

Los Angeles County Metropolitan Transportation Authority



Panel Review of the Gold Line Eastside Extension

June 29, 2009 – July 2, 2009

I. INTRODUCTION

The Los Angeles County Metropolitan Transportation Authority (Metro) is the regional public transportation provider for the county of Los Angeles. Metro operates approximately 2,000 buses, two surface running light rail lines, one grade-separated light rail line, and two heavy rail subway lines. The present Gold Line, one of two of the surfacing running light rail lines, is approximately 13.6 miles in length running between Downtown Los Angeles and Pasadena, through Highland Park and South Pasadena. The Gold Line operates both in an exclusive and semi-exclusive right-of-way alignment with at-grade crossings. The Gold Line Eastside Extension Project will extend Gold Line rail transit service 5.8 miles from the current terminus, Union Station, to Atlantic Avenue.

Metro requested a panel review of the new extension prior to the start of revenue to determine its operational readiness, with particular emphasis be placed on:

- Fire/Life Safety
- Grade Crossing Design
 - General Perspective
 - Temple Street/Alameda Avenue
 - 1st Street/Alameda Avenues
 - 1st Street/Indiana Avenues
 - 3rd Street/Indiana Avenues
 - Gless Avenue
- Alignment Characteristics – gated vs. non-gated crossings
- Operating Practices, Facilities, and Systems

II. METRO GOLD LINE EXTENSION DESCRIPTION

The Gold Line Eastside Extension is a 5.8 miles double track extension of the Pasadena Gold Line. As in the current Gold Line, a 750-volt DC overhead catenary system will provide propulsion power to 90-foot light rail vehicles. The predominant operating environment is street running in a center median, with a 1.7 mile underground segment and a short elevated segment. Six of the new passenger stations are at-grade and two are located underground. The top operating speed in the street running segment is 35 mph, 10 mph on the 101 Freeway Bridge, and 55 mph in the tunnel segment. Operating speeds will be regulated through a cab signal system. Train separation will be maintained by a train control system in the tunnel segment. In-street operation will be controlled in accordance with traffic signals for motorists and “bar” signals for trains. Service frequency is planned for 7 to 8 minutes during the weekday peak hours and 12 to 20 minutes during the non-peak hours, depending on time of day and day of the week.

Starting at Union Station, the Gold Line extends southerly onto a new elevated structure, over the 101 Freeway Bridge and Commercial Street, to Temple Street and Alameda Avenue, where it touches ground. After crossing Temple and Alameda at-grade, the alignment continues south in a short exclusive right-of-way segment. At 1st Street, the

alignment turns easterly. The alignment then moves along 1st Street for approximately 0.8 miles in a center median, which is for the exclusive use of light rail vehicles. At 1st Street and Gless Avenue, the alignment descends into a 1.7-mile tunnel, emerging at 1st Street and Lorena Avenue, the east portal. Continuing along 1st Street to Indiana, the alignment then turns south onto Indiana and then west onto 3rd Street. The alignment at this point continues in a generally westerly direction until the terminus at Atlantic Avenue.

III. Review Panel

The review panel consisted of three members with extensive rail transit operations, safety, and security experience. The panel included:

Cameron Beach
Beach Consulting
San Francisco, California

Harry Saporta
Good Harbor Consulting, LLC
Arlington, Virginia

Peter Tereschuck, Retired Transit Executive
San Diego, California

IV. METHODOLOGY

The panel review occurred from June 29, 2009 to July 2, 2009 at the headquarters of Metro. During this time period, the panel members met with Metro project staff, a representative of the Los Angeles City Fire Department, and others related to the Gold Line Eastside Extension Project, including representatives from Mayor Antonio Villaraigosa's office. Several site visits were also made along the alignment during daylight and evening hours to better understand the operating conditions during these times of the day. Additionally, a number of project documents were reviewed. A list of these documents is found in Appendix B.

It should be kept in mind that it was not possible to conduct a comprehensive, in-depth review of the safety and operational aspects of the Gold Line extension during the review time period. The review was high level; it provides a snapshot in time by the panel members over a three-day period.

V. OBSERVATIONS AND RECOMMENDATIONS

A. Alignment Characteristics

The alignment of the present Pasadena Gold Line and that of the Eastside Extension are vastly different and should not be compared.

Pasadena Gold Line

The Pasadena Gold Line alignment is mostly that of a former Santa Fe Railroad freight line. The 13.6 mile line operates in a semi-exclusive and exclusive right-of-way that is protected by barrier walls, grades, fencing, and/or dense vegetation. There is also a short tunnel segment, approximately 1262 feet in length. Because of warning devices installed at the grade crossings, operating speeds range between 45 mph to 55 mph in many segments of the rail line. Train speeds are controlled by cab signals. Train separation is provided through a train control system. There are 17 at-grade vehicular-pedestrian crossings that have four-quadrant gates, and most locations also have pedestrian gates. There are 13 rail stations; 6 that are at-grade, 3 that are elevated (Union Station, Chinatown Station, and Lincoln Heights/Cypress Park Station) one underground station (Memorial Park Station), and 3 stations that are in the median of the 210 freeway

Light rail operations where speeds are greater than 35 mph warrant the use of crossing gates in accordance with State regulations, the Manual of Uniform Traffic Devices (MUTCD) and industry practice. Also, the likelihood of serious injury or loss of life is 20 times more at crossings where speeds are greater than 35 mph. The practice in North America is to provide 2-quadrant crossing gates at these crossings. Where an additional level of protection is desired due to sightline obstructions or other factors, some transit agencies have installed 4-quadrant gates. It should be noted; however, that 4-quadrant gates do not totally resolve grade crossing violations by motorists or pedestrians, as evidenced by accident data for the Pasadena line and by data from the Federal Railroad Administration.

Eastside Extension

The Gold Line Eastside Extension is approximately 5.8 miles in length with a mixed operating environment. The line is predominately street running, with a top operating speed of 35 mph. At no time is the operating speed greater than the posted speed limit for vehicular traffic. The grade crossings are wide offering for the most part excellent sightlines. As mentioned earlier, this type of alignment, combined with the operating characteristics, does not justify or require the installation of crossing gates. Other segments of line include a 1.7-mile tunnel with a maximum operating speed of 55 mph, and a short aerial structure with an operating speed of 10 mph. The low operating speed on the aerial structure is due to the curvature of the bridge and steep grade.

The street running segment is characterized by operation within a light rail transit (LRT) strip in the middle of the street. A 6-inch mountable curb and stamped colored concrete delineates the median trainway. There are a total of 31 at-grade vehicle or pedestrian crossings protected by traffic signals or warning signals.

The street running segment is typical of many light rail operating systems in North America that operate without any crossing gates. Examples of similar street running segments are:

- Portland, Oregon – Burnside Street, Interstate Avenue
- San Diego, California – Mission Valley East (through La Mesa), Commercial Street
- Sacramento, California – 7th and 8th Street, 12th and O Streets, AMTRAK Extension
- San Jose, California – 1st Street, San Carlos

- Seattle, Washington - Rainer
- Phoenix, Arizona

The panel found no unusual characteristics or features that warrant extraordinary measures and determined the design of the project to be consistent with industry practices in North America. The panel, however, recommend several safety features to enhance the safety measures that have been implemented.

Signage



Signs have been placed within the 1st Street and 3rd Street trainways to warn pedestrians of trespass and motorists that vehicles are not permitted on the tracks. These signs are appropriate. However, the No Trespass sign size and lettering appear to be too small. The team was not able to easily read the sign until they were in the trainway itself, defeating the purpose of the sign. On the other hand the “No Vehicle on Tracks” sign and “No Vehicles” symbol sign, appear to be appropriately sized. See Figure 1

Figure 1 – No Trespass and No Vehicle Signs

There are several areas along 3rd Street where there are numerous “No Vehicle” signs in close proximity to one another. In other locations, such as Gless Avenue, the purpose of some of the signs is not clear and the number of signs confusing. Although the signs are meant to convey a clear message the frequency and clustering of the signs may add to driver distraction and confusion.

Recommendation 1 – No Trespass Signs

Evaluate the size of, and the lettering on, the “No Trespass” signs for readability and effectiveness. The signs should be able to be read before entering the trainway.

Recommendation 2 – Sign Clutter

Evaluate the purpose and number of signs throughout the extension. The signs should be clear as to the desired action, easily read, non confusing by eliminating multiple signs that are clustered together. This will also enhance the esthetics of the line.

Trainway Delineation

Trainways should be delineated to clearly indicate that it is not a roadway for motor vehicle traffic and to define the dynamic envelope of the train. The latter is particularly important for those segments where trains mix with vehicular traffic, such as in roadway intersections. Typical means to delineate the trainway are by striping, curbs (including mountable curbs), raised buttons or other tactile treatment. Along 1st Street and 3rd Street, the trainway is delineated by a 6-inch mountable curb, colored stamped concrete, and in some



locations reflective paddles atop the curbs. The panel found the stamped concrete to be noticeable during daylight hours. During hours

of darkness, the color contrast of the stamped concrete area with the roadway was much less discernable. This is a concern as a motorist negotiating a turn may mistake the trainway for the roadway, and as a consequence, enter the trainway. Additional treatment is needed to more clearly indicate that the trainway is not a roadway and that motorists are not to enter it. See Figure 2.



At several locations, catenary poles and catenary guy wires are located at the intrusion entry point of the trainway. The poles and guy wires need to be protected from errant vehicles. An option is to protect the poles and guys with bollards striped with retro-reflective tape. See Figure 3.

Figure 3 – Unprotected Guy Wire



The reflective paddles along 3rd Street visibly outline the trainway. However, the paddles are likely to become a maintenance issue as they are easily damaged. Several damaged paddles were seen during site visits. There are several other treatments that can achieve the same effect. One option is to place yellow raised buttons on the curbs with reflective pavement markers place every third one or so. Another option is to simply place reflective pavement markers on the curb. If on the other hand paddles are to be retained, they should be placed at approximately 15-foot intervals.

Figure 4 – Reflective Paddle Delineators

Recommendation 3 – Catenary Pole/Guy Wire Protection

Place bollards or other devices to protect the catenary poles and guy wires from being accidentally struck and damaged by an errant motor vehicle.

Recommendation 4 – Trainway Delineation

At those locations where motor vehicles may mistakenly enter the trainway, as in Figure 2, place large raised buttons or rumble strips to tactilely indicate that the trainway is not a roadway. Additionally place reflective pavement markers along entry point to further highlight the area.

Recommendation 5 – Trainway Delineators

Consider using raised button and/or reflective pavement markers, in lieu of reflective paddles, to outline the trainway.

B. Pedestrian and Grade Crossings

At-grade light rail crossings with median running trains can be challenging. The vast majority of collisions at these intersections are due to motorists and pedestrians disobeying traffic control devices, signs, and pavement markings. Also, collisions in street running light rail operations where train and motor vehicle speeds are less than 35 mph usually result in injuries that are less severe than those where speeds are greater than 35 mph, such as on the Pasadena Gold Line.

An important concept in developing strategies to control at-grade collisions is driver and pedestrian expectancies. The grade crossings along 1st Street and 3rd Street take this concept into account.

Motor Vehicle Intersections

There are 31 four-way intersections on the Eastside Extension operating environment where automobiles or pedestrians can cross the tracks. In addition, there are 19 T-intersections where the roadways do not continue across the tracks. As light rail traffic does not interact with motor vehicle traffic at T-intersections, traffic control devices are not necessary; consequently, none are present. Signage and a pipe rail have been placed at the end of, and perpendicular to, these T-roadways to indicate that the roadway ends.

The four-way intersections are controlled by traffic signals for motorists and train signals for trains. The Metro has also used a number of strategies to control the likelihood of a mishap. Advance warning signs and railroad pavement markings are used to warn motorists that they are about to enter a train crossing. Active signs, such as “No Right Turn” and “No Turn On Red” are used to prohibit movement when trains are present. “Train Coming Signs” warn motorists of an approach of a train. Passive signs; pavement markings, such as “Keep Clear” and “Stop Here” markings; and traffic light directional arrows are used to contribute to the safe movement of trains and motor vehicles through an intersection. In addition, train operators are provided with bar signals to advise them when there are conflicting or no conflicting motor vehicle movements present. All of these techniques, when used in combination as it is being done in the Eastside Extension, enhance the safety of light rail-motor vehicle crossings. To further the safety of intersections, the Metro will be implementing its photo enforcement program at 14 intersections on the Eastside Extension. The Metro program has proven itself to be successful in reducing light rail vehicle-motor vehicle collisions on its other light rail lines.

A safety design feature that has been successfully used at other light rail systems is the use of lagging left-turn phase at intersections. This permits the trains to proceed before giving the motorists a left-turn green phase. Thus, the left turn phase “lags” the train “proceed” phase. Its use; however, is dependent on traffic conditions. The City and County of Los Angeles evaluated the use of lagging left-turn phases and implemented them where feasible.

Light Rail Pedestrian Crossings

Pedestrian crossings are provided at intersections and at stations. Pedestrian crossings are not permitted mid-block. However, it is not uncommon for pedestrians to cross mid-block (jaywalk) at certain locations when it has been relatively easy and permitted to occur in the past. To discourage trespassing onto the light rail right-of-way and jaywalking, picket fences, pipe rail, bollard and cable, and bollard, chain fences, and other treatments have been successfully used to discourage pedestrians from crossing

mid-block and trespassing into a light rail right-of-way. The use of a fencing system should continue, but targeted at those locations where frequent trespass has been observed. The “No Trespass” and “No Pedestrian” symbol signs should also continue to be used. These locations should also be targeted for aggressive enforcement of the trespass/jaywalking laws.

Recommendation 6 – Mid-Block Fences

Continue the use of fencing, but target those areas where frequent jaywalking is observed.

Recommendation 7 – Jaywalking Enforcement

Target locations with high trespass/jaywalking violations for enforcement of the laws.

Pedestrian movements at intersections are controlled by traffic signals and pedestrian signals. These signals are used to control pedestrian movements across the roadways and light rail tracks. Additional treatment is usually not warranted, as these devices would be activated whenever there is a conflicting motor vehicle or light rail vehicle movement.

At light rail stations the concept of channelization is used to direct and control the movement of pedestrians. This concept is widely used by light rail operating systems. Channelization, as used in the Eastside Extension is very effective, as there is very little opportunity for a pedestrian trespass onto the trainway. This is particularly important at light rail stations, as train traffic is high. However, where the picket fences meet the pedestrian crossing, the height of the picket fence obstructs the visibility of pedestrians and of train operators. The picket fences in these areas should be lowered.

Recommendation 8 – Station Picket Fences

Picket fences immediately adjacent to station pedestrian crossings should be lowered to approximately 4 feet in height.

To further control pedestrian movements at stations, active pedestrian “Train Coming” signs are used at the end of station platforms and dual-active pedestrian warning signs or railroad style flashers are used at the crossings themselves. The type used is dependent on the most appropriate device for the location. In addition to the active signs, passive signs are used to notify and direct pedestrians. For added enforcement swing gates are used to encourage pedestrians to orient themselves in the direction of an approaching train and to discourage pedestrians from darting across the tracks. The combination of active and passive signs and swing gates as used on the Eastside Extension is considered a best practice.

At several locations; however, the direction of the swing did not properly orient the passenger toward the approach of a train. It is recommended that each gate be evaluated for proper orientation.

Recommendation 9 – Swing Gates

Evaluate the direction of the station swing gates to ensure that they properly orient a passenger toward the direction of an approaching train.

Temple Avenue and Alameda Avenue

The Temple Street and Alameda Avenue crossing is located near a fire station and is one of the primary routes for Los Angeles City Fire Department responses to emergencies. Prior to entering the crossing, eastbound trains descend a 5% grade. Concerns were raised early on as to whether trains would be able to stop short of the intersection during a fire department response. Working in partnership, the Metro and fire department resolved this issue through a special traffic signal preemption system. Although the panel considers this issue to be satisfactorily resolved, it should be noted that the effectiveness of this feature will depend on the degree to which firefighters use it during initial dispatch from the station when responding to a call.

1st Street and Alameda Avenue



Eastbound train moves from Little Tokyo Station through 1st Street and Alameda Avenue require operators to negotiate the move at 10 mph due to the sharp curve.



Trains moving through this crossing frequently encounter motor vehicles encroaching in the designated “Clear Zone”. The encroachment may be due to motorist confusion as to where to stop, as the “Wait Here” and “Keep Clear” zones appear to blend together. The encroachment creates two problems. First, it may impede train movements. Second, a train moving through the crossing may collide with the stopped vehicle, as it may not always be evident to the operator that there is insufficient clearance. The use of markers to define the dynamic envelope will assist the operator in knowing whether it is safe to proceed through the curve. Train clearance markers have an added benefit. They provide a visual queue to the operator where the end of the train is in relation to the curve and when it is safe to accelerate.

Recommendation 10 – Enforcement

Work closely with the Los Angeles Police Department and Los Angeles County Sheriff’s Department to strongly enforce the “Stop Here” and “Keep Clear” requirements.

Recommendation 11 – Dynamic Envelope Delineation

Mark the dynamic envelope of the train through the curve. This may be accomplished with striping or other treatment.

Recommendation 12 – Stop Bar Enhancement

Enhance the stop bar to make it more evident where motor vehicles are to stop.

Recommendation 13 – “Keep Clear” Zone

Cross hatch the “Keep Clear” zone to make evident that motorists are not to enter the zone.

1st Street and Indiana Avenue

At this location, trains begin the transition from 1st Street to Indiana Avenue. The issues at 1st Street and Indiana Avenue are very similar to those of 1st Street and Alameda Avenue. However, there are multiple intersecting streets, limited sightlines, and special stopping requirements for motorists. This requires added operator attention in knowing whether it is safe to proceed. Consequently, this area will require added enforcement to ensure the intersection remains clear of vehicle encroachment. In addition to the recommendations for the 1st Street and Alameda crossing, consideration should be given to setting the stop bars farther back. The panel was encouraged to see active enforcement being conducted by members of the Los Angeles County Sheriff's Department Traffic Enforcement units.

Recommendation 14 – Enforcement

Continue to work closely with the Los Angeles County Sheriff's Department to aggressively enforce the "Stop Here" and "Keep Clear" requirements.

Recommendation 15 – Dynamic Envelope Delineation

Delineate the dynamic envelope of the train through the curve. This may be accomplished with striping.

Recommendation 16 – Stop Bar Enhancement

Enhance the stop bar to make it more evident where motor vehicles are to stop.

Recommendation 17 – Stop Bar Set-back

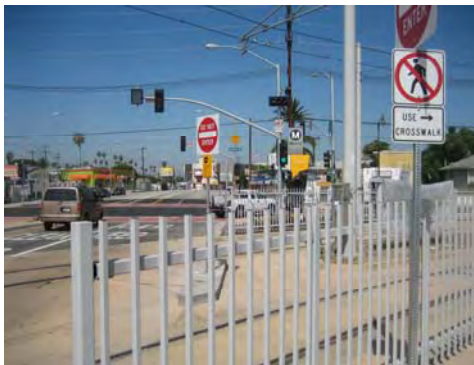
Evaluate the current stop bar locations to determine whether they should be set back further.

Recommendation 18 – "Keep Clear" Zone

Cross hatch the "Keep Clear" zone to make evident that motorists are not to enter the zone.

3rd Street and Indiana Avenue

The motor vehicle safety issues at the 3rd Street and Indiana Avenue crossing are also similar to those of 1st Street and Alameda Avenue. There is; however, a pedestrian safety issue that requires attention.



The photographs above show a view on 3rd street looking west at Indiana Avenue. The light rail station is just to the right in each photograph. Pedestrians approaching Indiana Avenue from the west (northwest quadrant of the intersection) are directed across

Indiana (toward the northeast quadrant) and onto what appears to be a pedestrian island. The area is not a pedestrian island, but in fact the northeast corner of the intersection. After reaching the corner, pedestrians are to proceed to the pedestrian crossing located on the south end of the 3rd and Indiana Station, if they wish to continue east along 3rd Street. Pedestrians are not to continue across the tracks as it places them into the roadway with no safe refuge, such as a sidewalk.

To discourage pedestrians from proceeding straight, there are picket fences on both the east and west sides of the trackway. However, the fencing on the east does not fully extend to the curb line, not making it fully clear that pedestrians are not to proceed straight across. Pedestrians ignore the fencing. The panel witnessed this several times during the site visit. Additional means are needed to direct pedestrians to the station crossing and to discourage them from proceeding straight. This is not an issue from the east approach to Indiana Avenue, as a pipe rail fence (right photograph) effectively directs pedestrians to the station crossing. Consideration should be given to extending the fence on the island to further discourage pedestrians from continuing on their original path.

Recommendation 19 – Enforcement

Work closely with the Los Angeles County Sheriff’s Department to strongly enforce the “Stop Here” and “Keep Clear” requirements.

Recommendation 20 – Dynamic Envelope Delineation

Delineate the dynamic envelope of the train through the curve. This may be accomplished with striping.

Recommendation 21 – Stop Bar Enhancement

Enhance the stop bar to make it more evident where motor vehicles are to stop.

Recommendation 22 – “Keep Clear” Zone

Cross hatch the “Keep Clear” zone to make evident that motorists are not to enter the zone.

Recommendation 23 – Pedestrian Island

Consideration should be given to extending the picket fence on the island to discourage pedestrians from continuing straight across the light rail tracks. A sign stating that pedestrian are prohibited from crossing the tracks at this location should be placed on the fence, as well.

1st Street and Gless Avenue



1st Street and Gless Avenue is the locality of the west end of the tunnel. Prior to the construction of the tunnel portal, vehicular traffic was permitted to cross 1st Street at this location. Now, high curbs with large reflective paddles on top have been put in place as a crossing barrier. A number of active and passive signs were also in place, informing motorists that they must not turn and proceed straight ahead. Although no damage to the barrier was found, the signage at this location

was cluttered and may be confusing. There were “No U Turn” and “No Left Turn” signs on Gless Street (only right turns are permitted). Signage at this location should be evaluated.

Recommendation 24 – Reevaluate Signage

Reevaluate the signage on Gless Avenue, as many of the signs are no longer applicable.



A significant safety issue was identified at the west portal (above photographs). The pickets on the perimeter of the portal walls are spaced far enough apart to permit objects from being pushed through and landing on the trainway, making contact with the catenary, or being dropped in front of an approaching train. Additionally, there is a large opening (see photograph on the right) that allows a person to climb on to the pipe spanning the tracks. Tight wire mesh or other tightly woven fabric should be placed on the pickets to prevent objects from being pushed through. Additionally, the large openings on each side of the pipe span should be closed.

Recommendation 25 – Picket Fence

Place tight woven fabric or mesh on the inside of the picket fence to prevent objects from being pushed through.

Recommendation 26 – Picket Fence Opening

Close the large opening on each side of the pipe span to prevent individuals from climbing onto the pipe.

C. Fire/Life Safety – Tunnel

Review of the preliminary hazard analysis, safety certification plan, Fire/Life Safety Committee minutes and other documents appear to indicate that the requirements of NFPA 130 are being met. In some cases, such as the emergency walkway and deluge system, they exceed the requirements of NFPA 130. However, there are two critical issues that must be corrected before revenue service may commence. During the testing of the emergency ventilation system, the sequencing of the fans and dampers it was found that they needed to be modified in order to meet the smoke and heat ventilation requirements of NFPA 130. A solution to the problem had been identified and the system control software is being revised. Another issue is the Emergency

Management Panels (EMP's). They have not been completed and tested. The EMP's and control software are required for revenue service.

A related issue is the SCADA system. The SCADA installation has not been completed and fully tested. Consequently, the emergency ventilation fans and dampers cannot be controlled remotely from the Rail Operations Center (ROC). Until such time that the SCADA system has been fully tested and operational, personnel should be posted at the EMP's to initiate an emergency ventilation system should a smoke or fire condition occur. Also, the gas detection system cannot be fully monitored and operated without the SCADA system. Revenue service must not commence until gas system indications can be monitored either from the EMP or the ROC.

Recommendation 27 – Emergency Management Panel

Test and confirm the functionality of the Emergency Management Panels

Recommendation 28 – Emergency Ventilation Control Software

Closely monitor and validate changes to the emergency ventilation control software

Recommendation 29 – Public Relations Tunnel Tours

Carefully evaluate conducting public relation tours through the tunnel until such time that the emergency ventilation system software has been validated and installed, and the gas detection system has been made fully operational and connected to the SCADA system.

During one of the tunnel tours it was noted that the “No Clearance” sign was simply stenciled with black paint on the concrete tunnel wall. The sign was difficult to see. The color scheme should be revised with a yellow background or yellow and black striped background to make the sign more pronounced.

Recommendation 30 – Tunnel “No Clearance” Sign

Change the background of the “No Clearance” sign so that the sign is more visible in the tunnel.

D. Security

Deputy Deployment

The LACMATA has contracted with the Los Angeles County Sheriff's Department to provide transit policing, security, and fare inspection services throughout the Metro service area. At the start of revenue service, two additional transit police deputies will be assigned to patrol the Eastside Extension. The planned deputy deployments do not appear to be sufficient.

Recommendation 31– Deputy Deployment

Evaluate current plans for deputy deployments. Consideration should be given to expanding police coverage by adding 6 or 8 additional personnel on trains, complemented by mobile units.

Tunnel Intrusion Detection System

A tunnel intrusion detection system has been installed to detect unauthorized persons and vehicles in the tunnel. Upon detection, an alert is sent to the ROC. A CCTV camera, mounted on the portal wall (see lower right photograph below) permits ROC personnel to view the intrusion. Additionally, a visual alert is displayed at the portal (see lower left photograph below) to notify train operators that an intruder is in the tunnel.

At each underground station there is an intrusion detection system that will be coupled to the platform end gates. Intruders entering the tunnel through the gate are immediately detected; sending an alarm to the ROC and are viewed through a CCTV system. Intrusions by stepping off the platform and into the trainway; however, would go undetected, as the detection device is only on the gate. Moreover, the platform detection system and the portal detection system are not integrated. Consequently, an intrusion from the portal would not automatically and immediately alert train operators already in the bores (the ROC Controller would have to notify these operators of the intrusion via radio communications). Conversely, trains entering the tunnel would not know of an intrusion from one of the stations unless notified by the Controller. Similarly, a train that has passed any one of the visual alerts would not know of an intrusion. For example, an eastbound train leaving the Boyle Heights Station would not know of an intrusion from the east portal. For safety and security reasons, it is vitally important that all trains be immediately informed of an intrusion. All of the detection systems should be fully integrated; sending visual alerts to all signs. Furthermore, an audible and visual alert should be annunciated locally to inform the intruder that they have been detected and they are to leave immediately.



Recommendation 32 – Detection System Integration

Integrate the platform and portal intrusion systems so that detection at any location will send an alert to all locations.

Recommendation 33 – Local Alarms

When an intruder is detected, a local visual and audible alarm should annunciate, informing the intruder that he has been detected and that he should leave the area immediately.

Recommendation 34 – Supplemental Alerts

Consider the installation of supplemental alert stations at locations between present detection points. The supplemental alerts would inform operators who have passed the current station and portal warning signs that an intrusion has occurred. One possible solution would be to install an amber light or strobe that would “wash” the bore when activated.

E. Rail Activation and Operations

Preparations are well underway for revenue service. A Rail Activation Plan has been developed and implemented as the roadmap to revenue service. Although many of the required activities are well underway, there are several issues that jeopardize revenue service. Although some of these issues may not be safety issues in themselves, they contribute to operator distraction and inattention to safe operations.

System Reliability

During the panel site visits, several system reliability issues were experienced. These issues must be resolved prior to the start of simulated revenue service. Although some of these issues may not be safety issues in themselves, they are operator distractions and contribute to operator inattention.

Radio Coverage

There is a serious void in radio coverage in the form of a “dead zone” from Atlantic Ave Interlocking to Maravilla Station. The radio is the primary means for reporting emergencies, car borne problems, and service issues.

Cab Signals

The loss of cab signals was experienced at several locations. It is not clear to the panel if the loss was rail car or wayside related. Operating staff reported cab signal loss was a reoccurring problem experienced on most trips.

Traction Electrification

During the tour of the tunnel, traction power was lost. Operating staff reported that the loss of power occurred on an intermittent basis.

Train Bar and “Train Coming” Warning System

During an evening site tour, it was noted that the train bar aspect cleared a train for the move through the intersection of 3rd and Arizona, and that the “Train Coming” icon was activated. However, no train was present. Driver expectancy is for a train to be approaching when the warning sign is activated. Improper warning system operation lead drivers to believe that the train warning system is not operating properly and encouraging drivers disobeying traffic signals.

SCADA

At this time, the SCADA system is not a reliability concern. The SCADA system; however, has not been completed and fully tested. The SCADA system is a critical component to monitoring and controlling safety critical systems, such as traction power gas detector indications, ventilation fan control systems, etc.

Operations

The operations department must have the opportunity to train operators, test run times, conduct normal and abnormal operations (single tracking, etc), and other functions well in advance of revenue service. This all must be done without interruptions caused by system reliability issues and construction schedules. A minimum of 4 weeks of simulated revenue service must be permitted.

Recommendation 35 – Simulated Revenue Service

Provide a minimum of 4 weeks of simulated revenue service.

As the new Eastside Extension is much different than the Pasadena Gold Line, schedule reliability may be an issue. There are numerous low speed curves and on-street operations that would impact schedule. Aside from the aforementioned distractions the ability to make the proposed schedule time of 23 minutes appears to be in question. If a 23 minute schedule must be maintained, the use of “drop back” trains may be necessary.

Recommendation 36 – Schedule Reliability

If it is determined that insufficient turn around time occurs at the end of the line, Metro should insert “drop back” trains, as necessary, to ensure schedule reliability. This may be necessary at both ends of the Gold Line.

Service Start-Up

At the time of the panel review, there was not a single individual responsible for ensuring that all of the required start-up activities – system testing, activation, construction, and operations activities were on-track and coordinated. It is essential that an individual be named as quickly as possible

Recommendation 37 – Start-Up Manager

As soon as possible, name a Start-Up Manager who would have the authority and responsibility to coordinate all functions to enable the start of revenue service.

F. Safety Education

A key aspect to any light rail transit safety program is a transit safety education and awareness program. These programs effectively reduce the number of mishaps by educating the public of the dangers of disobeying traffic signals and signs or acting inappropriately around rail tracks. The safety education and awareness program consists of a number of components. A unique program that has been implemented on the Eastside extension is the Ambassador program. Ambassadors actively promote safety awareness by interacting with the community at site-specific locations. The Ambassadors encourage safe behaviors through the distribution of safety materials, discussion with the community, and when necessary persuade correction of an observed unsafe behavior. The program is also used to identify potential safety and security operational issues at these locations prior to opening the Eastside Extension for revenue service. Other programs include:

- Public service announcements
- Written materials that are age appropriate
- School outreach program

- Mobile theater.
- Safety videos

The panel strongly endorses actively continuing the program throughout revenue operations. Additionally, consideration should be given to continuing the ambassador program for several weeks after opening day to identify safety issues. After the start of revenue service pedestrian and driver behaviors may change and require attention. The Ambassadors would be able to report those behaviors.

Recommendation 38 – Ambassador Program

Continue the Ambassador program for several weeks beyond the start of revenue service.

The panel considered the Metro safety outreach program to be outstanding and a model for the rail transit industry.

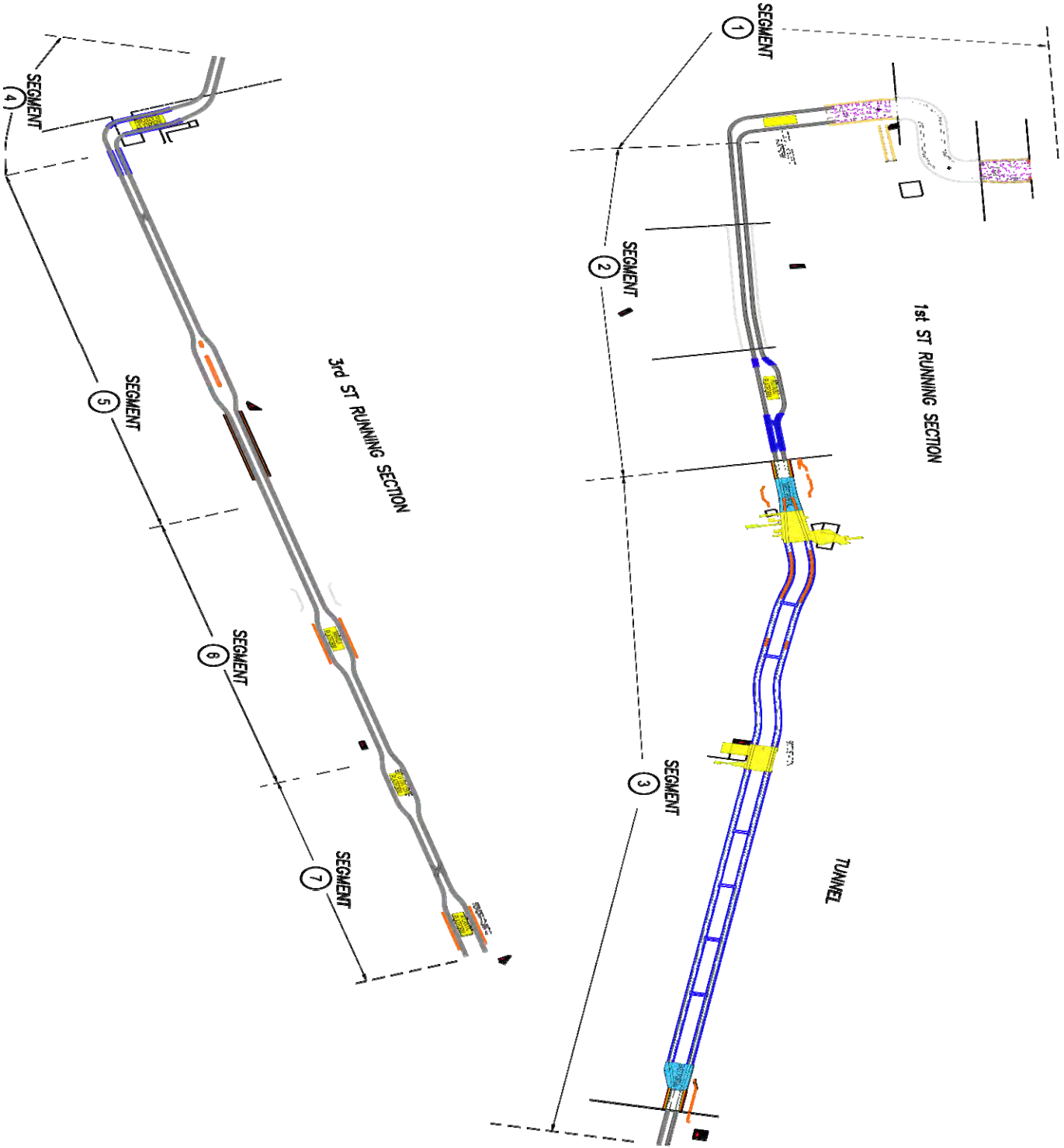
VI. CONCLUSION

In conclusion, the operational characteristics of Eastside Extension are not unlike many other light rail operating environments in the United States. It has been designed to be a safe, efficient, and effective extension of the Pasadena Gold Line. The at-grade crossings have incorporated design features to promote the safe movement of trains and motor vehicles through these intersections. However, there are a number of safety enhancements that should be evaluated and considered prior to the start of revenue service. Additionally, system reliability issues must be resolved prior to the start of pre-revenue operations, and Operations must have sufficient time, a minimum of 4 weeks, to fully test the operations plan. Lastly, a start-up manager with strong and demonstrated interpersonal skills must be named immediately to assure that all critical safety, security, construction, and operational issues are resolved prior to carrying passengers in revenue service.

The entire Review Panel appreciates the opportunity to review the Eastside Gold Line Extension Project and offer observations and recommendations. The panelists received extraordinary cooperation, assistance and access to Metro personnel. Without such assistance and cooperation, this review would not have been possible.

Appendix A

Eastside Extension Alignment



Appendix B

Documents

- California Public Utilities Grade Crossing Approvals
- California Public Utilities Letter – Eastside Extension Pre-Revenue Operations, May 22, 2009
- Eastside Extension Presentations
 - Construction
 - Fire/Life Safety
 - Motorist Safety Features
 - Operations
 - Pedestrian Safety Features
 - Safety and Security Certification
 - Systems
 - Transit Safety Education Programs, Safety Outreach & Education
- Gold Line Eastside Extension Project Fire/Life Safety Committee Minutes and Action Items
 - Meeting #47 – January 2009
 - Meeting #48 – February 2009
 - Meeting #49 – March 2009
 - Meeting #50 – April 2009
 - Meeting #51 – May 2009
- Gold Line Eastside Extension Project System Integration, Test & Acceptance Plan – Final, February 5, 2008
- Gold Line Eastside Extension Project Preliminary Hazard Analysis
- Gold Line Eastside Extension Project Safety and Security Certification Plan – Rev 4, March 24, 2008
- Gold Line Eastside Extension Project Safety/Security Certification Checklist Sign Off Log – June 9, 2009
- Gold Line Eastside Extension Review Advisory Committee
 - Letter to California Public Utility Commission – Pedestrian Gate Request, May 7, 2009
 - California Public Utility Commission Response to Pedestrian Gate Request, June 11, 2009
- Metro Gold Line Eastside Extension – Fact Sheet
- Metro Gold Line Eastside Extension – Safety Training Plan
- Metro Rail Safety Tips Brochure

- Metro Rail East Los Angeles Light Rail Transit Metro Gold Line Rail Activation Plan – Revision 24, June 5, 2009
- Pasadena Gold Line Train-Auto and Train-Pedestrian Accident History – 2003 to 2009
- Rail Division Capacity Assessment Report
- Vehicle Comparison – Siemens P2000 vs. Breda P2550 Light Rail Vehicles
- Report of the American Public Transportation Association Peer Review Panel on the Eastside Corridor LRT Alignment of the Los Angeles County Metropolitan Transportation Authority – May 2002

Appendix C

Recommendation Summary

Alignment Characteristics

Recommendation 1 – No Trespass Signs

Evaluate the size of, and the lettering on, the “No Trespass” signs for readability and effectiveness. The signs should be able to be read before entering the trainway.

Recommendation 2 – Sign Clutter

Evaluate the purpose and number of signs throughout the extension. The signs should be clear as to the desired action, easily read, non confusing by eliminating multiple signs that are clustered together. This will also enhance the esthetics of the line.

Recommendation 3 – Catenary Pole/Guy Wire Protection

Place bollards or other devices to protect the catenary poles and guy wires from being accidently struck and damaged by an errant motor vehicle.

Recommendation 4 – Trainway Delineation

At those locations where motor vehicles may mistakenly entry the trainway, as in Figure 2, place large raised buttons or rumble strips to tactilely indicate that the trainway is not a roadway. Additionally place reflective pavement markers along entry point to further highlight the area.

Recommendation 5 – Trainway Delineators

Consider using raised button and/or reflective pavement markers, in lieu of reflective paddles, to outline the trainway.

Pedestrian and Grade Crossings

Recommendation 6 – Mid-Block Fences

Continue the use of fencing, but target those areas where frequent jaywalking is observed.

Recommendation 7 – Jaywalking Enforcement

Target locations with high trespass/jaywalking violations for enforcement of the laws.

Recommendation 8 – Station Picket Fences

Picket fences immediately adjacent to station pedestrian crossings should be lowered to approximately 4 feet in height.

Recommendation 9 – Swing Gates

Evaluate the direction of the station swing gates to ensure that they properly orient a passenger toward the direction of an approaching train.

1st Street and Alameda Avenue

Recommendation 10 – Enforcement

Work closely with the Los Angeles Police Department and Los Angeles County Sheriff's Department to strongly enforce the "Stop Here" and "Keep Clear" requirements.

Recommendation 11 – Dynamic Envelope Delineation

Mark the dynamic envelope of the train through the curve. This may be accomplished with striping or other treatment.

Recommendation 12 – Stop Bar Enhancement

Enhance the stop bar to make it more evident where motor vehicles are to stop.

Recommendation 13 – "Keep Clear" Zone

Cross hatch the "Keep Clear" zone to make evident that motorists are not to enter the zone

1st Street and Indiana Avenue

Recommendation 14 – Enforcement

Continue to work closely with the Los Angeles County Sheriff's Department to aggressively enforce the "Stop Here" and "Keep Clear" requirements.

Recommendation 15 – Dynamic Envelope Delineation

Delineate the dynamic envelope of the train through the curve. This may be accomplished with striping.

Recommendation 16 – Stop Bar Enhancement

Enhance the stop bar to make it more evident where motor vehicles are to stop.

Recommendation 17 – Stop Bar Set-back

Evaluate the current stop bar locations to determine whether they should be set back further.

Recommendation 18 – "Keep Clear" Zone

Cross hatch the "Keep Clear" zone to make evident that motorists are not to enter the zone.

3rd Street and Indiana Avenue

Recommendation 19 – Enforcement

Work closely with the Los Angeles County Sheriff's Department to strongly enforce the "Stop Here" and "Keep Clear" requirements.

Recommendation 20 – Dynamic Envelope Delineation

Delineate the dynamic envelope of the train through the curve. This may be accomplished with striping.

Recommendation 21 – Stop Bar Enhancement

Enhance the stop bar to make it more evident where motor vehicles are to stop.

Recommendation 22 – “Keep Clear” Zone

Cross hatch the “Keep Clear” zone to make evident that motorists are not to enter the zone.

Recommendation 23 – Pedestrian Island

Consideration should be given to extending the picket fence on the island to discourage pedestrians from continuing straight across the light rail tracks. A sign stating that pedestrian are prohibited from crossing the tracks at this location should be placed on the fence, as well.

1st Street and Gless Avenue

Recommendation 24 – Reevaluate Signage

Reevaluate the signage on Gless Avenue, as many of the signs are no longer applicable.

Recommendation 25 – Picket Fence

Place tight woven fabric or mesh on the inside of the picket fence to prevent objects from being pushed through.

Recommendation 26 – Picket Fence Opening

Close the large opening on each side of the pipe span to prevent individuals from climbing onto the pipe.

Fire/Life Safety - Tunnel

Recommendation 27 – Emergency Management Panel

Test and confirm the functionality of the Emergency Management Panels

Recommendation 28 – Emergency Ventilation Control Software

Closely monitor and validate changes to the emergency ventilation control software

Recommendation 29 – Public Relations Tunnel Tours

Carefully evaluate conducting public relation tours through the tunnel until such time that the emergency ventilation system software has been validated and installed, and the gas detection system has been made fully operational and connected to the SCADA system.

Recommendation 30 – Tunnel “No Clearance” Sign

Change the background of the “No Clearance” sign so that the sign is more visible in the tunnel.

Security

Recommendation 31– Deputy Deployment

Evaluate current plans for deputy deployments. Consideration should be given to expanding police coverage by adding 6 or 8 additional personnel on trains, complemented by mobile units.

Recommendation 32 – Detection System Integration

Integrate the platform and portal intrusion systems so that detection at any location will send an alert to all locations.

Recommendation 33 – Local Alarms

When an intruder is detected, a local visual and audible alarm should announce, informing the intruder that he has been detected and that he should leave the area immediately.

Recommendation 34 – Supplemental Alerts

Consider the installation of supplemental alert stations at locations between present detection points. The supplemental alerts would inform operators who have passed the current station and portal warning signs that an intrusion has occurred. One possible solution would be to install an amber light or strobe that would “wash” the bore when activated.

Rail Activation and Operations

Recommendation 35 – Simulated Revenue Service

Provide a minimum of 4 weeks of simulated revenue service.

Recommendation 36 – Schedule Reliability

If it is determined that insufficient turn around time occurs at the end of the line, Metro should insert “drop back” trains, as necessary, to ensure schedule reliability. This may be necessary at both ends of the Gold Line.

Recommendation 37 – Start-Up Manager

As soon as possible, name a Start-Up Manager who would have the authority and responsibility to coordinate all functions to enable the start of revenue service.

Safety Education

Recommendation 38 – Ambassador Program

Continue the Ambassador program for several weeks beyond the start of revenue service.