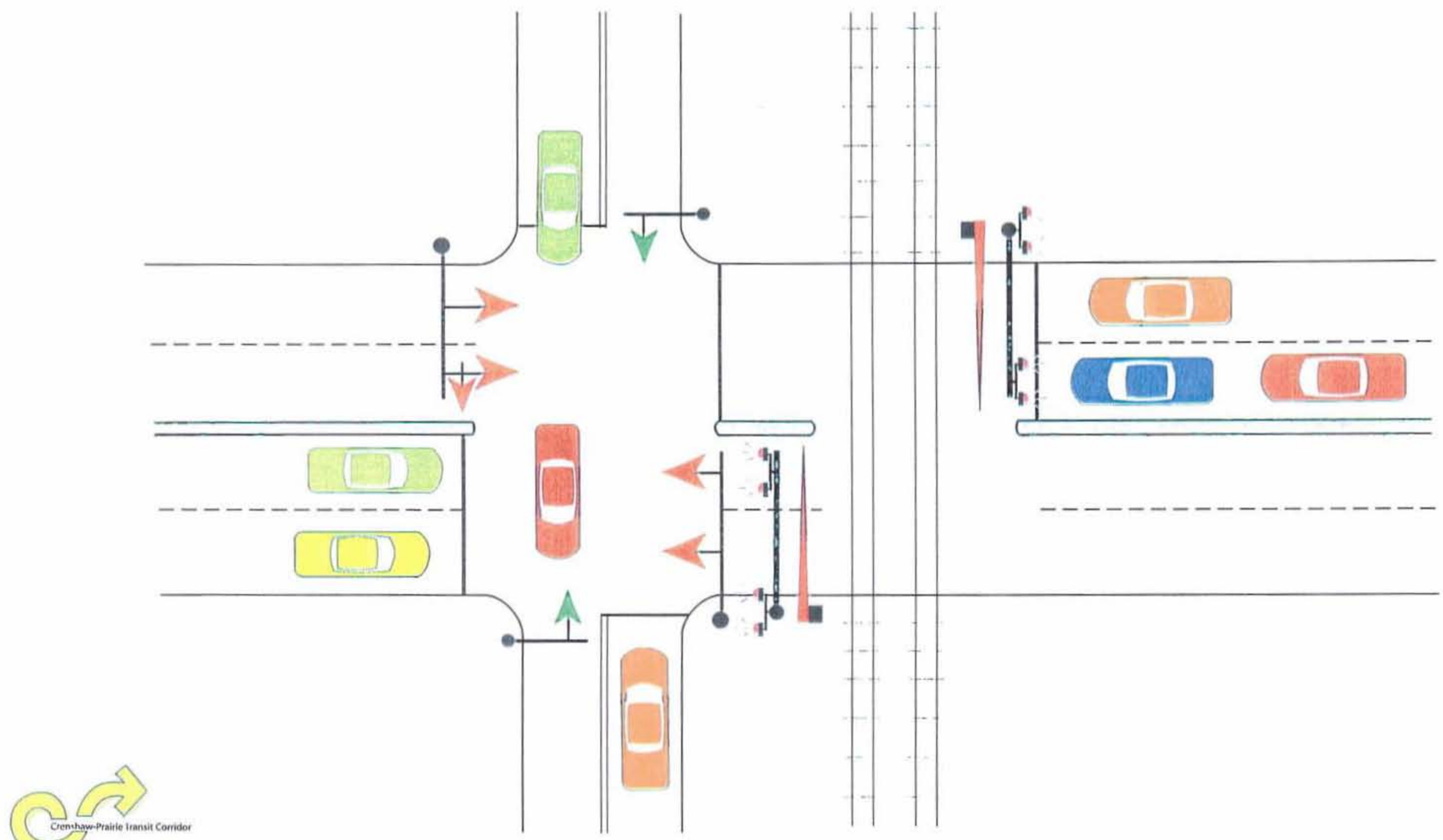
Typical Mid-Block LRT Crossing

Crenshaw - Prairie Corridor MIS

METRO

KORVE ENGINEERING

RAW INTERNATIONAL



Typical LRT Crossing Adjacent to Roadway Intersection

Crenshaw - Prairie Corridor MIS

METRO

KORVE ENGINEERING

RAW INTERNATIONAL

3.1 Passenger Operations

Two levels of passenger rail service were conceptually developed:

1. ***An initial level of service*** connecting the Metro Green Line Aviation Station (MP 13.6) with the Crenshaw Corridor (MP 8.00); and

2. ***A full level of service*** extending passenger operations east to the Metro Blue Line (MP 2.8).

The initial level of passenger service – from the Crenshaw Corridor to the Metro Green Line – was conceptually proposed to have hours of operation from 6:00 am to 12:01 am, with service every 30 minutes in each direction. A quick operations analysis was performed to identify the requirements for providing service on 30-minute, 20-minute, 15-minute and 10-minute headways. The operational discussion presented below focuses on 20- and 30-minute headways primarily due to the existing single track configuration in the Corridor. Increasing the service headway beyond a 20-minute frequency would require significant amounts of double tracking – essentially the entire system. Operating passenger service at 10- or 15-minute headways would increase capital costs dramatically. In addition to the cost of the double tracking, which may include some relocation of the existing single track and acquisition of adequate right-of-way, this level of service would require more vehicles, Centralized Traffic Control (computerized) train signals and a larger storage and maintenance facility.

The proposed 20- and 30-minute headway timings were also evaluated for operations at 30 mph, 40 mph and 50 mph. Table 3.1 below presents a conceptual schedule for passenger rail service operating on the existing trackage at 30 mph on 30-minute headways. The trip between the Crenshaw Corridor and the Metro Green Line Aviation Station was identified as requiring 17 minutes for both eastbound and westbound service.

Table 3.1: Conceptual Operating Schedule (30 mph service on 30-minute headways)

Station	Mile Post	Westbound Schedule Read Down			Eastbound Schedule Read Up		
Crenshaw Boulevard	8.0	6:00	6:30	7:00	6:17	6:47	7:17
Centinela Avenue	9.1	6:04	6:34	7:04	6:12	6:42	7:12
Lot C	11.6	6:10	6:40	7:10	6:06	6:36	7:06
Lot B	13.1	6:14	6:44	7:14	6:02	6:32	7:02
Green Line Station	13.6	6:17	6:47	7:17	6:00	6:30	7:00
Total Time (in minutes with recovery time)		**17**	**17**	**17**	**17**	**17**	**17**

Table 3.2 below presents the resulting westbound travel times if rail travel speeds were increased to 40 and 50 mph. The Corridor's service length is too short, and the station spacing too frequent, to allow for 60 mph operations. With track improvements to FRA Class 3 service, increasing the operational speed to 40 mph would reduce the westbound trip by approximately three minutes and a 50 mph speed would result in a 12.5 minute trip – a reduction of approximately five minutes.

Table 3.2: Resulting Travel Times (Minutes at 30 mph service on 30-minute headways)

Station	Mile Post	Travel Time @ 30 mph	Travel Time @ 40 mph	Travel Time @ 50 mph
Crenshaw Boulevard	8.0	0	0	0
Centinela Avenue	9.1	4	3	2
Lot C	11.6	6	5	4
Lot B	13.1	4	3	3
Green Line Aviation Station	13.6	3	3	3
Total Travel Time		**17**	**14**	**12**

The full level of passenger service – operating from the Metro Blue Line to the Metro Green Line – was conceptually proposed to have hours of operation from 6:00 am to 12:01 am, with service every 20 minutes in each direction. A quick operations analysis was performed to identify the requirements for providing service on 30-minute, 20- minute, 15-minute and 10-minute headways. Table 3.3 below presents a conceptual schedule for 50 mph service on 20-minute headways.

Table 3.3: Conceptual Operating Schedule (50 mph service on 20-minute headways)

Station	Mile Post	Westbound Schedule Read Down			Eastbound Schedule Read Up		
Blue Line Slauson Station	2.8	6:00	6:20	6:40	6:20	6:40	7:00
Normandie Avenue	6.1	6:04	6:24	6:44	6:15	6:35	6:55
Van Ness Avenue	7.1	6:06	6:26	6:46	6:13	6:33	6:53
Crenshaw Boulevard	8.0	6:08	6:28	6:48	6:11	6:31	6:51
Centinela Avenue	9.1	6:10	6:30	6:50	6:09	6:29	6:49
Lot C	11.6	6:14	6:34	6:54	6:05	6:25	6:45
Lot B	13.1	6:17	6:37	6:57	6:02	6:22	6:42
Green Line Aviation Station	13.8	6:20	6:40	7:00	6:00	6:20	6:40
Total Time (minutes with recovery time)		**20**	**20**	**20**	**20**	**20**	**20**

Each of the headway timings was also evaluated for operations at 30 mph, 40 mph and 50 mph as presented in Table 3.4 below. With track improvements to FRA Class 3 service, increasing the operational speed to 40 mph would reduce the westbound trip by six minutes and a 50 mph operational speed would result in a 20-minute trip – a reduction of 10 minutes in passenger travel time.

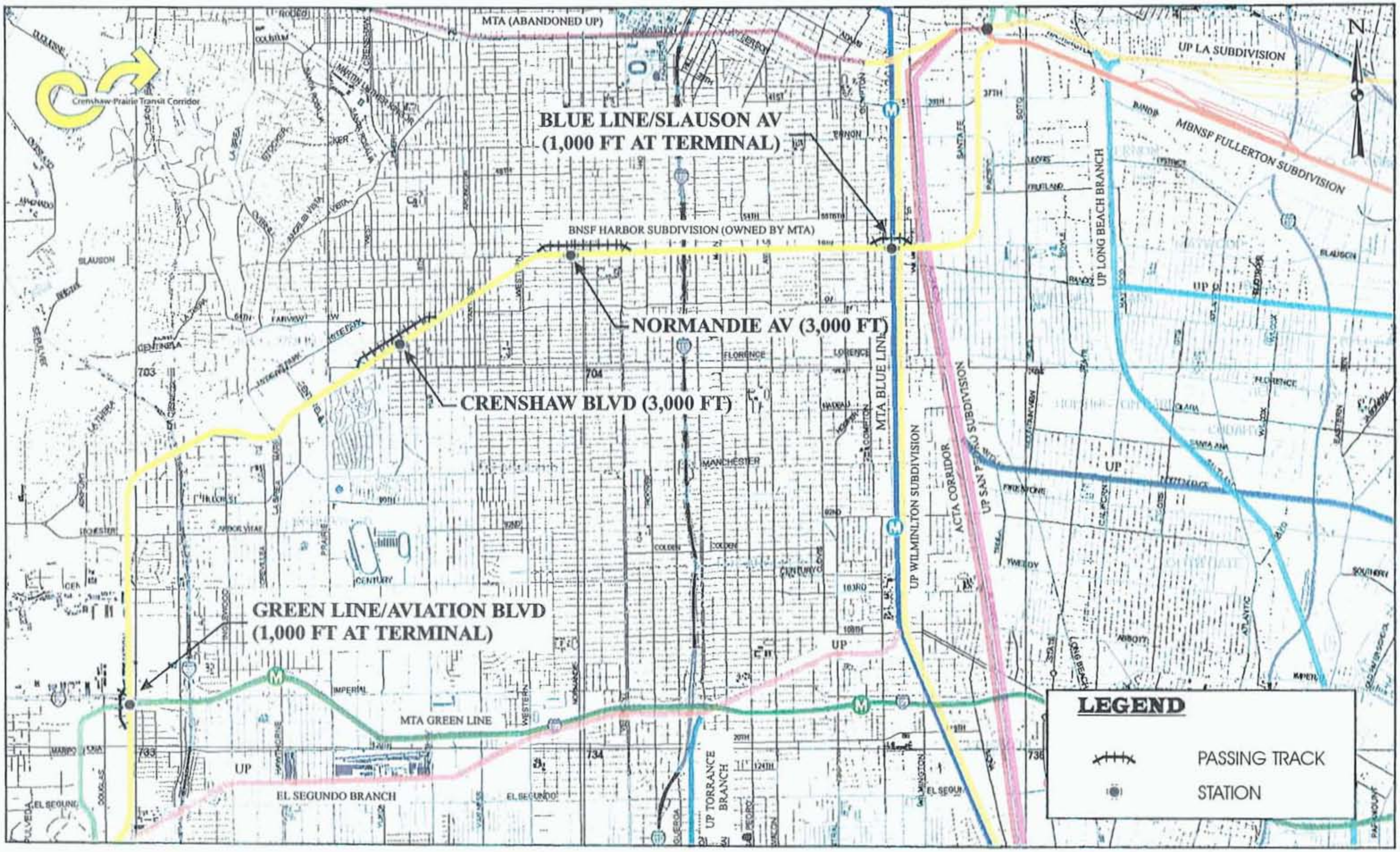
Table 3.4: Resulting Travel Times (Minutes at 50 mph service on 20-minute headways)

Station	Mile Post	Travel Time @ 30 mph	Travel Time @ 40 mph	Travel Time @ 50 mph
Blue Line Slauson Station	2.8	0	0	0
Normandie Avenue	6.1	7	6	4
Van Ness Avenue	7.1	3	2	2
Crenshaw Boulevard	8.0	3	2	2
Centinela Avenue	9.1	4	3	2
Lot C	11.6	6	5	4
Lot B	13.1	4	3	3
Green Line Aviation Station	13.8	3	3	3
Total Travel Time (minutes with recovery time)		**30**	**24**	**20**

The number of vehicles required to operate passenger rail service at varied headways and speeds was identified and is presented below in Table 3.5. The total number of vehicles assumes two car sets of equipment plus a 15 percent spare ratio rounded up to the next full car. The analysis assumes 60 seats and a crush load of 200 riders per car. With the operation of more frequent service, the vehicles required typically increases by approximately three times.

Table 3.5: Number of Vehicles Required (including spares)

Headways	30 mph	40 mph	50 mph
30 minute	7	7	5
20 minute	10	10	10
15 minute	12	10	10
10 minute	19	19	14



Passing Tracks Map

Crenshaw - Prairie Corridor MIS

METRO

KORVE ENGINEERING

RAW INTERNATIONAL

3.2 Passing Sidings

With single-track operations, passing tracks are required to accommodate both eastbound and westbound rail travel. Passenger service passing tracks are proposed to be located at stations, and would be between 2,500 and 5,000 feet in length depending on the final operational frequency and speed. By locating the passing tracks at stations, the potential for delay while waiting for an opposing train is minimized. In addition, the traveling public is less likely to notice the minor delay at a station.

The range of options for locating passing sidings varies based on the average speed of the trains, station dwell time, and staggering of each train's departure. However, for the purpose of developing cost estimates for this Study, analysis identified that placing a passing track every four miles creates an infrastructure that allows service on 20-minute headways with a degree of operational flexibility. The initial level of service would require a single passing track of 3,000 feet near the I-405 overpass. As illustrated on the following page, passing tracks were assumed to be located at near Crenshaw Boulevard and Normandie Avenue, along with the terminal stations at the Metro Green Line Aviation Station and the Metro Blue Slauson Station.

3.3 Passenger Vehicles

The potential passenger vehicles identified as viable for short-term (no catenary requirements) rail passenger service along this Corridor fall into the following two categories:

1. ***Self-Powered Light Rail Transit (SPLRT)*** – This is essentially a Blue Line vehicle with a self-contained alternative fueled (compressed natural gas or bio-fueled) power plant providing power to either a series of electric motors or a bus-type transmission. This car type is not compliant with Federal Railroad Administration (FRA) standards for use with freight operations as it does not meet crash requirements.

2. ***Self-Powered Multiple Unit (SPMU)*** – This is essentially a self-contained railroad train which operates utilizing either a CNG or bio-fueled power plant to power a standard bus-type transmission. This car type is compliant with Federal Railroad Administration (FRA) standards for use with freight operations.

Based on the expected nature of the service – short overall trip length, and frequent stops – locomotive-hauled coaches were not considered in this Study.

Due to environmental concerns, this Study effort assumed that to minimize community impacts, the vehicles would be powered by either compressed natural gas (CNG) or a clean burning diesel alternative fuel, instead of conventional diesel power plants. Currently, MTA operates a large fleet of CNG buses, which utilize the same power plants and drive mechanisms used on many SPMU's. Test usage of other alternative fuels, such as bio-diesel has proven very successful in small railroad applications in Northern California,[8] as well as commuter service in Florida.[9] Research yielded no existing rail vehicles that utilized either batteries or fuel cells for propulsion.

In addition, Corridor vehicle options are discussed as being either FRA compliant or non-compliant. An FRA-compliant vehicle is structurally reinforced (and more costly) allowing passenger rail service to utilize the same trackage as freight rail traffic. Metrolink and Amtrak vehicles are examples of FRA compliant cars. An FRA non-compliant vehicle typically would require its own dedicated trackage with

[8] Napa Valley Wine Train in Napa (using a modified 4 cycle engine) on a low speed 15 mph dinner train and Sierra Railway in Sonora (using an unmodified 2-cycle engine) on a 25 mph light duty local freight service.
[9] Tri-Rail in Miami (using an unmodified 2-cycle engine) on a 79 mph commuter service.

no freight rail operations allowed. For example, the Metro Blue vehicles are not FRA compliant and are not required to be as the passenger and freight rail services operate on separate tracks. Temporal separation of passenger and freight services – operating at different timeframes on the same tracks – may be a possibility based on FRA and Public Utilities Commission (CPUC) review and approval.

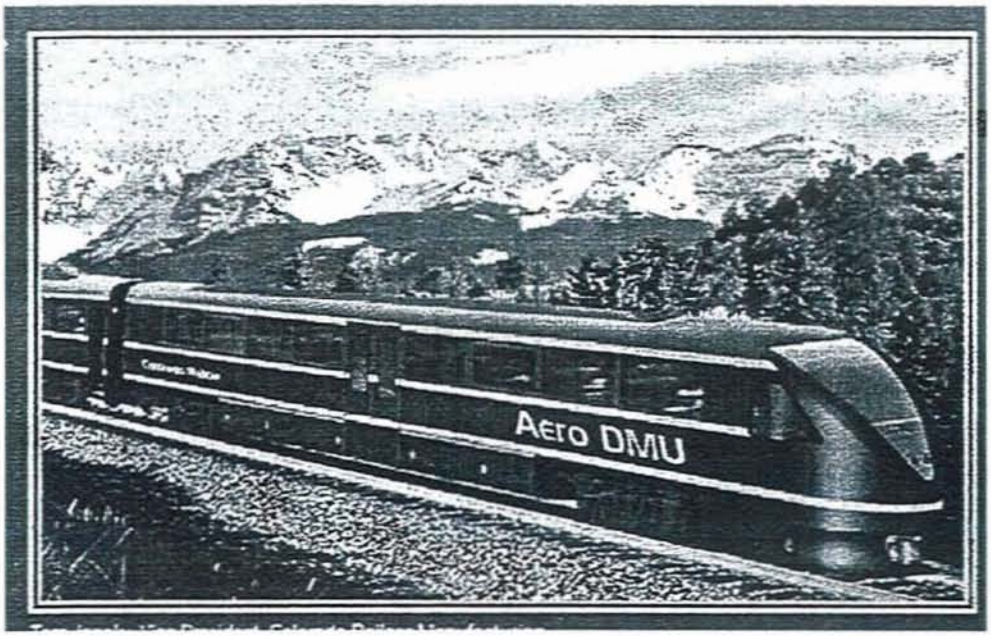


Figure 3.1: Colorado Railcar FRA Compliant Self-Propelled Multiple Unit Vehicle.

There are several FRA compliant vehicle options. Colorado Rail Car sent a prototype SPMU to the Transportation Test Center in Colorado during August of 2002, which will then tour the country demonstrating the vehicle to interested parties. With federal approval of the prototype, Colorado Rail Car projects vehicle delivery within one year of receipt of an order.

Bombardier (formerly Adtranz) has a compliant Self-Powered Multiple Unit vehicle prototype under development for use on the Long Island Railroad and a proposed line in Oregon. The lead-time for delivery of this car is estimated at approximately 18 months.

At the present time, there is also a small market of previously-used equipment available. These vehicles are all "Rail Diesel Cars" (RDC) type vehicles. The RDC was developed in the late 1940's as a method of providing inexpensive passenger service on lightly-utilized branch lines. The cars were constructed from stainless steel and powered by two diesel engines turning a hydraulic/mechanical drive similar to a standard bus arrangement. Recent improvements in both CNG and bio-fuel technology suggests that these cars could be readily adapted for use on the Harbor Subdivision.
The current previously-used market consists of cars used in Texas and Canada. The Dallas-area Trinity Rail Express recently retired its fleet with expansion of their service beyond the initial 10-mile operation. The original Budd Diesel Multiple Unit (DMU) vehicles were replaced with locomotive-hauled passenger coaches. These Budd vehicles were originally constructed in the mid-1950's for a Canadian operator and were then completely rehabilitated at a cost of approximately $2.0 million per car in the mid-1990s for Dallas area service. In Canada, the British Columbia Railway is considering replacement of its existing rail diesel cars with the new Colorado Rail Car vehicles. The Oregon Department of Transportation recently acquired several cars from the British Columbia Railway to initiate passenger rail service between Portland and Astoria on the Oregon coast.

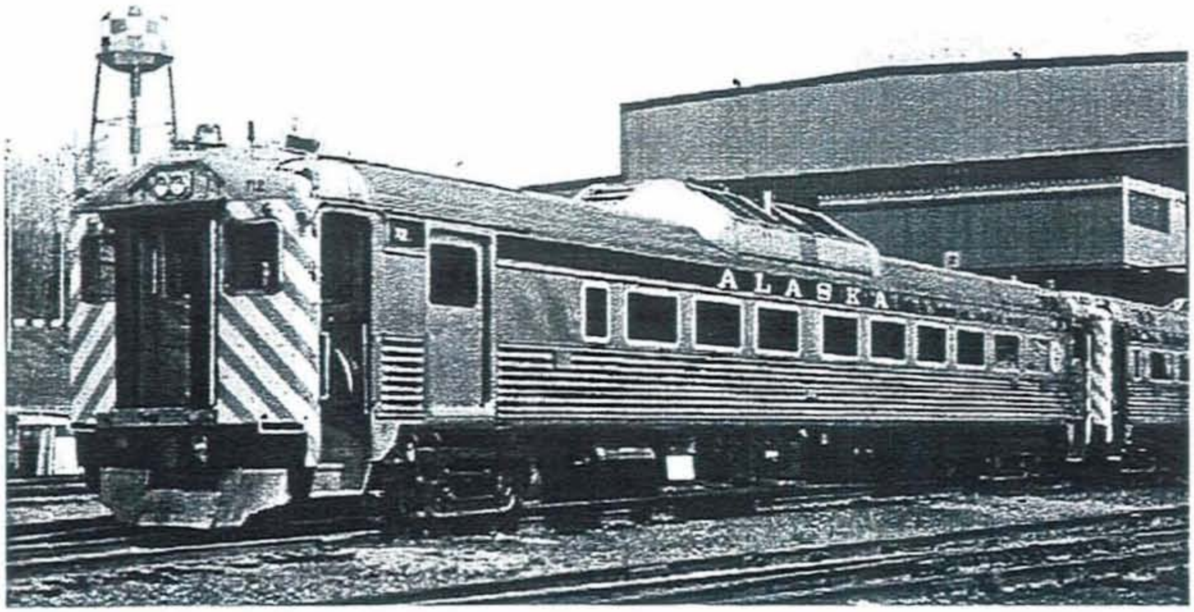


Figure 3.2: Rehabilitated Self-Powered Multiple Unit Budd Vehicle in service in Alaska

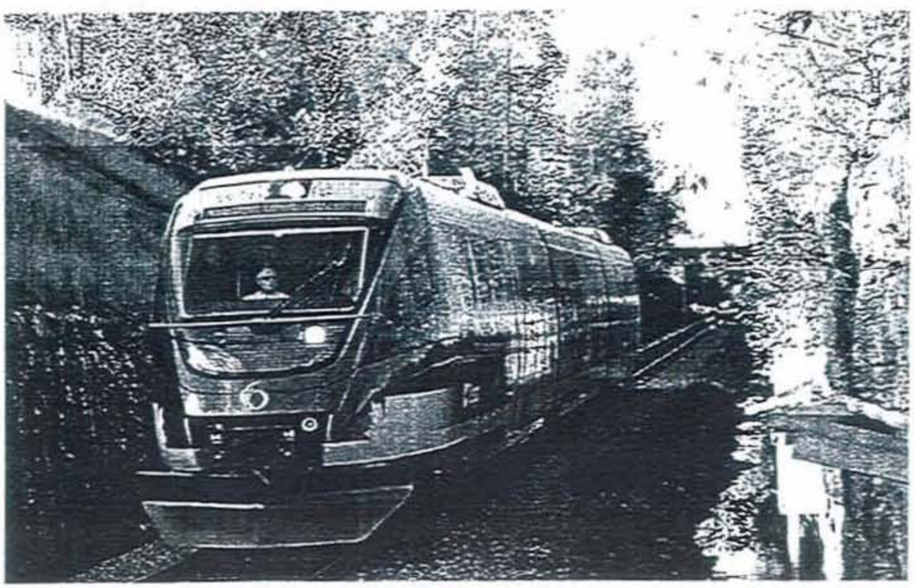


Figure 3.3: Bombardier Talent Self-Powered Rail Transit vehicle in service in Ottawa

While non-compliant self-powered light rail transit vehicles are used extensively in Europe, the only current North American use is in Ottawa using the Bombardier "Talent" equipment. Two new projects are developing SPRT vehicles for use in the United States. The first is the Southern New Jersey project of New Jersey Transit (NJT). This project is using what is essentially an off-the-shelf Bombardier rail vehicle used in Europe. The first cars were delivered to NJT in the third quarter of 2002, with service expected to commence in the fourth quarter of 2003. The other new project is being undertaken by the North County Transit District (NCTD) in San Diego County. NCTD has a specification for a Self-Powered Light Rail Transit (SPLRT) vehicle out for industry review at this time. The car is proposed to be self-powered using natural gas or other technologies and is expected to enter service in 2005.

provides a connection to another major rail and/or bus transit route. Intermediate stations, to enhance community access, could also be constructed along the route at regular intervals. For planning purposes, the team assumed four intermediate stations at Normandie Avenue (MP 6.1), Van Ness Avenue (MP 7.1), Centinela Avenue (MP 9.1) and Parking Lot C (MP 11.6) at LAX. These stations would be designed to serve the local community.

The passenger platforms for the service could be fairly simple. As there is a need to keep the line available for freight service, the platforms must be not more than 8" above the top of the rail in height. The platforms should be at least 275 feet long, capable of accommodating a three-car train, but designed to be expanded to 500 feet in the future. The platforms need to be at least 12 feet wide to allow a safety zone away from the platform edge while a train is entering or leaving the station. A conceptual station plan and cross-section are presented on the following page.

Tickets would be purchased from a Ticket Vending Machine (TVM) similar to those in service on other MTA systems. Each station would require at least two machines. Station amenities would be fairly limited with open shelters for some passenger weather protection and designed to provide sun and rain protection for the TVMs, along with bench seating and some lighting.

Parking needs will vary with the intended use of the station. The stations at the Metro Blue Line, LAX Parking Lots B and C, and the Metro Green Line would likely not result in the expansion of existing parking as part of initial passenger service implementation. The stations at Normandie Avenue, Van Ness Avenue, Crenshaw Boulevard and Centinela Avenue could provide parking assuming that suitable adjacent parcels could be identified.

3.5 Maintenance and Storage Facilities

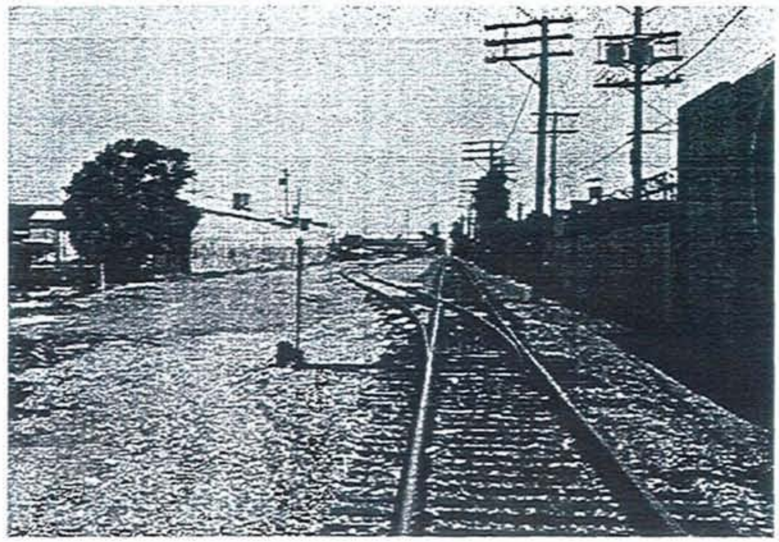


Figure 3.6: Potential layover and maintenance yard location at Van Ness Avenue looking east

Field survey efforts identified a potential layover and light maintenance site at MP 7.4 near Van Ness Avenue. The parcel is the location of a former small railroad switching and storage yard. The proposed facility would be small – intended only for light mechanical work and daily cleaning and inspections. Sufficient track to store all the vehicles would be provided outside, with a small building to house one car at a time for inspection and daily servicing (fueling, replacement of consumables, etc). Arrangements would need to be negotiated with other operators to perform heavy maintenance or repair work at locations beyond the Study Corridor. For a FRA compliant vehicle, either Amtrak or Metrolink could handle this type of work; both agencies maintain heavy rail equipment maintenance and repair shops along the Los Angeles River. If the equipment was non-compliant, then an agreement with the MTA Blue Line or Gold Line to maintain the vehicles at their shop facilities is a potential option. The vehicles could be moved between the storage yard and the shops on flatbed trucks.

It is critical to note that due to different philosophies between North American and European safety oversight agencies, what is permissible in Europe is not allowed in the United States. Europe works to avoid collisions through signaling and absolute train control devices. North America works to avoid collisions, but focuses on ensuring that in the event of a collision, the equipment will be survivable by the passengers and operating crews. In terms of the time required to initiate service on the line, the determination of whether or not to use FRA compliant or non-compliant vehicles is the single most important decision to be made. Under the current interpretation of the regulations, equipment that is non-compliant cannot be operated on the same tracks at the same time as compliant vehicles.

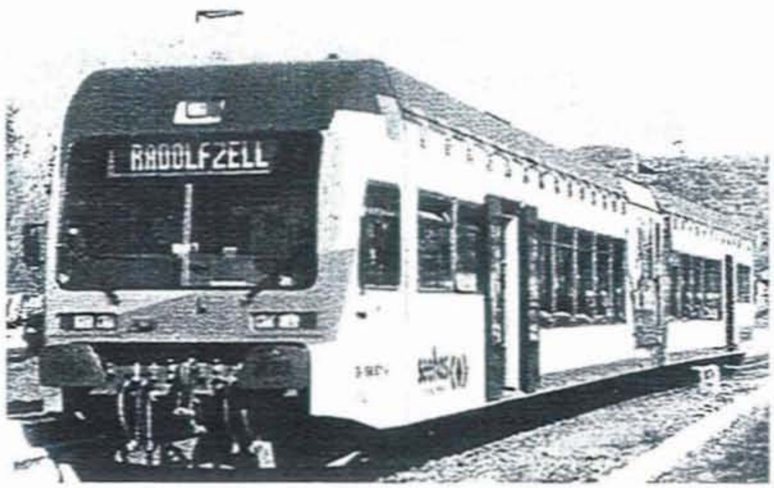


Figure 3.4: Adtranz (now Bombardier) GTW Self-Powered Light Rail Transit vehicle. This model will be used for Southern New Jersey service.

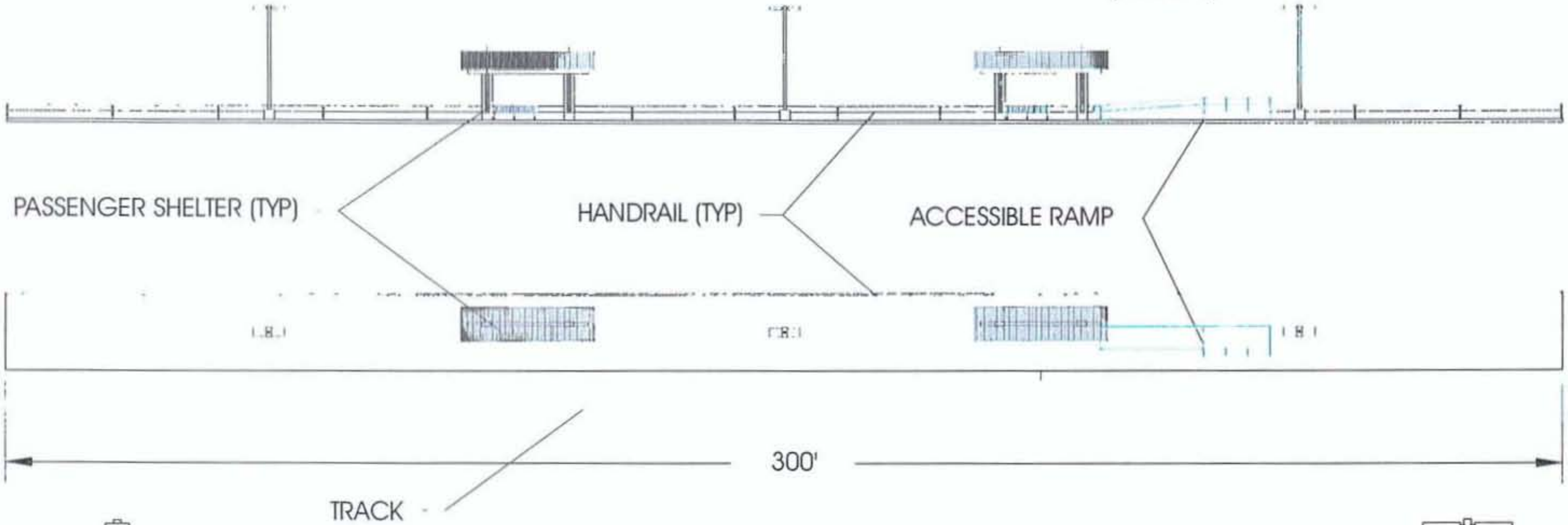
The normal practice, used on the San Diego Trolley/San Diego and Imperial Valley between San Diego, El Cajon and San Ysidro, is for the operations to be separated in time or temporal separation (i.e., only one type of vehicle on the tracks at a given time) and physically separated (derails, preferably powered, placed to prevent different types of equipment from entering the route). Operating protocols, train control signals would have to be identified to allow the use of a non-compliant vehicle. However, as the BN/SF is only operating limited freight service north of LAX, time separation may be possible.

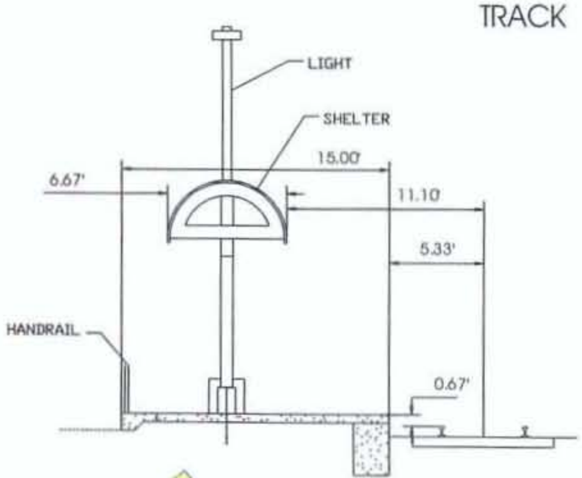
The use of a FRA compliant vehicle has the potential to significantly reduce the time required to initiate service, as neither of the agencies charged with regulating railroad safety (California Public Utilities Commission and the FRA) would need to provide waivers, and the freight operations of the BN/SF would not be affected. FRA compliant equipment is currently on the market, and can be obtained in less than a year. It is likely that three or more years would be required to acquire and place into service a FRA non-compliant self-powered rail vehicle.

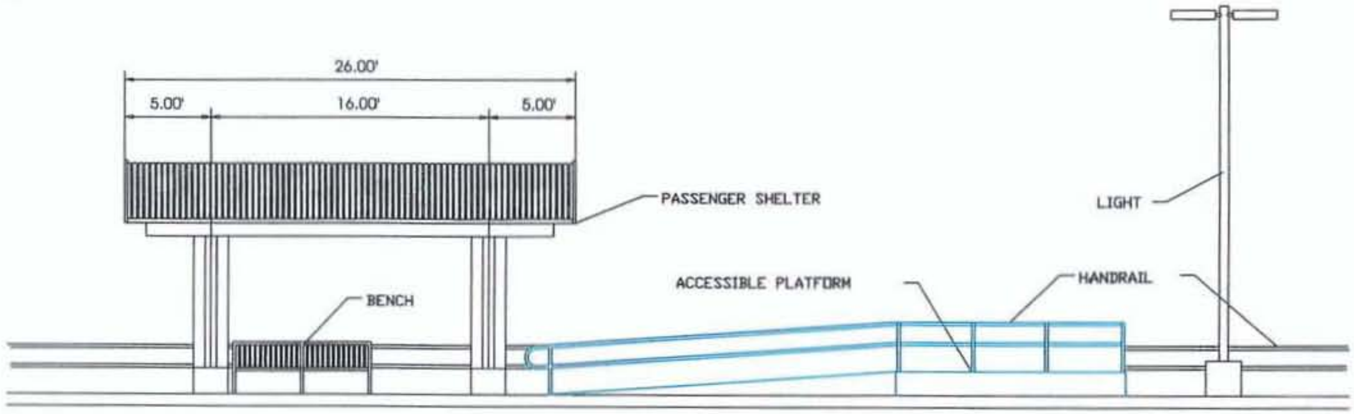
3.4 Stations

The number of stations will vary depending on the implemented level of service and the expected patronage. The minimum number of stations required for the full level of service is four located at the Metro Green Line Aviation Station (MP 13.8), Lot B at LAX (MP 13.1), Crenshaw Boulevard (MP 8.0) and Metro Blue Line Slauson Station (MP 2.8). Each of these locations

Figure 3.5: Metro Blue Line Crossing of Harbor Subdivision – a staircase would connect the two services.







DETAIL 1

Crenshaw-Prairie Transit Corridor

Conceptual LRT Station

Crenshaw - Prairie Corridor MIS

METRO

KORVE ENGINEERING

RAW INTERNATIONAL

3.6 Signals and Train Control Requirements

The current Harbor Subdivision is unsignaled and trains receive authorization to occupy the main track either via Track Warrants from a central dispatcher, or under General Code of Operating Rules (GCOR) Rule 6.13, Yard Limits. While these methods have worked well for low speed freight operations along the route, implementation of passenger service would require some form of signaling.

The simplest signaling system is Automatic Block Signals (ABS). Under this method, the signal only indicates whether or not the track ahead is occupied[10] and no movement authority is provided. This is the method used by a majority of the light rail operations in the country with trains given Track Warrants from a dispatcher. The Track Warrant includes instructions regarding the schedule that particular operator and equipment set are to adhere to that day, along with other information about track conditions and special circumstances. Meets between opposing trains are accommodated by directional running at the passing tracks, where the train in one direction (e.g. westbound) always is routed onto the right hand track, and trains in the other direction (e.g. eastbound) are always routed on the left hand track. This system works for a light density passenger service or a system that is completely double-tracked. The passenger service could operate on either 30- or 20-minute headways using ABS and spring switches.

Tracks that have a large number of train activity are normally operated under Centralized Traffic Control (CTC). Under CTC rules, the signals not only indicate whether the track ahead is occupied, but provide the authority for the train to move. The dispatcher from a remote location controls the switches and routing of trains at meeting points. CTC is a very flexible system, and allows the movement of a large number of trains over a single-tracked railroad with a great degree of reliability. This signaling system is significantly more expensive to install and operate than ABS. If the headways were reduced to less than 20 minutes, then serious consideration to installing CTC must be made. As an alternative, the route could be double-tracked and still operate under ABS rules.

If a FRA non-compliant vehicle is used, an additional signal cost would need to be budgeted for the signal systems used to ensure that there is no mixing in service of the compliant vehicles (BN/SF freight service) and non-compliant (passenger service) vehicles.

4.0 ASSESSMENT OF ALTERNATIVES

In summary, this report has defined a series of alternatives for providing an initial level of passenger rail service between the Metro Green Line, LAX Parking Lots B and C and the Crenshaw Corridor, along with a full level of service extending east to the Metro Blue Line Slauson Station. The alternatives included both Federal Railroad Administration (FRA) compliant vehicles, which can be operated on the same tracks as Metrolink, Amtrak and freight, and non-compliant vehicles that require separate tracks or operating times, similar to the Blue Line cars. All of the options reviewed assumed that the passenger service would be operated at 50 mph with 30- or 20-minute headways.

4.1 Capital and Operating Cost Estimates

Conceptual level capital and operating cost estimates have been identified for FRA compliant and non-compliant vehicles. It should be noted that a majority of the basic system elements are the same for all of the alternatives. Track rehabilitation, which includes tie replacement and track surfacing, and assumes reuse of the majority of the existing rail, was estimated at $110.00 a running foot.[11] It should be noted

[10] The rails are part of the signal circuitry, and thus can indicate if the rail has been broken which is a significant safety feature.

[11] Data on track rehabilitation and maintenance costs from a conversion with M.E. McGinley, Director of Engineering, Southern California Regional Rail Authority.

that the same amount of rehabilitation is required whether the trains operate at 31 mph or 50 mph. Rehabilitation for the initial level of passenger rail service, which is envisioned to operate at no more than 30 mph, was estimated to cost $30.00 a running foot.

New construction for the passing tracks and terminal trackage was assumed to be $175.00 a running foot. The passing tracks are estimated to be 3,000 feet in length, and the terminal tracks are assumed to be 1,000 feet in length. An Automatic Block System (ABS) type of signal protects each of the sidings and terminal tracks, with an allowance for an additional signal at the approach to each terminal. ABS signals were estimated to cost $110,000 per installation. The signal control circuitry would use the rails, and no new pole line or utility wires would be required.

Equipment requirements vary with the frequency of service. At 30-minute service headways, five cars were identified as being required. The fleet would be configured as two sets of two cars each, with a spare car for maintenance rotation and wreck protection. The cost estimates assumed use of previously-owned rehabilitated cars at $1.5 million each. New cars were estimated at $2.9 million each based on information from vehicles suppliers. At 20-minute service headways, a total of 10 cars was identified as being required. This fleet option would be configured as four sets of two cars each with a spare set for maintenance rotation and wreck protection.

The maintenance and storage facility was estimated to cost $3.0 million for 30-minute passenger rail service. The cost would increase to $3.5 million for operation of 20-minute service headways as a larger building and additional storage tracks would be required. The cost estimate assumed that the facility would deal only with light repairs, component change-out and cleaning, and that all heavy work would be performed at another maintenance facility such as that operated by Metrolink or MTA.

The transfer/interchange stations with the Metro Blue and the Green lines were estimated to cost $5.0 million each. This figure includes passenger rail service platforms, extension of the existing elevated platforms, connecting escalators (or elevators) and stairs. Intermediate stations were estimated to cost $1.8 million each. This cost includes a platform, shelter, furnishings, lighting, passenger information systems and ticket vending machines. The cost did not assume any parking, which was estimated to cost roughly $1,700 an at-grade space plus any required right-of-way acquisition.

The Harbor Subdivision is currently operated under "Track Warrant Control" (TWC) rules without wayside signals. TWC without signals is used on lightly traveled freight lines. The addition of passenger service would require at least Automatic Block Signals (ABS). The costs for signaling and train control increase significantly if a Centralized Traffic Control (CTC) system were to be installed. For example, a signal and turnout for an ABS system (such as is found at the end of a passing track) was estimated at $250,000, while a CTC version of the same project was projected to cost close to $500,000.

The operating and on-going track maintenance costs presented on the following pages are conceptual estimates only. The cost per train mile used by Caltrain[12] was used for operating costs; and the SCRRA cost for on-going right-of-way maintenance was used for track and signal costs. Service was assumed to operate 365 days a year similar to existing Metro Blue and Green Line service.

Table 4.1 on the following page presents a summary of the conceptual cost estimates in Year 2002 dollars for 50 mph passenger rail service operating at 20- and 30-minute headways. The identified conceptual costs are for providing the "full level of service" operating on the 11.0 miles from the Metro Green Line Aviation Station to Crenshaw Boulevard, and then connecting east to the Metro Blue Line Slauson Station.

[12] Conversation with Walt Stringer, Manger of Operations, Rail Services, Caltrain.

The capital cost difference between the compliant and non-compliant vehicle options is the same – $2.08 million – whether operating at 20- or 30-minute headways. The additional amount represents the cost to provide a Centralized Traffic Control (CTC) system as required for FRA non-compliant vehicles with continued freight operations. There is no difference in the estimated recurring operating cost between compliant and non-compliant vehicles. There is a $4.26 million annual operating cost difference between 20- and 30-minute headway service which represents the cost of operating an increased fleet size – from five to ten vehicles.

Table 4.1: Summary of Conceptual Level Cost Estimates (Year 2002 Dollars)

Vehicle Type	Capital Cost Estimate	Annual Recurring Operating and Maintenance Cost Estimate
FRA Compliant Vehicles		
30-minute headways at 50 mph	$63,968,000	$ 9,054,000
20-minute headways at 50 mph	$83,468,000	$13,312,000
FRA Non-Compliant Vehicles		
30-minute headways at 50 mph	$66,048,000	$ 9,054,000
20-minute headways at 50 mph	$85,548,000	$13,312,000

Conceptual level capital and operating cost estimates are presented on the following pages for the identified 50 mph alternatives:

1. **30-minute service headways**
    - ***FRA Compliant Vehicles*** – Tables 4.2 and 4.3; and
    - ***FRA Non-Compliant Vehicles*** – Tables 4.4 and 4.5.
2. **20-minute service headways**
    - ***FRA Compliant Vehicles*** – Tables 4.6 and 4.7; and
    - ***FRA Non-Compliant Vehicles*** – Tables 4.8 and 4.9.

Table 4.2: FRA Compliant Vehicles Cost Estimate (50 mph on 30-minute headways)

System Element	Total Cost	Cost Discussion
Track work		
Upgrade Harbor Subdivision for passenger rail service	$6,272,640	$110 per track foot, 10.8 miles
Grade Crossing Upgrades		
Single track new gates/house	$4,340,000	$217,000 each @ 20 locations
Double track, new gates/house	$5,000,000	$500,000 each @ 10 locations
Signals –ABS		
MP 2.8 to MP 13.6	$ 880,000	$110,000 each @ 8 locations for train control
Passing Sidings/Terminal Tacks	$1,680,000	2 Sidings, 3,000 feet each, plus 1,000 feet for terminal tracks
Signals –CTC		
MP 2.8 to MP 13.6	$ --	Not required
Equipment		
5 Vehicles	$14,500,000	2 sets and 1 spare car
Maintenance and Storage Facility		
New facility on MTA-owned land near Van Ness Avenue	$ 3,000,000	Light maintenance and storage only
Stations*		
Metro Blue Line Transfer Station	$ 5,000,000	Extend Metro Blue Line platform over Slauson, 300 foot platform, 2 TVMs, escalators.
Crenshaw Boulevard Station	$ 1,766,800	300 foot platform, 2 TVMs
Lot B Station	$ 1,766,800	300 foot platform, 2 TVMs
Metro Green Line Transfer Station	$ 5,000,000	Extend Metro Green Line platform over Aviation, 300 foot platform, 2 TVMs, escalators.
Subtotal	$49,206,240	
Contingency (30%)	$14,761,872	
Total Capital Cost	**$63,968,112**	

* Station costs do not include parking and assume utilization of existing right-of-way with no additional property acquisition required.

Table 4.3: Annual Recurring Cost Estimate (50 mph on 30-minute headways)

Cost Element	Cost	Cost Discussion
Operating		
Operating Subsidy (40% Farebox recovery)	$ 8,514,720	365 days, 72 one-way trips a day, $50.00 per mile
Track Maintenance		
Harbor Subdivision	$ 540,000	$50,000 per mile
Annual Cost	**$ 9,054,720**	

Table 4.4: FRA Non-Compliant Vehicle Cost Estimate (50 mph on 30-minute headways)

System Element	Total Cost	Cost Discussion
Track work		
Upgrade Harbor Subdivision for passenger rail service	$6,272,640	$110 per track foot, 10.8 miles
Grade Crossing Upgrades		
Single track new gates/house	$4,340,000	$217,000 each @ 20 locations
Double track, new gates/house	$5,000,000	$500,000 each @ 10 locations
Signals –ABS		
MP 2.8 to MP 13.6	$ 880,000	$110,000 each @ 8 locations for train control
Passing Sidings/Terminal Tacks	$1,680,000	2 Sidings, 3,000' each, plus 1,000 terminal tracks
Signals –CTC		
Power Derails for Equipment Separation	$1,600,000	Required at beginning and end of trackage shared with freight services
Equipment		
5 Vehicles	$14,500,000	2 sets and 1 spare car
Maintenance and Storage Facility		
New facility on MTA-owned land near Van Ness Avenue	$ 3,000,000	Light maintenance and storage only
Stations*		
Metro Blue Line Transfer Station	$ 5,000,000	Extend Metro Blue Line platform over Slauson, 300 foot platform, 2 TVMs, escalators
Crenshaw Boulevard Station	$ 1,766,800	300 foot platform, 2 TVMs
Lot B Station	$ 1,766,800	300 foot platform, 2 TVMs
Metro Green Line Transfer Station	$ 5,000,000	Extend Metro Green Line platform over Aviation, 300 foot Platform, 2 TVMs, escalators
Subtotal	$50,806,240	
Contingency (30%)	$15,241,872	
Total Capital Cost	**$66,048,112**	

* Station costs do not include parking and assume utilization of existing right-of-way with no additional property acquisition required.

Table 4.5: Annual Recurring Cost Estimate (50 mph on 30-minute headways)

Cost Element	Cost	Cost Discussion
Operating		
Operating Subsidy (40% Farebox recovery)	$ 8,514,720	365 days, 72 one-way trips a day, $50.00 per mile
Track Maintenance		
Harbor Subdivision	$ 540,000	$50,000 per mile
Annual Cost	**$ 9,054,720**	

Table 4.6: FRA Compliant Vehicles Cost Estimate (50 mph on 20-minute headways)

System Element	Total Cost	Cost Discussion
Track work		
Upgrade Harbor Subdivision for passenger rail service	$6,272,640	$110 per track foot, 10.8 miles
Grade Crossing Upgrades		
Single track new gates/house	$4,340,000	$217,000 each @ 20 locations
Double track, new gates/house	$5,000,000	$500,000 each @ 10 locations
Signals –ABS		
MP 2.8 to MP 13.6	$ 880,000	$110,000 each @ 8 locations for train control
Passing Sidings/Terminal Tacks	$1,680,000	2 Sidings, 3,000' each, plus 1,000 terminal tracks
Signals –CTC		
MP 2.8 to MP 13.6	$ --	Not required
Equipment		
10 Vehicles	$29,000,000	4 sets and 2 spare cars
Maintenance and Storage Facility		
New facility on MTA-owned land near Van Ness Avenue	$ 3,500,000	Light maintenance and storage only
Stations*		
Metro Blue Line Transfer Station	$ 5,000,000	Extend Metro Blue Line platform over Slauson, 300 foot platform, 2 TVMs, escalators
Crenshaw Boulevard Station	$ 1,766,800	300 foot platform, 2 TVMs
Lot B Station	$ 1,766,800	300 foot platform, 2 TVMs
Metro Green Line Transfer Station	$ 5,000,000	Extend Metro Green Line platform over Aviation, 300 foot Platform, 2 TVMs, escalators
Subtotal	$64,206,240	
Contingency (30%)	$19,261,872	
Total Capital Cost	**$83,468,112**	

* Station costs do not include parking and assume utilization of existing right-of-way with no additional property acquisition required.

Table 4.7: Annual Recurring Cost Estimate (50 mph on 20-minute headways)

Cost Element	Cost	Cost Discussion
Operating		
Operating Subsidy (40% Farebox recovery)	$ 8,514,720	365 days, 72 one-way trips a day, $50.00 per mile
Track Maintenance		
Harbor Subdivision	$ 540,000	$50,000 per mile
Annual Cost	**$ 9,054,720**	

Table 4.8: FRA Non-Compliant Vehicles Cost Estimate (50 mph on 20-minute headways)

System Element	Total Cost	Cost Discussion
Track work		
Upgrade Harbor Subdivision for passenger rail service	$6,272,640	$110 per track foot, 10.8 miles
Grade Crossing Upgrades		
Single track new gates/house	$4,340,000	$217,000 each @ 20 locations
Double track, new gates/house	$5,000,000	$500,000 each @ 10 locations
Signals –ABS		
MP 2.8 to MP 13.6	$ 880,000	$110,000 each @ 8 locations for train control
Passing Sidings/Terminal Tacks	$1,680,000	2 Sidings, 3,000' each, plus 1,000 terminal tracks
Signals –CTC		
Power Derails for Equipment Separation	$1,600,000	Required at beginning and end of trackage shared with freight services
Equipment		
10 Vehicles	$29,000,000	4 sets and 2 spare cars
Maintenance and Storage Facility		
New facility on MTA-owned land near Van Ness Avenue	$ 3,500,000	Light maintenance and storage only
Stations*		
Metro Blue Line Transfer Station	$ 5,000,000	Extend Metro Blue Line platform over Slauson, 300 foot platform, 2 TVMs, escalators
Crenshaw Boulevard Station	$ 1,766,800	300 foot platform, 2 TVMs
Lot B Station	$ 1,766,800	300 foot platform, 2 TVMs
Metro Green Line Transfer Station	$ 5,000,000	Extend Metro Green Line platform over Aviation, 300 foot Platform, 2 TVMs, escalators
Subtotal	$65,806,240	
Contingency (30%)	19,741,872	
Total Capital Cost	**$85,548,112**	

* Station costs do not include parking and assume utilization of existing right-of-way with no additional property acquisition required.

Table 4.9: Annual Recurring Cost Estimate (50 mph on 20-minute headways)

Cost Element	Cost	Cost Discussion
Operating		
Operating Subsidy (40% Farebox recovery)	$ 12,772,080	365 days, 72 one-way trips a day, $50.00 per mile
Track Maintenance		
Harbor Subdivision	$ 540,000	$50,000 per mile
Annual Cost	**$ 13,312,080**	

4.2 Findings

Figure 4.1: Remanufactured Budd FRA compliant vehicle in service for Trinity Rail Express in Texas.

Key study findings are as follows:

1. **FRA compliant passenger rail service could be implemented in 24-30 months.**
Federal Railroad Administration (FRA) compliant, Self-Powered Multiple Unit service, operated with pre-owned or "off-the-shelf" [13] cars, could be implemented in 24-30 months. This timeframe assumes that the engineering and contract procurement work for the track rehabilitation and stations is started approximately six months before the order to purchase the vehicles has been signed. Implementation of this type of service would have a capital cost between $37.0 million for 30 mph operations on 30-minute headways utilizing the existing trackage between the Metro Green Line and Crenshaw Boulevard to $83.5 million for service operating between the Metro Green and Blue Lines at 50 mph on 20-minute headways (with track and control system improvements).

2. **FRA non-compliant service could be implemented in 30-36 months.**
FRA non-compliant vehicle service (utilizing equipment similar to the Metro Blue or Green Line vehicles with self-powered or natural gas/electric traction operations; operated with "off-the shelf" vehicles) could be implemented in approximately 30-36 months. This is approximately one year longer than is required for a compliant vehicle. This timeframe assumes that the engineering and contract procurement work for track rehabilitation and stations is initiated approximately six months prior to the order to purchase the vehicles has been signed. The additional time for the implementation of non-compliant service compared to compliant service is due to longer equipment acquisition times, and obtaining approval from the California Public Utilities Commission (CPUC) resolving regulatory and safety issues with mixed freight/light rail passenger operations. The use of non-compliant vehicles does have advantages as the cars are smaller, potentially less expensive to purchase and operate, and have the ability to operate over the existing Metro Blue Line trackage into Downtown Los Angeles and Long Beach.

3. **The existing track is in generally good condition and maintained to FRA Class 2 standards.**
Corridor tracks and ties were found to be in generally good condition, and are currently maintained to FRA Class 2 standards which allows 30 mph passenger and 25 mph freight train speeds. A track rehabilitation program would be required to provide Class 3 service, which would allow up to 60 mph passenger and 40 mph freight train speeds. It should be noted that the same amount of track rehabilitation to provide a smooth ride and higher speeds would be required whether the passenger rail service operated at 31 mph or 60 mph.

[13] This timeline could be accelerated if previously-owned cars available on the market are purchased. Potential sources are Via Rail Canada, British Columbia Railway and the Dallas-Ft. Worth area Trinity Rail Express.

4. **Single-track passenger rail service could be operated at speeds of up to 50 mph and as frequently as 20-minute headways.**
This frequent and fast level of passenger service would require upgrading the tracks, installation of an Automatic Block Signal (ABS) system and passing tracks. Higher speeds, or more frequent headways, would require double-tracking or Centralized Traffic Control (CTC) signals, or both.

5. **The Harbor Subdivision right-of-way is generally wide enough to accommodate a double-tracked passenger rail system.**
The Corridor right-of-way width is generally 50 feet or more which is adequately-sized to accommodate the preferred operational right-of-way width of 45 feet. However, in some locations the right-of-way width narrows to 25 feet and property acquisition or adjacent street vacation would be required. The narrowest points occur at the Century Boulevard overcrossing, between Arbor Vitae and Manchester Boulevard in the LAX area, and between Ivy and Inglewood Avenues in Inglewood.

6. **The large number of existing at-grade crossings presents an important cost and safety issue.**
The cost for a complete upgrade of a double-tracked crossing to allow for more active rail service often exceeds $500,000.[14] Improvements to single-track grade crossings typically cost approximately $220,000, but the cost may increase due to site-specific safety and operational issues. Prior to initiating passenger rail service, a comprehensive study should be performed to identify necessary grade crossing improvements to ensure community safety along the route in order to maintain a passenger-friendly rail speed. This effort would determine which crossings could be closed or consolidated, and develop a program of fencing and pedestrian access.

7. **The number of stations will greatly affect the cost of the resulting project and service.**
The initial level of service between Crenshaw Boulevard and the Metro Green Line would require three stations: 1) Metro Green Line Aviation Station, 2) LAX Parking Lot B and 3) Crenshaw Boulevard. With extension of the full level of service east to the Metro Blue Line, a fourth station would be required at the Metro Blue Line Slauson Station. Intermediate stations to enhance community access could be located at Centinela Avenue and LAX Parking Lot C under the initial level of service, and at Normandie and Van Ness Avenues under the full level of service.

8. **Implementation of BRT service on the right-of-way could not preclude freight rail service at this time.**
Bus Rapid Transit (BRT) service facilities would have to be designed and constructed to allow for the existing freight rail trackage to remain in place at the present time. In the future, MTA may reach an agreement with the BN/SF to remove freight rail operations from MP 2.8 to 13.8 to allow for BRT operations. There are a number of locations where the right-of-way width is insufficient to accommodate both BRT and freight operations, and property acquisitions would be required.

   With continued freight operations, implementation of BRT service would also require temporal separation due to safety concerns related to the constrained right-of-way. Any co-operation of BRT and freight rail services would require FRA and CPUC approval. It should be noted that there is no precedent for joint BRT-freight operations and the regulatory approval process may be complicated and time-consuming. It is estimated that a minimum of 18 months would be required to secure regulatory approval of BRT operations on a joint-freight corridor. Concurrent with this effort, an environmental review and approval process would be required before BRT

[14] Upgrades to at-grade crossings include new signal warning devices, control circuitry, pavement signage, median islands and crossing surfaces.

facility construction could begin as BRT operations are not exempt from CEQA and NEPA environmental review requirements.

4.3 Next Steps

With agreement to proceed with implementation of passenger rail service along the Study section of the Harbor Subdivision, the following decisions – which frame the resulting service quality, cost and implementation timeframe – would be required:

1. Implement an initial or full level of service?

The decision on whether to implement an initial level of service from the Metro Green Line to Crenshaw Boulevard, or the full level of service extending east to the Metro Blue Line, would be made based on a combination of cost balanced with funding availability, service intent and patronage analysis. Conceptual cost estimates have identified a range of capital costs from $37.0 million to provide the 6.0-mile initial level of service to $87.5 million for the full level of service along the 11.0 miles from the Metro Green Line to the Metro Blue Line. In addition, there would be an annual recurring operating cost of from $9.1 to $13.3 million. Fit with existing funding resources or the development of funding partnerships, such as with LAX, would have to be identified and secured.

This decision also would reflect the service intent of the Harbor Subdivision passenger rail service, whether only to test its viability or to make the commitment to fully developing this link in the regional rail system. Any service decision should be made within the context of future service expansion options such as extending operations to Union Station and the South Bay communities. A patronage analysis could be performed to identify the most effective level of service. Any ridership modeling efforts should reflect the final LAX Master Plan, development plans along the right-of-way such as those in Inglewood, and the implementation of the expanded Metro Rapid service network, particularly along Crenshaw Boulevard.

2. Operate on existing or upgraded tracks?

The decision to on whether to operate passenger rail service on the existing or upgraded tracks has cost, service quality and implementation timeframe implications. The existing tracks currently serve freight travel only and are maintained to FRA Class 2 that would allow 30 mph passenger service. Some trackage improvements – tie replacement and track resurfacing – would be required even at a Class 2 level of service to ensure a smoother, more passenger-friendly ride. Upgrading the tracks to FRA Class 3 would allow for an even smoother as well as faster (up to 60 mph) passenger service.

Utilization of the existing Corridor trackage with minor improvements would have the lowest capital cost and provide the most immediate passenger service. While upgrading the tracks would result in a higher capital cost and a longer implementation timeframe, it would provide an upgraded system with the most passenger-friendly service. It should be noted that any track improvement decision should be made concurrently with the following decision on whether to operate on a single- or double-track system.

3. Operate on existing single-track or upgrade to a double-track system?

This decision has cost, implementation timeframe and both short- and long-term service implications. Use of the existing single-track system would have the lowest cost, allow for the most immediate implementation of passenger service and, with minor trackage improvements, would provide an acceptable quality of passenger service. In addition, implementation of passenger service in existing rail corridors is exempt from CEQA and NEPA requirements. With trackage improvements to FRA Class 3, single-track passenger rail service could operate at speeds up to 50 mph and as frequently as 20-minute headways. The need for more frequent service would require double-tracking. If the decision to double-track the system is made after the initiation of passenger service, construction needs may preclude passenger service as the existing single tracks are typically located in the center of the right-of-way. Double-tracking efforts would require the removal of the existing trackage resulting in the disruption of passenger service. In addition, double-tracking may require property acquisition or street vacations along narrow portions of the right-of-way, which would increase project costs and may trigger an environmental review process.

4. Utilize FRA compliant or non-compliant vehicles?

This decision primarily has service implementation timeframe and long-term service connectivity implications. Utilization of FRA compliant vehicles would allow for the most immediate implementation of service, particularly with the purchase of pre-owned cars. Compatible with freight operations, FRA compliant vehicles could accommodate Corridor freight service until the future when passenger rail service needs become constrained and an agreement reached to cease freight service.

Assuming the continuation of freight operations for the foreseeable future, non-compliant vehicle service – utilizing equipment similar to the Metro Blue or Green Lines – would require approximately one year longer to implement. The increased timeframe is due to a longer equipment acquisition timeframe, the need to work with BN/SF to allow for temporal separation operations, and obtaining approval from the California Public Utilities Commission (CPUC) resolving regulatory and safety issues with mixed freight/light rail operations. If a non-compliant vehicle were used and temporal separation operations were not feasible, an additional project cost would need to be budgeted for a signal system to ensure that there was no mixing in service of freight and non-compliant passenger service vehicles.

The use of non-compliant vehicles would have several advantages as the cars are smaller and less intrusive on the adjacent communities, along with potentially costing less to purchase and operate. Non-compliant vehicles would have the ability to operate over the existing Metro Blue Line trackage into Downtown Los Angeles and Long Beach, as well as north on Crenshaw Boulevard if an LRT system were constructed in the future.

5. How many stations?

The number of stations associated with passenger rail service primarily would have cost and service implications. Implementation of an initial level of service would require a minimum of three stations, while the full level of service could include up to eight stations, significantly increasing the project cost. Provision of the minimum number of stations located at key regional destinations (LAX and major transit system interface points) – with no station parking beyond what already exists – would allow for a lower-cost evaluation of the viability of providing passenger service in this rail corridor. Increasing the number of stations, to include community-oriented stations, would balance the impacts and benefits of passenger rail service for adjacent neighborhoods and would serve local and regional connectivity. Provision of an increased number of stations would increase the project cost not only for the station construction, but also for possible acquisition of property in some station areas to accommodate a station platform and possible parking. This may result in a longer implementation timeframe as an environmental review process may be required.

System Alternatives

For example, the decision could be made to implement the most immediate and lowest cost service scenario to evaluate the system viability with the following components:

- ***Freight rail remains*** – passenger rail service operates with temporal separation.

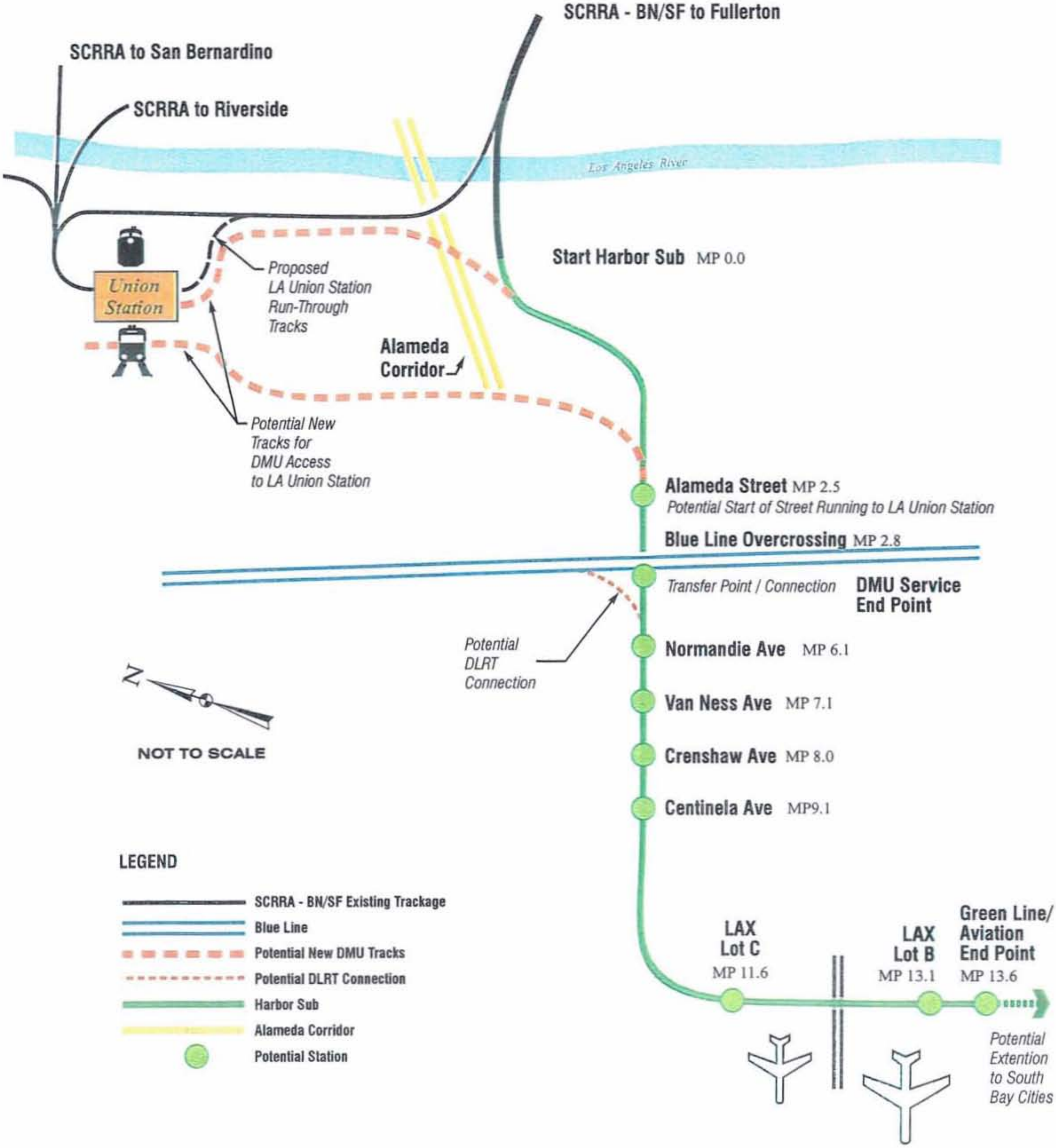
- ***Initial level of service*** – Metro Green Line (MP 13.8) to Crenshaw Boulevard (MP 8.0).
- ***Existing trackage with minor improvements*** (tie replacement and track resurfacing) – would allow FRA Class 2 service of 30 mph for passenger rail trains.
- ***Single-track operations*** with provision of passing sidings with no additional right-of-way acquisition.
- ***FRA compliant vehicles*** – pre-owned or off-the-shelf cars.
- ***Initial grade crossing safety improvement/consolidation program***– sufficient to allow 30 mph operations.
- ***Three stations*** – one modified existing station to allow for transfers (Metro Green Line Aviation Station) and two new community-serving stations (LAX Lot B and Crenshaw Boulevard).
- ***System-related improvements:*** maintenance/storage facility and Automatic Block Signal (ABS) system.

This initial system could be implemented within 24 to 30 months at a conceptual cost of $37.0 million. A detailed implementation schedule is presented on the following pages. Implementation of passenger service on existing railroad corridors is categorically exempt from both CEQA and NEPA review, though some environmental review may be necessary at the Crenshaw Boulevard Station if property acquisition is required.

Future system and service improvements could include:

- ***Freight rail vacates system*** – passenger rail service operations only.
- ***Full level of service*** – Metro Green Line (MP 13.6) to Metro Blue Line (MP 2.8).
- ***Future service extensions*** – connect east to Union Station and/or operate on Metro Blue Line tracks into Downtown Los Angeles and Long Beach.
- ***Upgrade track system to FRA Class 3 service*** (complete track and tie rehabilitation program) – would allow speeds up to 60 mph for passenger rail service.
- ***Double-track operations*** – would allow for faster, more frequent service.
- ***FRA non-compliant vehicles*** – would allow Corridor vehicles to operate on the Metro Blue and Gold Lines.
- ***Complete grade crossing safety improvement/consolidation program.***
- ***Up to a total of eight stations*** – two modified existing stations to allow for transfers (Metro Green Line Aviation Station and Metro Blue Line Slauson Station) and six new community-serving stations (LAX Lot B, LAX Lot C, Centinela Avenue, Crenshaw Boulevard, Van Ness Avenue and Normandie Avenue).
- ***System-related improvements:*** enlarged maintenance/storage facility and Centralized Traffic Control (CTC) signals.

This full service system could be implemented within 24 to 30 months if the decision is made to operate with FRA compliant vehicles, or 30 to 36 months if non-compliant vehicles are preferred. A more detailed implementation schedule is presented on the following pages. The conceptual level cost of this alternative, excluding service extension beyond the Metro Blue Line, has been identified as $83.5 million.



DMU Future Operation Schematic Map

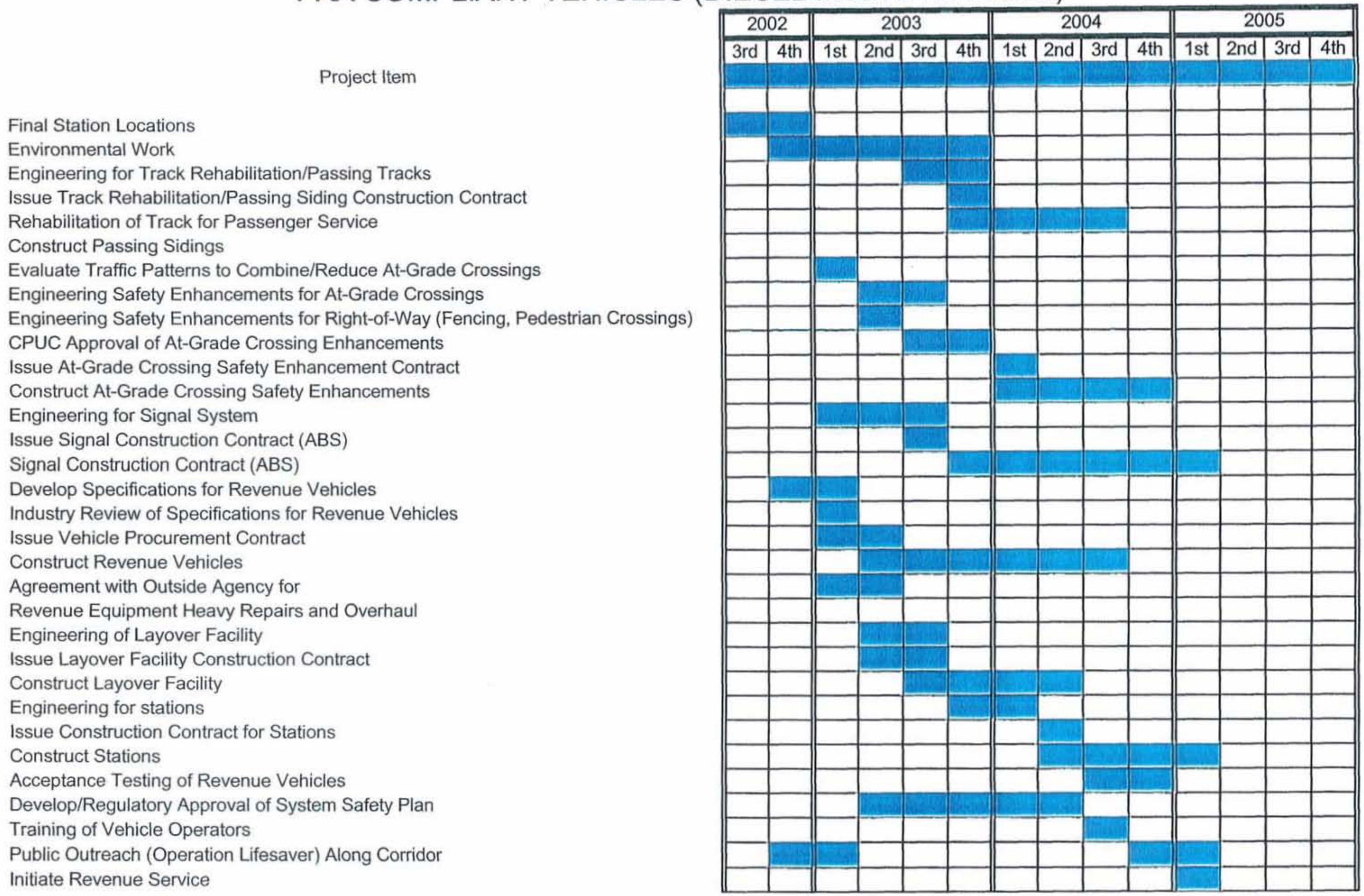
Crenshaw - Prairie Corridor MIS

METRO

KORVE RAW

Harbor Subdivision Service Implementation Schedule

FRA COMPLIANT VEHICLES (DIESEL MULTIPLE UNITS)



Harbor Subdivision Service Implementation Schedule

NON-FRA COMPLIANT VEHICLES (DIESEL LIGHT RAIL TRANSIT/DLRT)

	2002		2003				2004				2005			
	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
Project Item	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Final Station Locations	■	■												
Environmental Work		■	■	■	■	■								
Time Separation Agreement for DLRT Operation			■	■	■	■								
Engineering for Track Rehabilitation/Passing Tracks					■	■								
Issue Track Rehabilitation/Passing Siding Construction Contract						■								
Rehabilitation of Track for Passenger Service							■	■	■					
Construct Passing Sidings									■					
Evaluate Traffic Patterns to Combine/Reduce At-Grade Crossings			■											
Engineering Safety Enhancements for At-Grade Crossings				■	■									
Engineering Safety Enhancements for Right-of-Way (Fencing, Pedestrian Crossings)				■										
CPUC Approval of At-Grade Crossing Enhancements					■	■								
Issue At-Grade Crossing Safety Enhancement Contract							■							
Construct At-Grade Crossing Safety Enhancements							■	■	■	■				
Engineering for Signal System			■	■	■									
Issue Signal Construction Contract (ABS)					■									
Signal Construction Contract (ABS)						■	■	■	■	■	■			
Develop Specifications for Revenue Vehicles		■	■											
Industry Review of Specifications for Revenue Vehicles			■											
Issue Vehicle Procurement Contract			■	■										
Construct Revenue Vehicles					■	■	■	■	■	■	■			
Agreement with Outside Agency for			■	■										
Revenue Equipment Heavy Repairs and Overhaul														
Engineering of Layover Facility				■	■									
Issue Layover Facility Construction Contract				■	■									
Construct Layover Facility						■	■	■	■	■				
Engineering for stations								■	■					
Issue Construction Contract for Stations										■				
Construct Stations											■	■	■	
Acceptance Testing of Revenue Vehicles													■	
Develop/Regulatory Approval of System Safety Plan							■	■	■	■	■	■		
Training of Vehicle Operators												■	■	
Public Outreach (Operation Lifesaver) Along Corridor		■	■									■	■	
Initiate Revenue Service													■	