Metro

Los Angeles County Metropolitan Transportation Authority
One Gateway Plaza
3rd Floor Board Room
Los Angeles, CA

Agenda - Final

Thursday, November 16, 2017

9:00 AM

One Gateway Plaza, Los Angeles, CA 90012,
3rd Floor, Metro Board Room

System Safety, Security and Operations Committee

John Fasana, Chair
Robert Garcia, Vice Chair
Paul Krekorian
Mark Ridley-Thomas
Hilda Solis
Carrie Bowen, non-voting member

Phillip A. Washington, Chief Executive Officer

METROPOLITAN TRANSPORTATION AUTHORITY BOARD RULES
(ALSO APPLIES TO BOARD COMMITTEES)

PUBLIC INPUT

A member of the public may address the Board on agenda items, before or during the Board or Committee's consideration of the item for one (1) minute per item, or at the discretion of the Chair. A request to address the Board should be submitted in person at the meeting to the Board Secretary. Individuals requesting to speak on more than three (3) agenda items will be allowed to speak up to a maximum of three (3) minutes per meeting. For individuals requiring translation service, time allowed will be doubled.

Notwithstanding the foregoing, and in accordance with the Brown Act, this agenda does not provide an opportunity for members of the public to address the Board on any Consent Calendar agenda item that has already been considered by a Committee, composed exclusively of members of the Board, at a public meeting wherein all interested members of the public were afforded the opportunity to address the Committee on the item, before or during the Committee's consideration of the item, and which has not been substantially changed since the Committee heard the item.

The public may also address the Board on non-agenda items within the subject matter jurisdiction of the Board during the public comment period, which will be held at the beginning and/or end of each meeting. Each person will be allowed to speak for up to three (3) minutes per meeting and may speak no more than once during the Public Comment period. Speakers will be called according to the order in which the speaker request forms are received. Elected officials, not their staff or deputies, may be called out of order and prior to the Board's consideration of the relevant item.

In accordance with State Law (Brown Act), all matters to be acted on by the MTA Board must be posted at least 72 hours prior to the Board meeting. In case of emergency, or when a subject matter arises subsequent to the posting of the agenda, upon making certain findings, the Board may act on an item that is not on the posted agenda.

CONDUCT IN THE BOARD ROOM - The following rules pertain to conduct at Metropolitan Transportation Authority meetings:

REMOVAL FROM THE BOARD ROOM The Chair shall order removed from the Board Room any person who commits the following acts with respect to any meeting of the MTA Board:

a. Disorderly behavior toward the Board or any member of the staff thereof, tending to interrupt the due and orderly course of said meeting.
b. A breach of the peace, boisterous conduct or violent disturbance, tending to interrupt the due and orderly course of said meeting.
c. Disobedience of any lawful order of the Chair, which shall include an order to be seated or to refrain from addressing the Board; and
d. Any other unlawful interference with the due and orderly course of said meeting.

INFORMATION RELATING TO AGENDAS AND ACTIONS OF THE BOARD

Agendas for the Regular MTA Board meetings are prepared by the Board Secretary and are available

DISCLOSURE OF CONTRIBUTIONS

The State Political Reform Act (Government Code Section 84308) requires that a party to a proceeding before an agency involving a license, permit, or other entitlement for use, including all contracts (other than competitively bid, labor, or personal employment contracts), shall disclose on the record of the proceeding any contributions in an amount of more than $250 made within the preceding 12 months by the party, or his or her agent, to any officer of the agency, additionally PUC Code Sec. 130051.20 requires that no member accept a contribution of over ten dollars ($10) in value or amount from a construction company, engineering firm, consultant, legal firm, or any company, vendor, or business entity that has contracted with the authority in the preceding four years. Persons required to make this disclosure shall do so by filling out a "Disclosure of Contribution" form which is available at the LACMTA Board and Committee Meetings. Failure to comply with this requirement may result in the assessment of civil or criminal penalties.

ADA REQUIREMENTS

Upon request, sign language interpretation, materials in alternative formats and other accommodations are available to the public for MTA-sponsored meetings and events. All requests for reasonable accommodations must be made at least three working days (72 hours) in advance of the scheduled meeting date. Please telephone (213) 922-4600 between 8 a.m. and 5 p.m., Monday through Friday. Our TDD line is (800) 252-9040.

LIMITED ENGLISH PROFICIENCY

A Spanish language interpreter is available at all Board Meetings. Interpreters for Committee meetings and all other languages must be requested 72 hours in advance of the meeting by calling (213) 922-4600 or (323) 466-3876.

323.466.3876 x2
Español
323.466.3876 x3

한국어	日本語
中文	русский
Հայերէն	ภาษาไทย
Tiếng Việt	ហាមមើម

HELPFUL PHONE NUMBERS

Copies of Agendas/Record of Board Action/Recordings of Meetings - (213) 922-4880 (Records Management Department)
General Information/Rules of the Board - (213) 922-4600
Internet Access to Agendas - www.metro.net
TDD line (800) 252-9040

NOTE: ACTION MAY BE TAKEN ON ANY ITEM IDENTIFIED ON THE AGENDA

CALL TO ORDER

ROLL CALL

APPROVE Consent Calendar Items: 20, 21, 22, 23, 24, and 25.

Consent Calendar items are approved by one motion unless held by a Director for discussion and/or separate action.

CONSENT CALENDAR

20. SUBJECT: METRO BLUE LINE SERVICE DISRUPTION MOTION RESPONSE 2017-0725

RECOMMENDATION

RECEIVE AND FILE report on Metro activity and communication protocols in response to a Metro Blue Line Service Disruption on September 13, 2017.

Attachments: Attachment A- Motion-2017-0675

21. SUBJECT: PURCHASE OF PRODUCTION RAIL TAMPER 2017-0629

RECOMMENDATION

CONSIDER:

A. FINDING the only responsive responsible bid for acquisition of a Production Rail Tamper under Public Utilities Code (PUC) section 130232 has been rejected due to the lack of competition and the equipment may be purchased at a lower price on the open market (PUC §130233); and

B. AUTHORIZING the Chief Executive Officer to award a firm fixed price Contract no. OP42642000 with Plasser American Corporation, on the open market pursuant to PUC §130233, for one Production Rail Tamper in the amount of $3,378,292, inclusive of sales tax.

(REQUIRES TWO-THIRDS VOTE OF THE FULL BOARD)

Attachments: Attachment A - Procurement Summary

Attachment B - DEOD Summary

22. SUBJECT: ELEVATOR AND ESCALATOR INSPECTION SERVICES 2017-0632

RECOMMENDATION

AUTHORIZE the Chief Executive Officer to award a firm fixed unit rate Contract No. OP884190003367 for elevator and escalator inspection services throughout Metro bus and rail facilities with Lerch Bates, Inc. for a

not-to-exceed amount of $853,746 for the three-year base period, $304,980 for option year one, and $343,925 for option year two, for a combined total of $1,502,651, effective January 1, 2018 through December 31, 2022, subject to resolution of protest(s), if any.

Attachments: Attachment A - Procurement Summary

Attachment B - DEOD Summary

23. SUBJECT: P2000 FRICTION BRAKE SYSTEMS & AIR COMPRESSOR COMPONENT OVERHAUL 2017-0703

RECOMMENDATION

CONSIDER:

A. AUTHORIZING the Chief Executive Officer to award a 48-month, indefinite delivery/indefinite quantity Contract No. MA27583000 for the component overhaul of P2000 Light Rail Vehicle (LRV) Friction Brake System & Air Compressor Overhaul to Wabtec Passenger Transit, for a total not-to-exceed amount of $3,328,499; and

B. AWARDING a single source procurement, pursuant to Public Utilities Code section 130237 for component overhaul services of the Metro Green Line (MGL) and Blue Line Friction Brake System & Air Compressor Overhaul from the Original Equipment Manufacturer (OEM), to Wabtec Passenger Transit.

(REQUIRES TWO-THIRDS VOTE OF THE FULL BOARD)

Attachments: Attachment A - Procurement Summary

Attachment B - DEOD Summary

Presentation

24. SUBJECT: P2550 LIGHT RAIL VEHICLE (LRV) MIDLIFE MODERNIZATION PROGRAM - CONSULTANT SUPPORT SERVICES FOR SPECIFICATION DEVELOPMENT & SOLICITATION OF CONTRACTOR 2017-0642

RECOMMENDATION

AWARD a firm fixed price Contract No. 45383000 for Consulting Support Services to STV Incorporated for the P2550 Light Rail Vehicle (LRV) Midlife Modernization Program, in the amount of $1,421,086.73, for 24 months from Notice to Proceed, subject to resolution of protest(s), if any.

Attachments: Attachment A - Funding Expenditure Plan P2550 LRV Midlife

Attachment B - Procurement Summary

Attachment C - DEOD Summary

Presentation

25. SUBJECT: P2550 & P2020 FRICTION BRAKE SYSTEM OVERHAUL 2017-0693

RECOMMENDATION

CONSIDER:

A. AUTHORIZING the Chief Executive Officer to award an 84 month, indefinite delivery/indefinite quantity Contract No. MA24464000 to Knorr Brake Company for component overhaul services of P2550 and P2020 Light Rail Vehicle (LRV) Friction Brake Systems, for a total not- to-exceed amount of $4,546,031; and

B. AWARDING a single source procurement, pursuant to Public Utilities Code section §130237 for component overhaul services of the Metro Gold Line (MGL) P2550 and Metro Blue Lines (MBL) P2020 LRV Friction Brake Systems from the Original Equipment Manufacturer (OEM), to Knorr Brake Company.

(REQUIRES TWO-THIRDS VOTE OF THE FULL BOARD)

Attachments: Attachment A - Procurement Summary
Attachment B - DEOD Summary
Presentation

NON-CONSENT

26. SUBJECT: OPERATIONS EMPLOYEE OF THE MONTH 2017-0499

RECOMMENDATION

Operations Employee of the Month.

Attachments: Presentation - Employee of the Month

27. SUBJECT: ORAL REPORT ON SYSTEM SAFETY, SECURITY AND OPERATIONS 2017-0500

RECOMMENDATION

RECEIVE oral report on Metro's NextGen Bus Study.

Attachments: Presentation - Service Disruption and NextGenBusStudy

28. SUBJECT: MONTHLY UPDATE ON TRANSIT POLICING PERFORMANCE 2017-0722

RECOMMENDATION

RECEIVE AND FILE monthly update on Transit Policing Performance.

Attachments: Attachment A - System-Wide Law Enforcement Overview September 2017

Attachment B - MTA Supporting Data_ Sep 2017

Attachment C - Key Performance Indicators September

29. SUBJECT: SYSTEMWIDE BUS NETWORK RESTRUCTURING PLAN 2017-0623

RECOMMENDATION

AUTHORIZE the Chief Executive Officer to award an 18-month, firm fixed price Task Order No. PS878320003041 under Countywide Planning Services Bench Contract No. PS4010-3041-F-XX with Cambridge Systematics, Inc., for an amount of $1,295,762, to develop a Systemwide Bus Network Restructuring Plan, subject to resolution of protest(s), if any.

Attachments: Attachment A - Procurement Summary
Attachment B - Task Order Log
Attachment C - DEOD Summary

(ALSO ON AD HOC CUSTOMER EXPERIENCE COMMITTEE)

30. SUBJECT: P2000 LIGHT RAIL VEHICLE (LRV) MIDLIFE MODERNIZATION PROGRAM 2017-0643

RECOMMENDATION

AUTHORIZE the Chief Executive Officer to:

A. EXERCISE system component Option #3 Communications - New Vestibule Information and Map Displays for the P2000 Light Rail Vehicle Midlife Modernization Program (Contract No. OPP2000) to Alstom Transportation Inc. in the firm fixed amount of $2,803,953, increasing the total Contract Value from $130,673,440 to $133,477,394;

B. EXERCISE system component Option #4 Communications - New Audio Communication System for the P2000 Light Rail Vehicle Midlife Modernization Program (Contract No. OPP2000) to Alstom Transportation Inc. in the firm fixed amount of $3,054,526, increasing the total Contract Value from $133,477,394 to $136,531,920;

C. AMEND and increase the FY18 Budget in Cost Center 3043 in the amount of $31,404,998 for mobilization costs and accelerated project milestones from $13,415,079 to $44,820,077; and

D. EXECUTE Contract Modifications under this Contract for up to $1,000,000 per Contract Modification.

Attachments: Attachment A - Funding Expenditure Plan 206044
Attachment B - Procurement Summary
Attachment C - DEOD Summary
Presentation

31. SUBJECT: OFFICE OF THE INSPECTOR GENERAL REPORT ON REVIEW OF METRO RAIL SERVICE DISRUPTIONS 2017-0606

RECOMMENDATION

RECEIVE AND FILE Report on Review of Metro Rail Service Disruptions.

Attachments: Attachment A - Final Rpt Review of Metro Rail Service Disruptions 10-24-17 revised v2

Attachment B - Mgmt Response to Report

Presentation - Service Disruption Review

(ALSO ON AD HOC CUSTOMER EXPERIENCE COMMITTEE)

Adjournment

GENERAL PUBLIC COMMENT

Consideration of items not on the posted agenda, including: items to be presented and (if requested) referred to staff; items to be placed on the agenda for action at a future meeting of the Committee or Board; and/or items requiring immediate action because of an emergency situation or where the need to take immediate action came to the attention of the Committee subsequent to the posting of the agenda.

File #: 2017-0725, **File Type:** Motion / Motion Response **Agenda Number:** 20.

REVISED
SYSTEM SAFETY, SECURITY AND OPERATIONS COMMITTEE
NOVEMBER 16, 2017

SUBJECT: METRO BLUE LINE SERVICE DISRUPTION MOTION RESPONSE

ACTION: RECEIVE AND FILE

RECOMMENDATION

RECEIVE AND FILE report on Metro activity and communication protocols in response to a Metro Blue Line Service Disruption on September 13, 2017.

ISSUE

In response to a major Blue Line service disruption caused by police activity on September 13, 2017, Directors Hahn, Dupont-Walker and Garcia introduced Motion #34 (attached) at the September Board meeting directing staff to assess the effectiveness of Metro's coordination with law enforcement, as well as Metro's ability to manage the resulting impacts on transit service of the Metro Blue Line service disruption that occurred on September 13, 2017. Specifically, the motion directed staff to: A) Report details related to Metro's response; B) Explain coordination between transit security and operations; C) Explain how bus bridges are implemented; D) Explain how Metro communicates with its customers during service disruptions; E) Explore strategies to reduce the duration of service disruptions caused by police activity.

DISCUSSION

At approximately 5:35 a.m. on September 13, 2017, the Los Angeles Police Department (LAPD) called Metro's Rail Operations Center (ROC) to request a rail stoppage at Washington Street. LAPD advised the ROC that an armed subject was barricaded on the second floor of a building near the Blue Line tracks. Due to the proximity of the barricaded man to the tracks, the ROC halted train service at LAPD's request.

Metro's Incident Response and Bus Bridge Implementation

Metro staff responded to the incident by activating existing plans to communicate with passengers, establish direct coordination with law enforcement, and maintain service by coordinating bus and rail

operations.

When a bus bridge is needed to transport passengers around an incident to the next accessible station as a result of trains unable to proceed through a segment, a number of actions must take place to fully implement. Planned bus bridges for maintenance are scheduled and coordinated in advance to provide ample time for support departments to assemble and for customers to be notified. However, unplanned bus bridges as a result of emergencies require many departments to divert their attention away from normal duties. During rush hour periods, implementing a bus bridge can often take over one hour to organize. This is due to nearly every bus and operator being utilized for their normal assignments, heavy traffic to reach the incident location, and street closures associated with a major incident preventing buses from quickly reaching customers.

Bus capacity is also significantly smaller than rail capacity, so customers must often wait for several buses to pass through until they are able to board. Furthermore, if an in-service bus is redirected to a bus bridge assignment, there is likelihood that bus passengers waiting for the redirected bus are affected with a trip cancellation. Bus operations makes every effort to minimize those impacts by prioritizing their request to buses returning to bus divisions or from frequent services where the next bus is scheduled just a few minutes later.

Following LAPD's call to the ROC at 5:35 a.m., the ROC contacted the Bus Operations Center (BOC) at 5:39 a.m. to establish a bus bridge. During this incident, passengers were transported between Washington Station, Grand /LATTC Station and 7th & Metro via bus. Rail Operations and Metro Security personnel were deployed to the affected stations to assist with customer service and crowd control.

Although bus bridges were established per protocol, pick up locations adjacent to Washington Station were affected by adjustments to the LAPD crime scene perimeter. In a few cases pickup locations were changed with little notice - adversely affecting passengers and creating confusion because of LAPD & LADOT expanding the perimeter of the street closures.

Based on scheduled service between 6am-1pm, a total of 100 trips were affected for both directions

Metro's Public Information Protocol

The Metro social media team strives to issue a service alert quickly after an incident, within five minutes in most cases, but no more than 15 minutes after a major disruption to service occurs - on the condition that we have solid and reliable information to distribute. Thereafter, we update at least once an hour during peak service hours and at least once every two hours during off-peak times until regular service resumes. More frequent alerts are provided when operations plans change or when additional service information becomes available. During an unplanned police emergency, Rail Operations and Metro Security personnel are deployed to affected stations and act as customer service staff due to the fluidity of police related activity because it can end as quickly as it starts.

When the September 13 incident occurred, at 5:48 a.m., Metro issued a preliminary service advisory via social media, followed by a series of detailed service advisories beginning at 6:05 a.m. Metro updated passengers via the web, social media, rail operators, customer service staff, and through our public address system located throughout the Blue Line platforms. Updates were provided from the

initial service notification at 5:48 a.m. until rail service was restored at approximately 12:45 p.m. Specifically, Metro informed passengers that alternative bus service would transport passengers between Washington Station, San Pedro Station, Grand LATTC Station, and 7th & Metro.

Reducing Service Delays: Coordination between Transit Security, Operations and Law Enforcement

Service disruptions caused by police activity are dynamic, complex and occasionally significant. While Metro's goal is to minimize such delays whenever possible, ensuring the safety and security of passengers and employees is the highest priority. Additionally, Metro must defer to law enforcement during active criminal investigations, even when this incident's relationship between the armed, barricaded subject and transit service is indirect.

Coordination between Metro and the LAPD met established protocols. LAPD's Transit Bureau Chief and Metro's System Security Chief communicated via phone; Metro's Senior Executive Rail Officer responded to LAPD's Command Post to coordinate transit service; supervisors and staff from operations and transit security responded to the field to assist passengers by directing them to the bus bridges. Coordination between Metro and LAPD continued until the incident was resolved at 12:45 p.m.

Metro will continue to coordinate closely with law enforcement to reduce service delays caused by police activity. As each incident is unique, immediate and direct communication between Metro and law enforcement is critical to minimize adverse impacts on service. Whenever possible, Metro will continue to deploy senior executive staff to police command posts to serve as a liaison.

ATTACHMENTS

Attachment A - Motion-2017-0675

Prepared by: Susan M. Walker, Director, Physical Security, (213) 922-7464

Reviewed by: Alex Z Wiggins, Chief, System Security and Law Enforcement, (213) 922-4433
James T. Gallagher, Chief Operations Officer, (213) 418-3108
Pauletta Tonilas, Chief Communication Officer, (213) 922-3777

Phillip A. Washington
Chief Executive Officer

Los Angeles County
Metropolitan Transportation
Authority
One Gateway Plaza
3rd Floor Board Room
Los Angeles, CA

Metro

Board Report

File #:2017-0675, **File Type:**Motion / Motion Response

Agenda Number:

REGULAR BOARD MEETING
SEPTEMBER 28, 2017

Motion by:

Hahn, Dupont-Walker and Garcia

Related to Item 34 (2017-0510): Metro Blue Line Pedestrian Safety Enhancements At Grade Crossings

On Wednesday, September 13th, Los Angeles Police responded to the 200 block of East Washington Boulevard at 3 a.m. on report of a suspect who had stabbed a man with a sword. During the nine-hour standoff, LAPD SWAT was called out and streets were closed around Washington Boulevard and Santee Street. Moreover, Metro Blue Line service was stopped between the Grand-Los Angeles Trade-Technical College and the San Pedro Street stations.

Metro first alerted service riders at 5:28 a.m., with numerous electronic communications sent periodically until service was restored at 1 p.m. During the service interruptions, Metro provided a “bus bridge” to connect passengers who found themselves stranded between stops during the ongoing police activity.

However, many service riders reported lack of awareness on the Blue Line closures, confusion about their alternative route options - particularly for bus bridges, and were severely inconvenienced over the service delays.

We believe there can be lessons learned from this incident as it relates to Metro’s emergency response efforts as well as the coordination between law enforcement agencies and Metro riders in order to minimize any negative impacts experienced during often unpredictable police activity.

WE, THEREFORE, MOVE, that Metro Staff conduct an assessment, including:

A. Details on Metro’s response to the September 13th incident described above
B. Metro’s coordination between their Transit Safety and their Operations for both rail and bus,
C. The existing Bus Bridge protocol as it relates to unanticipated line closures,
D. Metro’s public information distribution protocols,
E. Ways to reduce the duration of service interruption time, consistent with Metro Transit Safety guidelines.

We request Metro Staff to report back on the above items by the October Board cycle.

Los Angeles County
Metropolitan Transportation
Authority
One Gateway Plaza
3rd Floor Board Room
Los Angeles, CA

File #: 2017-0629, **File Type:** Contract **Agenda Number:** 21.

**SYSTEM SAFETY, SECURITY AND OPERATIONS COMMITTEE
NOVEMBER 16, 2017**

SUBJECT: PURCHASE OF PRODUCTION RAIL TAMPER

ACTION: APPROVE CONTRACT AWARD

RECOMMENDATION

CONSIDER:

A. FINDING the only responsive responsible bid for acquisition of a Production Rail Tamper under Public Utilities Code (PUC) section 130232 has been rejected due to the lack of competition and the equipment may be purchased at a lower price on the open market (PUC §130233); and

B. AUTHORIZING the Chief Executive Officer to award a firm fixed price Contract no. OP42642000 with Plasser American Corporation, on the open market pursuant to PUC §130233, for one Production Rail Tamper in the amount of $3,378,292, inclusive of sales tax.

(REQUIRES TWO-THIRDS VOTE OF THE FULL BOARD)

ISSUE

This procurement is for the replacement of a Metro owned and operated rail tamping machine. A rail tamping machine is used to "tamp" stone ballast underneath and around rail track for proper track leveling and support. This equipment is required to support the track maintenance of light and heavy rail track throughout the Metro system. The current machine has been in operation since 1995. In the last several years it has experienced reduced reliability and has now surpassed its useful life and requires replacement.

Staff recommends awarding the rail tamper machine contract through a negotiated process rather than a bid. Although a formal solicitation was attempted, only one bidder made an offer and that bid price was not deemed fair and reasonable. However, through cost analysis and negotiation Metro was able to obtain a significant price reduction from the bid price. Through market survey staff found no evidence that a re-solicitation would result in a better outcome.

DISCUSSION

The new machine is a heavy duty, high performance switch and production tamping machine. It is a multifunctional machine with fully automatic track lifting, lining, and cross leveling capabilities. It is specially designed for high density transit commuter lines with tight radius curves. The production rail tamper is designed to properly align the track and has the capability of lifting the rails to ensure that the ballast beneath the ties is level and compacted for maximum support.

The purchase of the production rail tamper will provide the Metro Track Maintenance Department with the necessary equipment for the consistent, timely and effective maintenance of Metro light and heavy rail track systems for the next 15-20+ years. In addition, Plasser American Corporation will provide training to the Metro employees in order to operate the machine as well as perform preventive maintenance, troubleshooting, inspections and repairs.

DETERMINATION OF SAFETY IMPACT

The purchase of the new equipment will provide Metro with an advanced state-of-the-art system that includes an acoustically insulated, climate controlled and air pressurized cabin to reduce noise and eliminate particulates, thus maximizing operator safety. Finally, the new equipment will facilitate the timely maintenance of rail track to ensure the safe and quiet operation on Metro light and heavy rail trains.

FINANCIAL IMPACT

The recommendation for award is $3,378,292. The funding is included in Cost Center 3790 Maintenance Administration; Project 208082 and 208091 Rail Equipment; Account 53106, Acquisition of Service Vehicle. The delivery of the equipment is scheduled for up to 16 months after the date of award.

Impact to Budget

The source of funds for this procurement will come from Federal, State and local funding sources including sales tax and fares that are eligible for Rail Operating or Capital Projects. They will maximize fund use given funding allocation provisions.

ALTERNATIVES CONSIDERED

Staff considered leasing equipment and/or contracting out tamping services, but it was found cost prohibitive and therefore not recommended. Production tamping is an in-house task currently performed by ATU contract personnel. Contracting out this service would conflict with the Metro/ATU Collective Bargaining Agreement.

The alternative of retaining the existing rail tamper for primary track tamping is not recommended. Diminished reliability, high maintenance costs, unavailability of spare parts and frequent repairs over the past several years has rendered the use of the existing tamping machine a poor alternative for

continued operation.

Not purchasing the recommended rail production tamper will significantly reduce the ability of the Metro Track Maintenance Department to effectively maintain the Metro light and heavy rail track systems. Further, the expanding maintenance requirements of the Metro track system and the expansion of Metro light rail track requires Metro to purchase a new, reliable and effective piece of equipment to ensure cost-effective, timely maintenance of the Metro system for the next 20 years.

NEXT STEPS

Following the authorization and execution of the Contract, the vendor will begin the manufacturing process and provide Metro with a production schedule to identify milestones consistent with the scheduled delivery of the equipment 16 months after the award of the Contract.

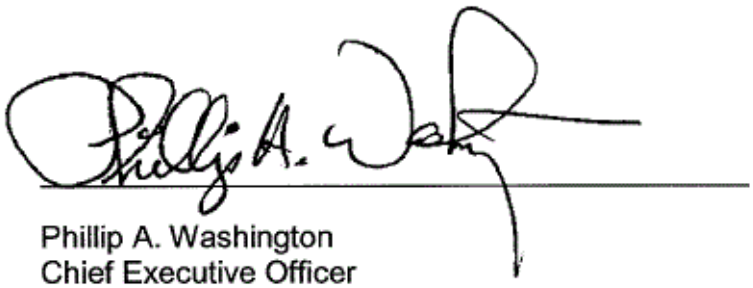
ATTACHMENTS

Attachment A - Procurement Summary
Attachment B - DEOD Summary

Prepared by: Daniel Ramirez, Sr. Director, Non-Revenue Fleet Maintenance, (213) 922-9233

Remi Omotayo, DEO, Wayside Systems Engineering & Maintenance, (213) 922-3243

Reviewed by: James T. Gallagher, Chief Operations Officer, (213) 418-3108
Debra Avila, Chief Vendor/Contract Management Officer, (213) 418-3051



Phillip A. Washington
Chief Executive Officer

PROCUREMENT SUMMARY

PURCHASE OF PRODUCTION RAIL TAMPER / OP42642000

1.	**Contract Number**: OP42642000	
2.	**Recommended Vendor**: Plasser American Corporation	
3.	**Type of Procurement (check one):** ☒ **IFB** ☐ **RFP** ☐ **RFP–A&E** ☐ **Non-Competitive** ☐ **Modification** ☐ **Task Order**	
4.	**Procurement Dates**:	
	A. Issued: 07/07/2017	
	B. Advertised/Publicized: 07/07/2017	
	C. Pre-Bid Conference: 07/13/2017	
	D. Bids Due: 09/07/2017	
	E. Pre-Qualification Completed: 09/13/2017	
	F. Conflict of Interest Form Submitted to Ethics: 09/11/2017	
	G. Protest Period End Date: 11/17/2017	
5.	**Solicitations Picked up/Downloaded**: 7	**Bids Received**: 1
6.	**Contract Administrator**: Aryani L. Guzman	**Telephone Number**: 213-922-1387
7.	**Project Manager**: Dan Ramirez	**Telephone Number**: 562-658-0231

A. Procurement Background

This Board Action is to approve Contract No. OP42642000 issued in support of the light and heavy track maintenance throughout the Metro's rail system.

Invitation for Bid (IFB) No. OP42642 was issued in accordance with Metro's Acquisition Policy and the contract type is a firm fixed price.

Two amendments were issued during the solicitation phase of this IFB:

- Amendment No. 1, issued on August 1, 2017, revised bid due date;
- Amendment No. 2, issued on August 4, 2017, new requirements were issued.

One bid was received on September 7, 2017.

B. Evaluation of Bids

Metro received one bid from Plasser American Corporation (Plasser American).

As a result of receiving a single bid, in accordance with Metro's Acquisition Policy and Public Utility Code §130233, the solicitation was canceled and staff entered into negotiations for a non-competitive contract with Plasser American. Accordingly, staff was required to obtain cost data from Plasser American to conduct a formal cost analysis. In addition to the cost analysis being performed, Metro's project management and technical staff members conducted a technical evaluation of the proposed direct labor hours, labor categories, and on the bill of material associated

with the rail tamper equipment. These elements were found to be technically acceptable, as well as Plasser American being found to be overall technically acceptable.

Metro conducted a market survey to determine the reasons for only receiving one bid. One potential bidder indicated it did not manufacture the rail tamper equipment but wanted to offer a re-built rail tamper which Metro's Technical Specification prohibited. Another potential bidder requested material changes to Metro's technical specifications which were not acceptable. There was adequate time to respond with a formal price bid with additional time authorized via a formal Amendment to the IFB. None of the firms interviewed expressed any concerns regarding restrictions in Metro's specification requirements.

Plasser American was determined to be responsive, responsible and was deemed qualified to perform the scope of work based on the solicitation requirements.

C. Cost Analysis

Metro staff conducted a cost analysis of the bidder's proposal and, accordingly, reviewed various elements of cost (i.e. direct labor rates, overhead rates, material costs, and other direct costs). Based on our cost analysis, technical analysis, clarifications, and negotiations with Plasser American, the final agreed to Firm Fixed Price (FFP) is considered fair and reasonable. The recommended FFP reflects a 16.7% savings for the original bid price and is 8% lower than Metro's Independent Cost Estimate.

Bidder Name	Original Bid Amount	Final FFP	Metro ICE
Plasser American Corporation	$3,908,484	$3,378,292	$3,620,000

D. Background on Recommended Contractor

The recommended firm, Plasser American Corporation, located in Chesapeake, Virginia, has been in business for 60 years, and is a leader in the production tamping and switch machines used throughout the United States, Turkey and Pakistan. Plasser American has provided rail tampers to San Francisco Bay Area Rapid Transit (BART), Washington Metropolitan Area Transit Authority, Long Island Rail Road, and the Massachusetts Bay Transportation Authority.

DEOD SUMMARY

PURCHASE OF PRODUCTION RAIL TAMPER / OP42642

A. Small Business Participation

The Diversity and Economic Opportunity Department (DEOD) did not recommend a Small Business Enterprise/Disabled Veteran Business Enterprise (SBE/DVBE) goal for this solicitation due to the lack of subcontracting opportunities. This procurement involves the Original Equipment Manufacturer (OEM) purchase of a customized production rail tamper that is shipped directly to Metro.

B. Living Wage and Service Contract Worker Retention Policy Applicability

The Living Wage and Service Contract Worker Retention Policy is not applicable to this Contract.

C. Prevailing Wage Applicability

Prevailing wages are not applicable to this Contract.

D. Project Labor Agreement/Construction Careers Policy

Project Labor Agreement/Construction Careers Policy is not applicable to this Contract.

Los Angeles County
Metropolitan Transportation
Authority
One Gateway Plaza
3rd Floor Board Room
Los Angeles, CA

File #: 2017-0632, **File Type:** Contract **Agenda Number:** 22.

**SYSTEM SAFETY, SECURITY AND OPERATIONS COMMITTEE
NOVEMBER 16, 2017**

SUBJECT: ELEVATOR AND ESCALATOR INSPECTION SERVICES

ACTION: APPROVE CONTRACT AWARD

RECOMMENDATION

AUTHORIZE the Chief Executive Officer to award a firm fixed unit rate Contract No. OP884190003367 for elevator and escalator inspection services throughout Metro bus and rail facilities with Lerch Bates, Inc. for a not-to-exceed amount of $853,746 for the three-year base period, $304,980 for option year one, and $343,925 for option year two, for a combined total of $1,502,651, effective January 1, 2018 through December 31, 2022, subject to resolution of protest(s), if any.

ISSUE

The existing contract to provide elevator and escalator inspection services is due to expire on December 31, 2017. To continue providing the critical inspection services for Metro's elevators and escalators system-wide, a new contract award is required effective January 1, 2018.

DISCUSSION

Under the new Contract, the consultant will continue to conduct annual equipment audits and periodic inspections on each of the 148 escalators and 199 elevators throughout Metro's transit system, including all bus and rail stations, locations, terminals, the Union Station East Portal and the Gateway Building.

Performing annual equipment audits and generating critical reports by certified and highly trained professionals within the vertical transportation industry are necessary to verify that equipment operation and condition conform to the latest codes, regulations and standards governing vertical transportation equipment, ensure equipment safe operations, closely monitor the maintenance contractor's performance, and recommend repairs in a timely manner, minimize downtime and maintain equipment reliability and service availability.

The consultant is also required to provide inspection and acceptance of newly installed equipment ensuring compliance with project specifications and code requirements, as well as perform as-needed services reviewing and preparing specifications for equipment additions, upgrades, modifications and related construction support services.

DETERMINATION OF SAFETY IMPACT

The approval of this item will ensure meeting Metro maintenance standards providing the necessary technical expertise to ensure elevators and escalators safe operations and reliability.

FINANCIAL IMPACT

Funding of $142,291 is included in the FY18 budget in cost center 8370 - Elevators/Escalators, account 50316, Professional and Technical Services, under various operating projects.

Since this is a multi-year contract, the cost center manager and the Sr. Executive Officer, Maintenance and Engineering will be accountable for budgeting the cost in future years.

Impact to Budget

The source of funds for this action will come from Federal, State, and local funding sources including sales tax and fares that are eligible for Bus and Rail Operating Projects. They will maximize fund use given funding allocation provisions.

ALTERNATIVES CONSIDERED

Staff considered providing this service through in-house staff; however, this would require the hiring, training and certification of additional personnel, purchase of additional equipment, vehicles, and supplies to support the expanded responsibility. Staff's assessment indicates that this is not a cost-effective option for Metro.

NEXT STEPS

Upon Board approval, staff will execute Contract No. OP884190003367 to Lerch Bates, Inc., effective January 1, 2018, to provide the necessary elevator and escalator inspection services throughout Metro bus and rail facilities.

ATTACHMENTS

Attachment A - Procurement Summary
Attachment B - DEOD Summary

Prepared by: Brady Branstetter, DEO, Facilities Maintenance, (213) 922-6767
Lena Babayan, Sr. Director, Facilities Maintenance, (213) 922-6765

Reviewed by: James T. Gallagher, Chief Operations Officer, (213) 922-4424
Debra Avila, Chief Vendor/Contract Management Officer, (213) 418-3051

Phillip A. Washington
Chief Executive Officer

ATTACHMENT A

PROCUREMENT SUMMARY

ELEVATOR AND ESCALATOR CONSULTING SERVICES / OP884190003367

1.	**Contract Number:** OP884190003367	
2.	**Recommended Vendor**: Lerch Bates, Inc.	
3.	**Type of Procurement (check one):** ☐ **IFB** ☒ **RFP** ☐ **RFP–A&E** ☐ **Non-Competitive** ☐ **Modification** ☐ **Task Order**	
4.	**Procurement Dates**:	
	A. Issued: July 6, 2017	
	B. Advertised/Publicized: July 7, 2017	
	C. Pre-proposal/Pre-Bid Conference: July 19, 2017	
	D. Proposals/Bids Due: August 7, 2017	
	E. Pre-Qualification Completed: September 26, 2017	
	F. Conflict of Interest Form Submitted to Ethics: October 3, 2017	
	G. Protest Period End Date: November 20, 2017	
5.	**Solicitations Picked up/Downloaded**: 9	**Bids/Proposals Received**: 3
6.	**Contract Administrator**: Rommel Hilario	**Telephone Number**: (213) 922-4654
7.	**Project Manager**: Ronald White	**Telephone Number**: (213) 922-6737

A. Procurement Background

This Board Action is to approve a contract award to provide regular and as-needed consulting services in support of Metro's existing elevator/escalator maintenance contract as outlined in Request for Proposal (RFP) No. OP42511. Metro provides testing, inspections, routine maintenance, repair and improvement services through contracted services for 199 elevators and 148 escalators system wide. Board approval of contract awards are subject to resolution of any properly submitted protest.

The RFP was issued as a competitive negotiated procurement in accordance with Metro's Acquisition Policy. The contract type is firm fixed unit rate.

One amendment was issued during the solicitation phase of this RFP:

- Amendment No. 1, issued on July 20, 2017, provided pre-proposal documents including agenda, sign-in sheets, and planholder's list.

A pre-proposal conference was held on July 19, 2017. A total of three participants representing three firms were in attendance.

On August 7, 2017, Metro received three proposals as follows, in alphabetical order:

1. HKA Consulting Services, Inc.
2. Lerch Bates, Inc.
3. National Elevator Inspection Services

B. Evaluation of Proposals

The Proposal Evaluation Team (PET), consisting of staff from the Facility Maintenance and General Services departments reviewed proposals based on the technical criteria consistent with the qualifications, experience, and resources necessary to meet the requirements of the RFP. Each proposal addressed the firm's degree of skills, personnel experience, understanding of the work, and cost/price to perform the work.

Proposals were evaluated in accordance with the criteria and weights established in the RFP and in compliance with Metro's Acquisition Policy.

- Degree of the Consultants Team's Skills and Experience 20%
- Effectiveness of Management Plan 25%
- Understanding of Work and Appropriateness of Approach for Implementation 15%
- Cost Proposal 40%

Several factors were considered in developing these weights, giving greatest importance to the cost proposal.

To clarify the requirements of the Statement of Work, Best and Final Offers (BAFO) were requested from each proposer and were subsequently evaluated by the PET.

The following is a summary of the PET's evalation scores:

1	FIRM	Average Score	Factor Weight	Weighted Average Score	Rank
2	**Lerch Bates, Inc.**				
3	Degree of the Consultants Team's Skills & Experience	86.5	20%	17.3	
4	Effectiveness of Management Plan	80.0	25%	20.0	
5	Understanding of Work and Appropriateness of Approach for Implementation	74.7	15%	11.2	

6	Cost Proposal	89.0	40%	35.6	
7	**Total**		**100.00%**	**84.1**	**1**
8	**National Elevator Inspection Services**				
9	Degree of the Consultants Team's Skills & Experience	65.5	20%	13.1	
10	Effectiveness of Management Plan	62.4	25%	15.6	
11	Understanding of Work and Appropriateness of Approach for Implementation	48.7	15%	7.3	
12	Cost Proposal	100.0	40%	40.0	
13	**Total**		**100.00%**	**76.0**	**2**
14	**HKA Consulting Services, Inc.**				
15	Degree of the Consultants Team's Skills & Experience	65.5	20%	13.1	
16	Effectiveness of Management Plan	51.2	25%	12.8	
17	Understanding of Work and Appropriateness of Approach for Implementation	53.3	15%	8.0	
18	Cost Proposal	56	40%	22.4	
19	**Total**			**56.3**	**3**

C. Cost/Price Analysis

The recommended price has been determined to be fair and reasonable based upon adequate competition, price analysis, independent cost estimate, fact finding, and technical evaluation.

PROPOSER	AMOUNT	METRO ICE	AWARD AMOUNT
Lerch Bates, Inc. (incumbent)	$1,502,651.00	$1,558,276.29	$1,502,651.00
National Elevator Inspection Services	$1,330,619.00		
HKA Consulting, Inc.	$2,393,075.69		

D. Background on Recommended Contractor

In 1947, Lerch Bates, Inc. became the first independent elevator consulting firm in the US. Since then, they have added offices and capabilities around the world, bringing industry expertise and technology together to work with clients. In 1986, Lerch Bates became an employee owned consulting firm.

Lerch Bates' experience in public transportation consulting covers some of the largest systems in North America and includes Washington Metropolitan Area Transit, Bay Area Rapid Transit, Massachusetts Bay Transportation Authority, Seattle Sound Transit, and New York City Transit. In addition to their public transportation consulting, Lerch Bates also provides vertical transportation consulting on some of the largest buildings around the world, such as the Burj Khalifa, Taipei 1010, Shanghai World Financial Center, Petronas Towers 1 and 2, the Empire State Building, and the Willis Tower. Lerch Bates also currently provides vertical transportation consulting for Metro and has performed satisfactorily.

DEOD SUMMARY

ELEVATOR AND ESCALATOR CONSULTING SERVICES / OP884190003367

A. Small Business Participation

The Diversity and Economic Opportunity Department (DEOD) did not establish a Small Business Enterprise/Disabled Veteran Business Enterprise (SBE/DVBE) goal for this procurement for highly specialized elevator/escalator inspection services due to the lack of certified firms available to perform the work. Lerch Bates, Inc. did not make an SBE commitment.

B. Living Wage and Service Contract Worker Retention Policy Applicability

The Living Wage and Service Contract Worker Retention Policy (LW/SCWRP) is not applicable to this Contract.

C. Prevailing Wage Applicability

Prevailing wage is not applicable to this Contract.

D. Project Labor Agreement/Construction Careers Policy

Project Labor Agreement/Construction Careers Policy is not applicable to this Contract.

Los Angeles County
Metropolitan Transportation
Authority
One Gateway Plaza
3rd Floor Board Room
Los Angeles, CA

Metro

Board Report

File #: 2017-0703, **File Type:** Contract **Agenda Number:** 23.

SYSTEM SAFETY, SECURITY AND OPERATIONS COMMITTEE
NOVEMBER 16, 2017

SUBJECT: P2000 FRICTION BRAKE SYSTEMS & AIR COMPRESSOR COMPONENT OVERHAUL

ACTION: APPROVE CONTRACT AWARD

RECOMMENDATION

CONSIDER:

A. AUTHORIZING the Chief Executive Officer to award a 48-month, indefinite delivery/indefinite quantity Contract No. MA27583000 for the component overhaul of P2000 Light Rail Vehicle (LRV) Friction Brake System & Air Compressor Overhaul to Wabtec Passenger Transit, for a total not-to-exceed amount of $3,328,499; and

B. AWARDING a single source procurement, pursuant to Public Utilities Code section 130237 for component overhaul services of the Metro Green Line (MGL) and Blue Line Friction Brake System & Air Compressor Overhaul from the Original Equipment Manufacturer (OEM), to Wabtec Passenger Transit.

(REQUIRES TWO-THIRDS VOTE OF THE FULL BOARD)

ISSUE

The P2000 LRV fleet is due for Friction Brake Systems and Air Compressor Overhaul as recommended by the Original Equipment Manufacturer (OEM) established guidelines. This procurement is for the professional services to complete a component overhaul of 52 assemblies inclusive of two spares. The existing friction brake system and air compressor equipment is proprietary. The purchase is for the sole purpose of purchasing overhaul services of existing equipment already in use. Execution of this component overhaul will safeguard passenger safety and maintaining equipment performance in a continuous State of Good Repair (SGR).

DISCUSSION

The P2000 fleet currently operates on Metro's Green, Blue and Expo Lines. The Siemens P2000 LRV is in its 16th year of operation. In order to ensure continued safety and performance of the safety critical friction brake and air compressor systems, a complete systems overhaul is required at the

four year service interval as defined by the OEM and monitored by the CPUC. The overhaul consists of disassembly, thorough cleaning and inspection, and repair of various components including electrical, pneumatic and mechanical component parts that wear out under normal service and operating conditions. Routine maintenance and periodic overhaul of these systems is of critical importance for passenger safety and accident prevention to ensure the vehicle stops within specified stopping distance during routine and emergency brake applications. Rail Fleet Services (RFS) Engineering developed an equipment overhaul specification for the friction brake and air condition systems overhaul based upon OEM recommendations and in conjunction with RFS maintenance experience. The contractor will perform overhaul services in accordance with predefined schedule using Metro provided technical specification requirements.

The P2000 Component Overhaul Program consists of nine major vehicle systems to be overhauled, including friction brake, air compressor, air hose replacement, power axle, non-power axel bearing replacement, car battery replacement, couplers, exterior and interior paint. The friction brake and air compressor overhaul is due for the new cycle requiring board approval. Currently, two of the systems (air hose replacement and non-power axel bearing replacement) have been completed and five of the systems are on-going.

DETERMINATION OF SAFETY IMPACT

Passenger and employee safety are of the utmost importance to Metro and, therefore, it is imperative to maintain the P2000 fleet to maintain a state of good repair. The friction brake systems overhaul is in support of routine maintenance and an established component overhaul program. This effort will ensure that the fleet is maintained in accordance with OEM recommendations, regulatory standards, and within Metro's internal Corporate Safety policies and procedures.

FINANCIAL IMPACT

The approved Life-of-Project (LOP) for the P2000 Fleet Component Overhaul Program under capital project number 206006 is for the amount of $26,360,100 established in 2012. Funding of $1,299,996 for this Contract is included in the FY18 budget in cost center 3941 and cost center 3943, Rail Fleet Services Maintenance, under project number 206006, line item 50441, Parts - Revenue Service.

Since this is a multi-year Contract, the cost center manager, project manager, and Sr. Executive Officer, RFS will ensure that the balance of funds is budgeted in future fiscal years.

Impact to Budget

The source of funds for this procurement will come from Federal, State and local funding sources that are eligible for Rail Capital Projects. This will maximize fund use given funding allocation provisions.

ALTERNATIVES CONSIDERED

The vehicle's friction brakes are a safety critical system which are required to be overhauled per the

OEM and regulatory requirements in order to prevent catastrophic events resulting from extending stopping distance of complete failure of the braking systems during emergency brake application. Deferring the friction brake and air compressor overhaul is not recommended as Metro could also be subject to penalties mandated by the California Public Utilities Commission.

NEXT STEPS

Overhaul of the P2000 Light Rail Vehicle Friction Brake & Air Compressor systems will continue in accordance with RFS scheduled requirements. If approved, the project is scheduled to commence in July 2018.

ATTACHMENTS

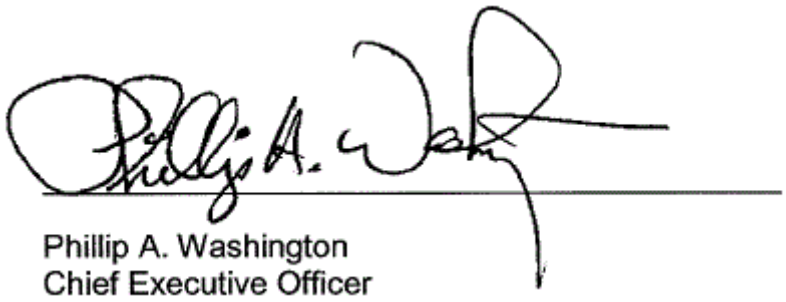
Attachment A - Procurement Summary
Attachment B - DEOD Summary

Prepared by:

Bob, Spadafora, Sr. Executive Officer, Rail Fleet Services, (213) 922-3144
Richard M. Lozano, Sr. Director, Rail Fleet Services, (310) 816-6944
Brian McNeely, Director Rail Fleet Services, (310) 643-3804

Reviewed by:

James T. Gallagher, Chief Operations Officer, (213) 418-3108
Debra Avila, Chief Vendor/Contract Management Officer, (213) 418-3051



Phillip A. Washington
Chief Executive Officer

PROCUREMENT SUMMARY

P2000 FRICTION BRAKE SYSTEMS & AIR COMPRESSOR OVERHAUL 179579/MA27583000

1.	**Contract Number**: MA27583000	
2.	**Recommended Vendor**: Wabtec Passenger Transit	
3.	**Type of Procurement (check one):** ☐ **IFB** ☒ **RFP** ☐ **RFP–A&E** ☒ **Non-Competitive** ☐ **Modification** ☐ **Task Order**	
4.	**Procurement Dates**:	
	A. Issued: 4/27/17	
	B. Advertised/Publicized: N/A	
	C. Pre-Proposal Conference: N/A	
	D. Proposals Due: 6/8/17	
	E. Pre-Qualification Completed: 8/21/17	
	F. Conflict of Interest Form Submitted to Ethics: 7/19/17	
	G. Protest Period End Date: 11/17/17	
5.	**Solicitations Picked up/Downloaded**: 1	**Proposals Received**: 1
6.	**Contract Administrator**: Jean Davis	**Telephone Number**: 213/922-1041
7.	**Project Manager**: Brian McNeeley	**Telephone Number**: 310/643-3804

A. Procurement Background

This Board Action is to approve Contract No. MA27583000 in support of Metro's Green Line Light Rail Vehicle (LRV) to procure services required for the complete overhaul and repair of the brake system valves and components including air compressor. The existing brake system valves and components on the Siemens P2000 passenger rail cars were designed and built by the original equipment manufacturer (OEM), Wabtec Passenger Transit (Wabtec). It was determined by Metro's engineering and operations team to ensure full operational capability that the overhaul of the P2000 rail car brake systems valves and components be overhauled by the Wabtec.

The non-competitive Request for Proposal (RFP) was issued to the Wabtec on April 7, 2017, and the contract type is an Indefinite Delivery, Indefinite Quantity (IDIQ).

Two amendments were issued during the solicitation phase of this RFP:

- Amendment No. 1, was issued on May 9, 2017, to extend the proposal due date revise the critical dates;
- Amendment No. 2, was issued on May 26, 2017, to further extend the proposal due date to June 8, 2017.

B. Evaluation of Proposal

This is a single source procurement that is consistent with Public Utility Code §130237, for the duplication or replacement of existing equipment already in use. Metro's

technical staff conducted technical fact-finding meetings and a technical evaluation of the technical proposal. The proposal was evaluated based on the proposed labor hours, proposed assigned technical personnel and labor categories. The proposal was found to be technically acceptable.

The firm recommended for award, Wabtec Passenger Transit, was found to be in full compliance with the proposal requirements.

C. Cost/Price Analysis

In accordance with Metro's Acquisition Policy for a single source acquisition a cost analysis was conducted by Metro's Estimating Department. Based on Metro's cost analysis there was a unit price variation of 11.3% between the unit price offered and our unit cost analysis. In assessing the variance, it was concluded that the price difference was attributed to the product being a specialty item with no other manufacturing source; therefore, Metro would be expected to pay a premium for the procurement of this specialty product. Based on the cost analysis performed, the total proposed price was considered fair and reasonable.

Proposer Name	Proposal Amount	Metro ICE
Wabtec Passenger Transit	$3,328,499	$2,926,404

D. Background on Recommended Contractor

Wabtec was formed in November 1999 when Westinghouse Air Brake Company merged with Motive Power Industries, Inc. The original Westinghouse Air Brake Company was founded in 1869. Wabtec manufactures a broad range of products for locomotives, freight cars and passenger transit vehicles. These products include a vast array of pneumatic, electronic and mechanical devices such as braking equipment, controllers, and couplers for the transit industry worldwide. Wabtec has been providing rail equipment and services in the United States for 130 years.

DEOD SUMMARY

P2000 FRICTION BRAKE SYSTEMS & AIR COMPRESSOR OVERHAUL 179579/MA27583000

A. Small Business Participation

The Diversity and Economic Opportunity Department (DEOD) did not establish a Small Business Enterprise (SBE) goal for this solicitation. The P2000 Friction Brake Systems & Air Compressors are Original Equipment Manufacturer (OEM) products, and are shipped directly to Metro. While the Project Manager initially confirmed that there were no subcontracting opportunities, Wabtec Passenger Transit (Wabtec), through its outreach efforts, was able to identify an SBE to perform modification and assembly services. Wabtec made a 5% SBE commitment.

Small Business Goal	**0% SBE**	**Small Business Commitment**	**5% SBE**

	SBE Subcontractors	**% Committed**
1.	Altech Services Inc.	5%
	Total Commitment	**5%**

B. Living Wage and Service Contract Worker Retention Policy Applicability

The Living Wage and Service Contract Worker Retention Policy is not applicable to this Contract.

C. Prevailing Wage Applicability

Prevailing wage is not applicable to this Contract.

D. Project Labor Agreement/Construction Careers Policy

Project Labor Agreement/Construction Careers Policy is not applicable to this Contract.

Overview of Items 23, 24, 25 and 30

System Safety, Security & Operations Committee

Metro

November 2017

Rail Vehicle Maintenance, Overhaul & Modernization

Maintenance	• Preserve level of performance
Overhaul	• Heavy maintenance repair/replacement at specific OEM intervals (age/mileage) • No change to the design
Modernization	• Improve systems and performance • Approximate mid-life • Upgrade the system designs

Metro

Fleet Plan 10 Year Horizon

Series	Maintenance	Overhaul	Modernize	Retire	Replace
P865	Yes	No	No	In process	P3010
P2020	Yes	Yes	No	Future	P3010
P2000	Yes	Yes	Yes	Future	Future
P2550	Yes	Yes	Yes	Future	Future
P3010	Yes	To be Scheduled	2030 ±	Future	Future
A650 Base	Yes	No	No	Future	HR4000 Base
A650	Yes	Yes	Yes	Future	HR4000 Option

Fleet Plan

❑ P2020 LRT Car Series

- **Delivered:** 15
- **Lines :** Blue and Expo Lines
- **Overhaul Program**
  - Ten components
  - Program LOP $ 30,000,000
  - Contract for air hose replacement - Completed
  - Contract for axle assembly, gearbox/roller, cab slider, body repair, seat removal for bikes, wheelchair, cameras and propulsion – On-Going
  - Contract for Friction Brake– Nov 2017 (Item 23)

❑ P2000 LRT Car Series

- **Delivered:** 52
- **Lines:** Green, Blue and Expo Lines
- **Overhaul Program**
  - Nine components
  - Program LOP $ 26,360,100
  - Contracts for air hose replacement and non-power axle bearing replacement – Completed 2012
  - Contracts for power axle, car battery, couple, exterior and interior paint – On-going
  - Contracts for Friction Brake and Air Compressor – Nov 2017 (Item 25)
- **Modernization**
  - Renew systems:
    - Carbody; Door; HVAC; Electrical; Propulsion; Trucks; Braking Equipment; Communication; Automatic Train Control; Trainline; Destination Signs
  - Exercise optional features (Item 30)
  - Contract to Alstom
  - LOP $160,800,000
  - Projected Completion August 2021

Metro

Fleet Plan

❑ P2550 LRT Car Series

- **Delivered:** 50
- **Lines :** Gold Line
- **Overhaul Program**
  - Nine components
  - Program LOP $ 35,007,540
  - Contracts for axle assemblies, and coupler awarded – June & Sept 2017
  - Contract for Friction Brake – Nov 2017 (Item 25)
  - Contracts for propulsion, pantograph, battery, doors, truck and suspension systems – Anticipated 2018/2019
- **Modernization**
  - Renew systems:
    - Carbody; Door; HVAC; Electrical; Propulsion; Trucks; Braking Equipment; Couplers; Communication; Battery
  - Specification Prep Phase
  - Contract to STV Incorporated (Item 24)
    - Consultant $1,421,086 –Nov 2017
  - Estimated LOP TBD
  - Projected Start 2020

❑ A650 Subway Car Series

- **Delivered:** 74
- **Lines :** Red Line
- **Overhaul Program**
  - Ten components
  - Program LOP $ 30,000,000
  - Contracts for air compressor, HVAC compressor, passenger door, and car battery replacement – Completed
  - Contracts for friction brake, traction motor, gearbox, coupler, AC, and DC – On-Going
- **Modernization**
  - Renew systems:
    - Propulsion; Trucks; Friction Brakes; Doors; Communication; Interiors; Signal System, HVAC
  - Design and engineering phase
  - Contract to Talgo
  - LOP $72,970,494
  - Projected Completion December 2021


Thank you
Metro

Los Angeles County
Metropolitan Transportation
Authority
One Gateway Plaza
3rd Floor Board Room
Los Angeles, CA

Metro

Board Report

File #: 2017-0642, **File Type:** Contract **Agenda Number:** 24.

SYSTEM SAFETY, SECURITY AND OPERATIONS COMMITTEE
NOVEMBER 16, 2017

SUBJECT: P2550 LIGHT RAIL VEHICLE (LRV) MIDLIFE MODERNIZATION PROGRAM - CONSULTANT SUPPORT SERVICES FOR SPECIFICATION DEVELOPMENT & SOLICITATION OF CONTRACTOR

ACTION: APPROVE CONTRACT AWARD

RECOMMENDATION

AWARD a firm fixed price Contract No. 45383000 for Consulting Support Services to STV Incorporated for the P2550 Light Rail Vehicle (LRV) Midlife Modernization Program, in the amount of $1,421,086.73, for 24 months from Notice to Proceed, subject to resolution of protest(s), if any.

ISSUE

The P2550 LRVs have an average age of ten (10) years from date of Acceptance. The fleet is in need of modernization to address obsolescence of components; decreased reliability and availability; increased maintainability costs; and to ensure a State of Good Repair (SGR). Approval of this action authorizes STV Incorporated to assist Metro with:

a) The development of a Request for Proposal (RFP) package for the solicitation of a Contractor; documents include the commercial and technical specifications, scope of work, and associated technical documents; and with

b) The Contractor solicitation and award process.

DISCUSSION

Metro is seeking Rail Vehicle Consultant support services for the development of an RFP package and solicitation of a Contractor for the midlife modernization of its AnsaldoBreda (AB) P2550 LRV fleet consisting of fifty (50) rail cars. The primary goal of this LRV midlife program is to maintain this fleet in a State of Good Repair. The current P2550 LRVs require repair, upgrades, and/or replacement of components, appointments, and subsystems to maintain fleet safety, reliability, availability, performance, and passenger comfort.

Metro currently operates fifty (50) AB P2550 LRV's on the Gold/Foothill Extension lines. These cars

have an average age of 10 years (from date of acceptance) and approximately 500,000 (500k) revenue service miles. They have a design life of 30 years and are accumulating approximately 70k miles per year. The fleet is also approaching its mid-life at which point reliability and availability begin to decrease and maintenance costs begin to increase unless a modernization effort is affected to maintain the cars in a State of Good Repair. It is the intent of this action to develop a scope of work and technical specifications for the modernization program based on a condition-based assessment of the fleet and the OEM's recommendations.

Performing the modernization program is in accordance with the Rail Fleet Management Plan FY2015-FY2040 (Draft, May 24, 2016, v.8). The plan outlines the anticipated program to expand rail fleets to accommodate anticipated growth in ridership; line extensions; and to overhaul or replace vehicles reaching mid-life or end of life, as appropriate.

Metro is seeking expert rail vehicle consulting services to develop the RFP package and support the solicitation of a Contractor for the midlife modernization of the 50 AB P2550 LRV fleet. The primary objective of the project is to obtain safe, reliable, high quality modernized LRVs on-time and within budget, and to create new jobs for Los Angeles County that can be tied directly to the Modernization Program.

The Diversity and Economic Opportunity Department (DEOD) recommended a Disadvantaged Business Enterprise (DBE) goal of 20% for this procurement (please refer to Attachment E). STV Incorporated's reported 20.11% DBE goal complies with the DEOD's recommendation.

DETERMINATION OF SAFETY IMPACT

The approval of this Contract award will have a direct and positive impact to system safety, service quality, system reliability, maintainability and overall customer satisfaction. The P2550 Light Rail Vehicle Overhaul Program will permit Metro to maintain the State of Good Repair (SGR) on the P2550 LRV fleet.

FINANCIAL IMPACT

The FY18 planned expenditure of $615,000 is included in the FY18 budget for the Overhaul Program in Cost Center 3043, Rail Vehicle Acquisition, Account 50308, Service Contract (Non-Bus) Maintenance, under CP 214003, P2550 Light Rail Vehicle Midlife Modernization Program.

Since this is a multi-year contract, the cost center manager will be responsible for dispersing the cost for subsequent years.

Impact to Budget

The source of funds for this action include Federal Section 5337 State of Good Repair funds. Other eligible funds include Proposition A 35% and Measure R 2% which are eligible for rail capital activities. Concurrently, staff is actively pursuing additional Federal, State and Local funding sources such as FAST Act and Cap and Trade as they become available to meet project funding needs.

ALTERNATIVES CONSIDERED

Staff considered the alternative of using in-house Metro resources to perform this work. This approach is not recommended as Metro does not have sufficient resources and Subject Matter Experts (SME) available to perform this work.

The Board of Directors may choose not to authorize the contract award for this project; however, this alternative is not recommended by Metro staff because the Modernization Program is critical to maintaining a SGR on the 50 AB P2550 LRVs and to enable the Maintenance Department to effectively plan and schedule its work.

NEXT STEPS

Upon Board approval, a contract will be awarded and a Notice-to-Proceed date will be given to STV Incorporated. Metro and STV Incorporated will mobilize required resources and SMEs to ensure timely completion of deliverables including specifications development, scope of work (SOW), and an RFP package to initiate the solicitation of a contractor and award a Midlife Modernization contract.

ATTACHMENTS

Attachment A - Funding/Expenditure Plan
Attachment B - Procurement Summary
Attachment C - DEOD Summary

Prepared by: Annie Yang, Sr. Director, Project Control, Rail Vehicle Acquisition, (213) 922-3254
Jesus Montes, Sr. Executive Officer, Vehicle Acquisitions, (213) 418-3278

Reviewed by: James T. Gallagher, Chief Operations Officer, (213) 418-3108
Debra Avila, Chief Vendor/Contract Management Officer, (213) 418-3051

Phillip A. Washington
Chief Executive Officer

ATTACHMENT A

FUNDING/EXPENDITURE PLAN - CP214003

P2550 LIGHT RAIL VEHICLE (LRV) MIDLIFE MODERNIZATION PROGRAM

		From Inception to Date (ITD) thru FY17	7/1/17 - 6/30/18	7/1/18 - 6/30/19	7/1/19 - 6/30/20	7/1/20 - 6/30/21	7/1/21 - 6/30/22	7/1/22 - 6/30/23	7/1/22 - 6/30/24	7/1/22 - 6/30/25	7/1/22 - 6/30/26		
1	**Use of Funds**		**FY18**	**FY19**	**FY20**	**FY21**	**FY22**	**FY23**	**FY24**	**FY25**	**FY26**	**Total**	**% of Project**
2	Overhaul 50 AB Light Rail Vehicles (LRVs) (CP 214003)	$0	$0	0	$6,527,785	$18,170,600	$25,170,000	$25,170,000	$18,170,000	$20,690,819		$113,899,204	79.8%
3	Professional Services	$0	$600,000	$650,000	$225,396	$1,500,000	$2,000,000	$2,000,000	$1,800,000	$1,500,000	$660,200	$10,935,596	7.7%
4	MTA Administration	$0	$450,000	$627,600	$658,200	$493,800	$507,700	$532,800	$549,000	$565,400	$582,200	$4,966,700	3.5%
5	Contingency	$0	$0	$0	$0	$0	$0	$0	$0	$0	$12,909,500	$12,909,500	9.0%
6	**Total**	**$0**	**$1,050,000**	**$1,277,600**	**$7,411,381**	**$20,164,400**	**$27,677,700**	**$27,702,800**	**$20,519,000**	**$22,756,219**	**$14,151,900**	**$142,711,000**	**100.0%**
7			**7/1/17 - 6/30/18**	**7/1/18 - 6/30/19**	**7/1/19 - 6/30/20**	**7/1/20 - 6/30/21**	**7/1/21 - 6/30/22**	**7/1/22 - 6/30/23**	**7/1/22 - 6/30/24**	**7/1/22 - 6/30/25**	**7/1/22 - 6/30/26**		
8	**Use of Funds**		**FY18**	**FY19**	**FY20**	**FY21**	**FY22**	**FY23**	**FY24**	**FY25**	**FY26**	**Total**	**% of Project**
9	**Sources of Funds**												
10	**Sources of Funds**												
11	**Sources of Funds**												
12	**Total**												

PROCUREMENT SUMMARY

P2550 LRV MIDLIFE MODERNIZATION PROGRAM – CONSULTANT SUPPORT SERVICES / PS45383000

1.	**Contract Number**: PS45383000	
2.	**Recommended Vendor**:	
3.	**Type of Procurement (check one):** ☐ **IFB** ☒ **RFP** ☐ **RFP–A&E** ☐ **Non-Competitive** ☐ **Modification** ☐ **Task Order**	
4.	**Procurement Dates**:	
	A. Issued: 8.18.17	
	B. Advertised/Publicized: 8.18.17	
	C. Pre-Proposal Conference: 8.24.17	
	D. Proposals Due: 9.29.17	
	E. Pre-Qualification Completed: 10/19/17	
	F. Conflict of Interest Form Submitted to Ethics: 10.09.17	
	G. Protest Period End Date: 11.17.17	
5.	**Solicitations Picked up/Downloaded**: 35	**Bids/Proposals Received**: 3
6.	**Contract Administrator**: Nicole Dang	**Telephone Number**: 213-922-7438
7.	**Project Manager**: Annie Yang	**Telephone Number**: 213-922-7438

A. Procurement Background

This Board Action is to approve Contract No. PS45383000 issued to obtain expert consulting services to develop an overhaul Statement of Work (SOW), Technical Specification, and Request for Proposal (RFP) package for solicitation of a Contractor for the midlife overhaul of the Ansaldo Breda (AB) P2550 Light Rail Vehicle (LRV) fleet consisting of 50 rail cars. Board approval of contract awards are subject to resolution of any properly submitted protest.

The RFP was issued in accordance with Metro's Acquisition Policy and the contract type is a firm fixed price.

Three amendments were issued during the solicitation phase of this RFP:

- Amendment No. 1, issued on August 31, 2017, revised the proposal due date;
- Amendment No. 2, issued on September 07, 2017, revised the submittal requirements;
- Amendment No. 3, issued on September 19, 2017, clarified the proposal due time, revised the submittal requirements, and deleted DBE Instructions to Proposers Pro Form 068B.

A total of three proposals were received on September 29, 2017. A total of 33 questions were submitted and Metro responded to all 33 questions by September 19, 2017.

B. Evaluation of Proposals

A Proposal Evaluation Team (PET) consisting of staff from Rail Vehicle Acquisition and Rail Vehicle Warranty were convened and conducted a comprehensive technical evaluation of the proposals received.

The proposals were evaluated based on the following evaluation criteria and weights:

- Project Manager/Lead Engineer & Key Personal Qualification 35 percent
  - A) Project Manager/Lead Engineer (20 percent)
  - B) Two (2) Rail Vehicle Engineers (15 percent)
- Previous Experience on Similar Projects in the United States 15 percent
- Availability 10 percent
- Project Understanding/Approach and Management 10 percent
- Price 30 percent

The evaluation criteria are appropriate and consistent with criteria developed for other, similar best value procurements. Several factors were considered when developing these weights, giving the greatest importance to the project manager and lead engineer's qualification.

Of the three proposals received, all three were determined to be within the competitive range. The three firms within the competitive range are listed below in alphabetical order:

1. LTK Engineering Services, Inc.
2. Mott MacDonald, Inc.
3. STV, Inc.

The evaluation committee convened from October 1, 2017 through October 9, 2017 to review the proposals. Request for Clarifications were issued to all three firms on October 4, 2017 and responses were received on October 6, 2017. The evaluation committee determined that the responses were satisfactory.

Qualifications Summary of Firms within the Competitive Range (firms listed in order of evaluation rank):

STV, Inc.

STV, Inc.'s proposal demonstrated their understanding of the project through the collective experience of their proposed team. Proposed Project Manager Elson Hao has nearly 40 years of engineering experiences including 25 years with the San Francisco Municipal Transportation Agency as a senior Light Rail Vehicle Engineer. Mr. Hao was the Deputy Project Manager assisting LACMTA with the HR4000 Acquisition Program. While working for MBTA, Mr. Hao was a subject matter expert

providing design, review support and product evaluation of submittals for various systems such as HVAC, trucks, interior, and doors for the procurement of 404 HRVs for the Orange and Red Line. STK's proposed Deputy Project Manager, Andrew Frohn has over 30 years of rail experience. Mr. Frohn has worked on the rail fleet maintenance side, managing day to day inspections, repairs, and life cycle maintenance programs. Mr. Frohn recently supported LACMTA through the specification development and procurement process for Metro HR4000 HRV fleet.

LTK Engineering Services, Inc.

LTK Engineering Services, Inc.'s proposal demonstrated their understanding of the project through the collective experience of their proposed team. Proposed Project Manager Jeff Stastny has nearly 22 years of engineering experiences with mechanical engineering disciplines, with particular expertise in carbody structures. In addition, proposed lead engineer, Rahul Dixit has 17 years of experience working in the transit and railroad industry. Mr. Dixit has worked on the design and production of Boston Green Line No. 9 cars while at CAF USA, Inc. In addition, while Mr. Dixit was at Transitair Systems, he was responsible for designing, refurbishing, testing and commissioning complete electrical and mechanical systems including trucks.

Mott MacDonald, Inc.

Mott MacDonald, Inc.'s proposal demonstrated their understanding of the project through the collective experience of their proposed team. Proposed Project Manager Mark Terry has over 35 years of experience in overhaul, procurement, and maintenance of LRVs. Mr. Terry managed the overhaul of Ansaldo T68 and T68A LRV Fleets. In addition, Mr. Terry also has 16 years of experience in rail vehicle engineering working directly for British Railways in practical, hands-on technical and supervisory positions. Proposed System Integration Engineer, Avril Heins worked on London Tramlink, Croydon Mid-Life Overhaul of CR4000 LRV fleet as the Project Manager.

Proposal Evaluation Team's recommendation

1	Firm	Average Score	Factor Weight	Weighted Average Score	Rank
2	**STV, Inc.**				
3	Project Manager/Lead Engineer & Key Personal Qualification. A) Project Manager/Lead Engineer and Key Personnel	7.66	20.00%	15.33%	
4	Project Manager/Lead Engineer & Key Personal Qualification. B) Minimum of two (2) Rail Vehicle Engineers	8.67	15.00%	13.00%	
5	Previous Experience on Similar Projects in the United States	9.00	15.00%	13.50%	
6	Availability	7.00	10.00%	7.00%	
7	Project Understanding/Approach and Management	8.33	10.00%	8.33%	
8	Price		30.00%	30.00%	
9	**Total**		**100.00%**	**87.16**	**1**
10	**LTK Engineering, Inc.**				
11	Project Manager/Lead Engineer & Key Personal Qualification. A) Project Manager/Lead Engineer and Key Personnel	7.83	20.00%	15.66%	
	Project Manager/Lead Engineer & Key Personal Qualification. B) Minimum of two (2) Rail Vehicle Engineers	8.67	15.00%	13.00%	
12	Previous Experience on Similar Projects in the United States	9.00	15.00%	13.50%	
13	Availability	5.67	10.00%	5.67%	
14	Project Understanding/Approach and Management	7.66	10.00%	7.66%	
15	Price		30.00%	19.67%	
16	**Total**		**100.00%**	**75.16%**	**2**
17	**Mott MacDonald, Inc.**				
18	Project Manager/Lead Engineer & Key Personal Qualification. A) Project Manager/Lead Engineer and Key Personnel	6.66	20.00%	13.32%	
19	Project Manager/Lead Engineer & Key Personal Qualification. B) Minimum of two (2) Rail Vehicle Engineers	7.33	15.00%	11.01%	
20	Previous Experience on Similar Projects in the United States	7.00	15.00%	10.50%	
21	Availability	6.33	10.00%	6.33%	

22	Project Understanding/Approach and Management	8.33	10.00%	8.33%	
23	Price		30.00%	16.96%	
24	**Total**		**100.00%**	**66.45%**	**3**

C. Cost/Price Analysis

The recommended price has been determined to be fair and reasonable based upon adequate price competition, an independent cost estimate (ICE), and price analysis. The firm fixed milestone pricing from the highest technically rated proposer, STV, Inc., is significantly lower than the other proposers and 11% lower than Metro's ICE. Price analysis revealed some variances in the fixed price milestones from each of the proposers. These values were reconciled with the proposers through discussions to ensure that there was a clear understanding of the deliverable, the requirements, and the fixed price for the milestone.

	Proposer Name	Proposal Amount	Metro ICE	Negotiated or NTE amount
1.	LTK Engineering Services, Inc.	$2,167,919	$1,575,462	$2,167,919
2.	Mott MacDonald, Inc.	$2,514,093	$1,575,462	$2,514,093
3.	STV, Inc.	$1,421,086	$1,575,462	$1,421,086

D. Background on Recommended Contractor

STV, Inc. (STV) has been in business for 100 years and has a local office in Los Angeles, CA. STV has incorporated a Vehicle Technology and Operations group into their organization which offers consulting support in rail vehicle specification development and procurement, rail vehicle condition assessment, rail vehicle overhaul specification development and support, inspection and quality control support, and failure analysis. STV, through a joint venture, developed the performance based technical specification for Metro HR4000 Heavy Rail Vehicle procurement which they performed satisfactory. STV has provided rail engineering support to municipals such as Massachusetts Bay Transportation Authority (MBTA), Maryland MTA, City of Ottawa Confederation and Metro.

ATTACHMENT C

DEOD SUMMARY

P2550 LIGHT RAIL VEHICLE (LRV) MIDLIFE MODERNIZATION PROGRAM / PS45383

A. Small Business Participation

The Diversity and Economic Opportunity Department (DEOD) established a 20% Disadvantaged Business Enterprise (DBE) goal for this solicitation. STV Incorporated made a 20.11% DBE commitment.

Small Business Goal	20% DBE	Small Business Commitment	20.11% DBE

	DBE Subcontractors	Ethnicity	% Commitment
1.	Capitol Government Contract Specialist, Inc.	Hispanic American	10.85%
2.	Virginkar & Associates, Inc.	Subcontinent Asian American	6.70%
3.	Global Innovations, USA	African American Female	2.56%
	Total Commitment		**20.11%**

B. Living Wage and Service Contract Worker Retention Policy Applicability

The Living Wage and Service Contract Worker Retention Policy is not applicable to this Contract.

C. Prevailing Wage Applicability

Prevailing wage is not applicable to this Contract.

D. Project Labor Agreement/Construction Careers Policy

Project Labor Agreement/Construction Careers Policy is not applicable to this Contract.

Overview of Items 23, 24, 25 and 30

System Safety, Security & Operations Committee

Metro

November 2017

Rail Vehicle Maintenance, Overhaul & Modernization

Maintenance	• Preserve level of performance
Overhaul	• Heavy maintenance repair/replacement at specific OEM intervals (age/mileage) • No change to the design
Modernization	• Improve systems and performance • Approximate mid-life • Upgrade the system designs

Metro

Fleet Plan 10 Year Horizon

Series	Maintenance	Overhaul	Modernize	Retire	Replace
P865	Yes	No	No	In process	P3010
P2020	Yes	Yes	No	Future	P3010
P2000	Yes	Yes	Yes	Future	Future
P2550	Yes	Yes	Yes	Future	Future
P3010	Yes	To be Scheduled	2030 ±	Future	Future
A650 Base	Yes	No	No	Future	HR4000 Base
A650	Yes	Yes	Yes	Future	HR4000 Option

Fleet Plan

❑ P2020 LRT Car Series

- **Delivered:** 15
- **Lines :** Blue and Expo Lines
- **Overhaul Program**
  - Ten components
  - Program LOP $ 30,000,000
  - Contract for air hose replacement - Completed
  - Contract for axle assembly, gearbox/roller, cab slider, body repair, seat removal for bikes, wheelchair, cameras and propulsion – On-Going
  - Contract for Friction Brake– Nov 2017 (Item 23)

❑ P2000 LRT Car Series

- **Delivered:** 52
- **Lines:** Green, Blue and Expo Lines
- **Overhaul Program**
  - Nine components
  - Program LOP $ 26,360,100
  - Contracts for air hose replacement and non-power axle bearing replacement – Completed 2012
  - Contracts for power axle, car battery, couple, exterior and interior paint – On-going
  - Contracts for Friction Brake and Air Compressor – Nov 2017 (Item 25)
- **Modernization**
  - Renew systems:
    - Carbody; Door; HVAC; Electrical; Propulsion; Trucks; Braking Equipment; Communication; Automatic Train Control; Trainline; Destination Signs
  - Exercise optional features (Item 30)
  - Contract to Alstom
  - LOP $160,800,000
  - Projected Completion August 2021

Metro

Fleet Plan

❑ P2550 LRT Car Series

- **Delivered:** 50
- **Lines :** Gold Line
- **Overhaul Program**
  - Nine components
  - Program LOP $ 35,007,540
  - Contracts for axle assemblies, and coupler awarded – June & Sept 2017
  - Contract for Friction Brake – Nov 2017 (Item 25)
  - Contracts for propulsion, pantograph, battery, doors, truck and suspension systems – Anticipated 2018/2019
- **Modernization**
  - Renew systems:
    - Carbody; Door; HVAC; Electrical; Propulsion; Trucks; Braking Equipment; Couplers; Communication; Battery
  - Specification Prep Phase
  - Contract to STV Incorporated (Item 24)
    - Consultant $1,421,086 –Nov 2017
  - Estimated LOP TBD
  - Projected Start 2020

❑ A650 Subway Car Series

- **Delivered:** 74
- **Lines :** Red Line
- **Overhaul Program**
  - Ten components
  - Program LOP $ 30,000,000
  - Contracts for air compressor, HVAC compressor, passenger door, and car battery replacement – Completed
  - Contracts for friction brake, traction motor, gearbox, coupler, AC, and DC – On-Going
- **Modernization**
  - Renew systems:
    - Propulsion; Trucks; Friction Brakes; Doors; Communication; Interiors; Signal System, HVAC
  - Design and engineering phase
  - Contract to Talgo
  - LOP $72,970,494
  - Projected Completion December 2021


Thank you
Metro

Los Angeles County
Metropolitan Transportation
Authority
One Gateway Plaza
3rd Floor Board Room
Los Angeles, CA

File #: 2017-0693, **File Type:** Contract **Agenda Number:** 25.

SYSTEM SAFETY, SECURITY AND OPERATIONS COMMITTEE
NOVEMBER 16, 2017

SUBJECT: P2550 & P2020 FRICTION BRAKE SYSTEM OVERHAUL

ACTION: APPROVE CONTRACT AWARD

RECOMMENDATION

CONSIDER:

A. AUTHORIZING the Chief Executive Officer to award an 84 month, indefinite delivery/indefinite quantity Contract No. MA24464000 to Knorr Brake Company for component overhaul services of P2550 and P2020 Light Rail Vehicle (LRV) Friction Brake Systems, for a total not- to-exceed amount of $4,546,031; and

B. AWARDING a single source procurement, pursuant to Public Utilities Code section §130237 for component overhaul services of the Metro Gold Line (MGL) P2550 and Metro Blue Lines (MBL) P2020 LRV Friction Brake Systems from the Original Equipment Manufacturer (OEM), to Knorr Brake Company.

(REQUIRES TWO-THIRDS VOTE OF THE FULL BOARD)

ISSUE

The P2020 fleet operates on Metro's Blue Line and is currently undergoing a Friction Brake Overhaul Program similar to the above mentioned P2550 fleet. Knorr Brake Company is the friction brake system OEM and because these programs are being executed in parallel, this procurement is for both fleet types.

The existing friction brake systems on both the MGL P2550 and MBL P2020 are proprietary and this procurement is for component overhaul services of existing equipment already in use. Execution of the overhaul will ensure that both fleet types remain in a continuous State of Good Repair (SGR) while safeguarding passenger safety, vehicle reliability and equipment longevity.

DISCUSSION

In June 2017, the Board of Directors approved Life of Project Budget for contracts to overhaul the P2550 Fleet under a Component Overhaul Program. The P2550 Component Overhaul Program

consists of a total of nine individual procurements for the overhaul of the major vehicle systems inclusive of propulsion, pantograph, battery, doors, couplers, high voltage and auxiliary power, friction brakes and truck systems. The friction brake overhaul is third in succession of the nine component overhaul procurements requiring board approval. This procurement is for the professional services to complete the overhaul of 53 friction brake assemblies inclusive of 3 spares for the P2550 fleet as recommended by the OEM established guidelines.

The Ansaldo Breda P2550 LRV is in its eighth year of operation. In order to ensure continued safety and performance of the friction brake systems a complete overhaul is required at the 600,000 mileage interval as defined by the OEM and monitored by the California Public Utilities Commission (CPUC). The friction brake overhaul consists of several assemblies inclusive of electrical and mechanical component parts as well as the air compressor and pneumatic components that wear out due to normal service and operations. Routine maintenance and periodic overhaul of the friction brake systems is of critical importance for passenger safety and accident prevention to ensure the vehicle stops within specified stopping distance during routine and emergency braking applications.

The Nippon Sharyo P2020 fleet is in its 23rd year of operation with over 1.7 million in-service miles. The friction brake overhaul is an element of the Preventative Maintenance Program PMP to be done at the 4 year interval as defined by the OEM and monitored by the CPUC. The overhaul consists of several assemblies including electrical, mechanical, and pneumatic systems that wear out during normal service and operations.

Rail Fleet Services (RFS) Engineering developed an equipment overhaul specification for the friction brake systems overhaul based on OEM recommendations and in conjunction with RFS maintenance expertise. The contractor will perform overhaul services in accordance with predefined schedules using Metro provided technical specification requirements.

DETERMINATION OF SAFETY IMPACT

Passenger and employee safety are of the utmost importance to Metro and, therefore, it is imperative to maintain the P2550 & P2020 fleet to a constant state of good repair. The friction brake systems overhaul is in support of the complete P2550 component overhaul program. This effort will ensure that these vehicles are maintained in accordance with OEM recommendations and regulatory standards, according to the defined schedule and technical specifications requirements, and within Metro's internal Corporate Safety policies and procedures.

FINANCIAL IMPACT

The approved Life-of-Project (LOP) for the P2550 Fleet Component Overhaul Program under capital project number 214001 is for the amount of $35,007,546. Funding of $1,431,697 for this Contract (P2550) is included in the FY18 budget in cost center 3944, Rail Fleet Services Maintenance, under project number 214001, line item 50441, Parts - Revenue Service. Funding of $1,000,000 for this Contract (P2020) is included in the FY18 budget in cost center 3941, Rail Fleet Services Maintenance, under project number 211018, line item 50441, Parts - Revenue Service.

Since this is a multi-year Contract, the cost center manager, project manager, and Sr. Executive Officer, RFS will ensure that the balance of funds is budgeted in future fiscal years.

Impact to Budget

The source of funds for this procurement will come from Federal, State and local funding sources that are eligible for Rail Capital Projects. Use of these funding sources will maximize funds use given allocation provisions.

ALTERNATIVES CONSIDERED

Vehicle friction brakes are a safety critical system which are required to be overhauled per the OEM and regulatory requirements to avoid catastrophic events resulting from extending stopping distance of complete failure of the braking systems during emergency brake application. Deferring the friction brake overhaul is not recommended as Metro could also be subject to penalties mandated by the California Public Utilities Commission.

NEXT STEPS

Overhaul of the P2550 Light Rail Vehicle Friction Brake systems will continue in accordance with RFS scheduled requirements. If approved, the project is scheduled to commence in July 2018. In addition, the RFS Department will continue with the P2020 Component Overhaul of the Friction Brake systems as noted above with the exception of the friction brake overhaul which is a program that has already commenced.

ATTACHMENTS

Attachment A - Procurement Summary
Attachment B - DEOD Summary

Prepared by:

Bob Spadafora, Sr. Executive Officer, Rail Fleet Services, (213) 922-3144
Richard M. Lozano, Sr. Director, Rail Fleet Services, (310) 816-6944
Russell Homan, Director Rail Fleet Services, (626) 478-7831

Reviewed by:

James T. Gallagher, Chief Operations Officer, (213) 418-3108
Debra Avila, Chief Vendor/Contract Management Officer, (213) 418-3051

Phillip A. Washington
Chief Executive Officer

PROCUREMENT SUMMARY

P2020 & P2550 FRICTION BRAKE SYSTEM OVERHAUL KITS 166089/189204 /MA24464000

1.	**Contract Number**: MA24464000	
2.	**Recommended Vendor**: Knorr Brake Company	
3.	**Type of Procurement (check one):** ☐ **IFB** ☒ **RFP** ☐ **RFP–A&E** ☒ **Non-Competitive** ☐ **Modification** ☐ **Task Order**	
4.	**Procurement Dates**:	
	A. Issued: 4/21/17	
	B. Advertised/Publicized: N/A	
	C. Pre-Proposal Conference: N/A	
	D. Proposals Due: 6/7/17	
	E. Pre-Qualification Completed: 7/5/17	
	F. Conflict of Interest Form Submitted to Ethics: 7/19/17	
	G. Protest Period End Date: 11/17/17	
5.	**Solicitations Picked up/Downloaded**: 1	**Proposals Received**: 1
6.	**Contract Administrator**: Jean Davis	**Telephone Number**: 213/922-1041
7.	**Project Manager**: Russell Homan	**Telephone Number**: 626/471-7831

A. Procurement Background

This Board Action is to approve Contract No. MA24464000 in support of Metro's Gold Line (P2550) and Blue Line (P2020) Light Rail Vehicles (LRV) to procure services required for the complete overhaul and repair of the friction brake systems on a sole source basis. The existing friction brake systems for the P2550 and P2020 were designed and built by the original equipment manufacturer (OEM), Knorr Brake Company. It was determined by Metro's engineering and operations team to ensure full operational capability that the overhaul of Metro's P2550 and P2020 rail car friction brake systems be overhauled by the OEM, Knorr Brake Company.

The non-competitive Request for Proposal was issued to Knorr Brake Company on April 21, 2017, in accordance with Metro's Acquisition Policy, and the contract type is a not-to exceed Indefinite Delivery, Indefinite Quantity (IDIQ).

Two amendments were issued during the solicitation phase of this RFP as follows:

- Amendment No. 1, was issued on May 3, 2017, to extend the proposal due date and to revise the critical dates.
- Amendment No. 2, was issued on August 24, 2017, to revise the Statement of Work and Specifications, and to extend proposal due date.

B. Evaluation of Proposal

This single source procurement is consistent with Public Utility Code section 130237, applied for the purpose of duplicating equipment already in existence at Metro. Metro's technical staff conducted technical fact-finding meetings and a technical evaluation of the technical proposal. The proposal was evaluated based on the proposed management and quality assurance plans, proposed facility and assigned technical personnel. The proposal was found to be technically acceptable. Staff and the proposer mutually negotiated selected terms and conditions, schedule, and warranty.

The firm recommended for award, Knorr Brake Company, was found to be in compliance with the proposal requirements.

C. Price Analysis

Single source acquisitions require a cost analysis be performed to determine fair and reasonable prices. Due to the proposer's unwillingness to provide essential company sensitive cost support data needed to perform a cost analysis and the equipment availability from only a single source, staff performed a Price Analysis. The Price Analysis consisted of market research, engineering and price estimating assessments, and historical price comparisons for similar purchases. Based on staff's Price Analysis it was determined that the total proposed price was fair and reasonable.

Proposer Name	Proposal Amount	Metro ICE
Knorr Brake Company	$4,546,031	$4,360,228

D. Background on Recommended Contractor

Knorr Brake Company (KBC) founded in 1971 is a subsidiary of Knorr Bremse AG. Knorr Bremse, an international group of industrial companies, is a manufacturer of braking systems and supplier of additional sub-systems for rail and commercial vehicles for over 110 years. KBC located in Westminster, MD is the North American Mass Transit brake division of Knorr Bremse and the principal engineering and manufacturing facility. KBC is the OEM of the braking systems for Metro's P2020 Nippon Sharyo Blue Line rail cars and Metro Breda P2550 Gold Line rail cars. KBC has completed contracts for Valley Metro of Phoenix, AZ, Sacramento RTD, and Las Vegas Monorail last year and, currently, has contracts with Metropolitan Transit System, San Diego, Sacramento RTD, and Tri Met, Portland, OR. The firm completed a Metro contract in July 2015 and performed overhaul work for Metro's Blue Line vehicles in December 2016.

ATTACHMENT B

DEOD SUMMARY

P2550 AND P2020 FRICTION BRAKE SYSTEM OVERHAUL / MA24464000

A. Small Business Participation

The Diversity and Economic Opportunity Department (DEOD) did not establish a Disadvantaged Business Enterprise (DBE) goal for this solicitation. The P2550 and P2020 Friction Brake System Overhaul Kits are Original Equipment Manufacturer (OEM) products, and are shipped directly to Metro. Knorr Brake Company proposed to utilize the services of a non-DBE firm and did not make a DBE commitment.

B. Living Wage and Service Contract Worker Retention Policy Applicability

The Living Wage and Service Contract Worker Retention Policy is not applicable to this Contract.

C. Prevailing Wage Applicability

Prevailing wage is not applicable to this Contract.

D. Project Labor Agreement/Construction Careers Policy

Project Labor Agreement/Construction Careers Policy is not applicable to this Contract.

Overview of Items 23, 24, 25 and 30

System Safety, Security & Operations Committee

Metro

November 2017

Rail Vehicle Maintenance, Overhaul & Modernization

Maintenance	• Preserve level of performance
Overhaul	• Heavy maintenance repair/replacement at specific OEM intervals (age/mileage) • No change to the design
Modernization	• Improve systems and performance • Approximate mid-life • Upgrade the system designs

Metro

Fleet Plan 10 Year Horizon

Series	Maintenance	Overhaul	Modernize	Retire	Replace
P865	Yes	No	No	In process	P3010
P2020	Yes	Yes	No	Future	P3010
P2000	Yes	Yes	Yes	Future	Future
P2550	Yes	Yes	Yes	Future	Future
P3010	Yes	To be Scheduled	2030 ±	Future	Future
A650 Base	Yes	No	No	Future	HR4000 Base
A650	Yes	Yes	Yes	Future	HR4000 Option

Fleet Plan

❑ P2020 LRT Car Series

- **Delivered:** 15
- **Lines :** Blue and Expo Lines
- **Overhaul Program**
  - Ten components
  - Program LOP $ 30,000,000
  - Contract for air hose replacement - Completed
  - Contract for axle assembly, gearbox/roller, cab slider, body repair, seat removal for bikes, wheelchair, cameras and propulsion – On-Going
  - Contract for Friction Brake– Nov 2017 (Item 23)

❑ P2000 LRT Car Series

- **Delivered:** 52
- **Lines:** Green, Blue and Expo Lines
- **Overhaul Program**
  - Nine components
  - Program LOP $ 26,360,100
  - Contracts for air hose replacement and non-power axle bearing replacement – Completed 2012
  - Contracts for power axle, car battery, couple, exterior and interior paint – On-going
  - Contracts for Friction Brake and Air Compressor – Nov 2017 (Item 25)
- **Modernization**
  - Renew systems:
    - Carbody; Door; HVAC; Electrical; Propulsion; Trucks; Braking Equipment; Communication; Automatic Train Control; Trainline; Destination Signs
  - Exercise optional features (Item 30)
  - Contract to Alstom
  - LOP $160,800,000
  - Projected Completion August 2021

Metro

Fleet Plan

❑ P2550 LRT Car Series

- **Delivered:** 50
- **Lines :** Gold Line
- **Overhaul Program**
  - Nine components
  - Program LOP $ 35,007,540
  - Contracts for axle assemblies, and coupler awarded – June & Sept 2017
  - Contract for Friction Brake – Nov 2017 (Item 25)
  - Contracts for propulsion, pantograph, battery, doors, truck and suspension systems – Anticipated 2018/2019
- **Modernization**
  - Renew systems:
    - Carbody; Door; HVAC; Electrical; Propulsion; Trucks; Braking Equipment; Couplers; Communication; Battery
  - Specification Prep Phase
  - Contract to STV Incorporated (Item 24)
    - Consultant $1,421,086 –Nov 2017
  - Estimated LOP TBD
  - Projected Start 2020

❑ A650 Subway Car Series

- **Delivered:** 74
- **Lines :** Red Line
- **Overhaul Program**
  - Ten components
  - Program LOP $ 30,000,000
  - Contracts for air compressor, HVAC compressor, passenger door, and car battery replacement – Completed
  - Contracts for friction brake, traction motor, gearbox, coupler, AC, and DC – On-Going
- **Modernization**
  - Renew systems:
    - Propulsion; Trucks; Friction Brakes; Doors; Communication; Interiors; Signal System, HVAC
  - Design and engineering phase
  - Contract to Talgo
  - LOP $72,970,494
  - Projected Completion December 2021


Thank you
Metro

Los Angeles County
Metropolitan Transportation
Authority
One Gateway Plaza
3rd Floor Board Room
Los Angeles, CA

Metro

Board Report

File #: 2017-0499, **File Type:** Oral Report / Presentation **Agenda Number:** 26.

SYSTEM SAFETY, SECURITY AND OPERATIONS COMMITTEE
NOVEMBER 16, 2017

SUBJECT: OPERATIONS EMPLOYEE OF THE MONTH

RECOMMENDATION

Operations Employee of the Month.

DISCUSSION

Operations Employee of the Month recognizes Transportation and Maintenance frontline employees for their outstanding leadership contributions to the Operations Department.

ITEM 26

November
Employees of the Month

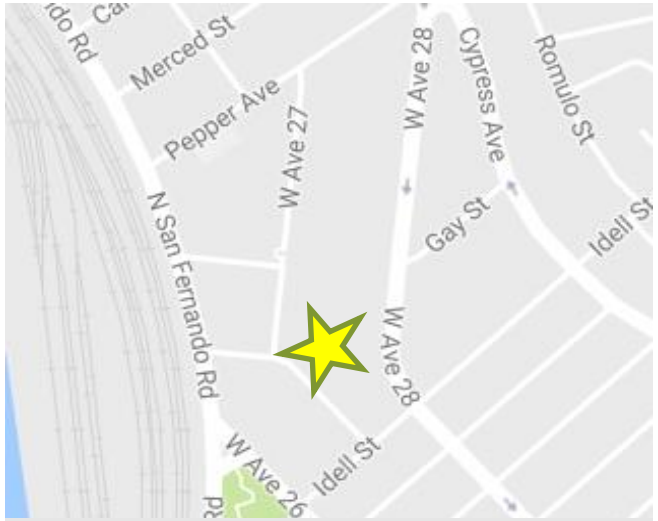
Metro

Employees of the Month

Transportation

Bus Operator

Enrique Aguilera

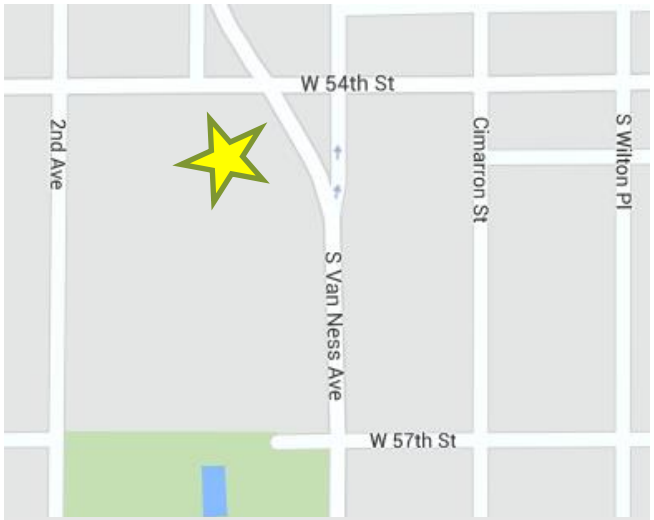


Division 3 – Los Angeles

Maintenance

Service Attendant Leader

Michael Ashford



Division 5 – Los Angeles

Metro

Los Angeles County
Metropolitan Transportation
Authority
One Gateway Plaza
3rd Floor Board Room
Los Angeles, CA

Metro

Board Report

File #: 2017-0500, **File Type:** Oral Report / Presentation **Agenda Number:** 27.

SYSTEM SAFETY, SECURITY AND OPERATIONS COMMITTEE
NOVEMBER 16, 2017

SUBJECT: ORAL REPORT ON SYSTEM SAFETY, SECURITY AND OPERATIONS

RECOMMENDATION

RECEIVE oral report on Metro's NextGen Bus Study.

DISCUSSION

The presentation includes status of consultant contract award for the systemwide bus network restructure (to be done at the same meeting under an Action item), stakeholder engagement and public outreach plan, and project committee structure.

ITEM 27

Rail Service Disruptions
&
NextGen Bus Study Outreach

System Safety, Security & Operations Committee

COO Report

November 2017

Metro

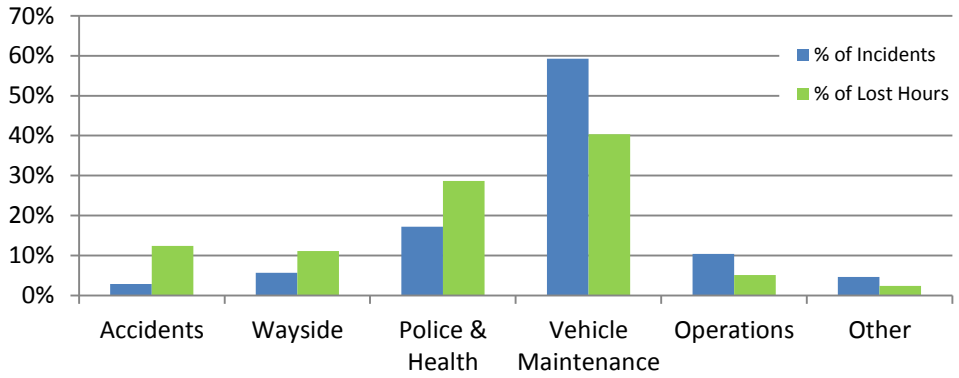
CAUSES OF RAIL SERICE DELAYS

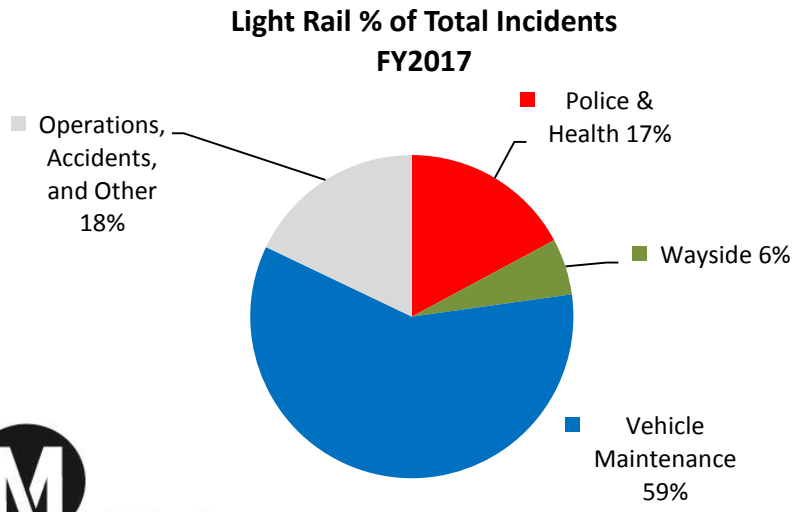
- Rail Vehicles Failures
  (e.g. doors, brakes, propulsion)
- Police & Health
  (e.g. customer altercations, sickness)
- Accidents
  (e.g. traffic)
- Operations
  (e.g. single tracking, terminal departures, customers)
- Wayside Failures
  (e.g. track, power, signals, other infrastructure)

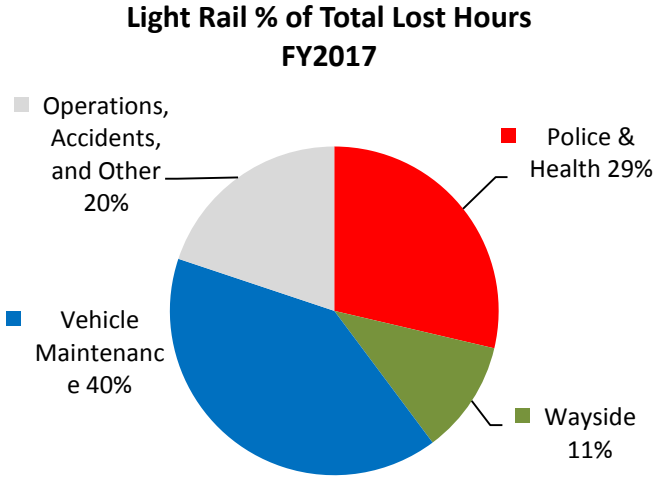
Metro

FY17 LRT INCIDENTS AND LOST HOURS

	% of Incidents	% of Lost Hours
Accidents	3%	12%
Wayside	6%	11%
Police & Health	17%	29%
Vehicle Maintenance	59%	40%
Operations	10%	5%
Other	5%	2%
Total	100%	100.0%



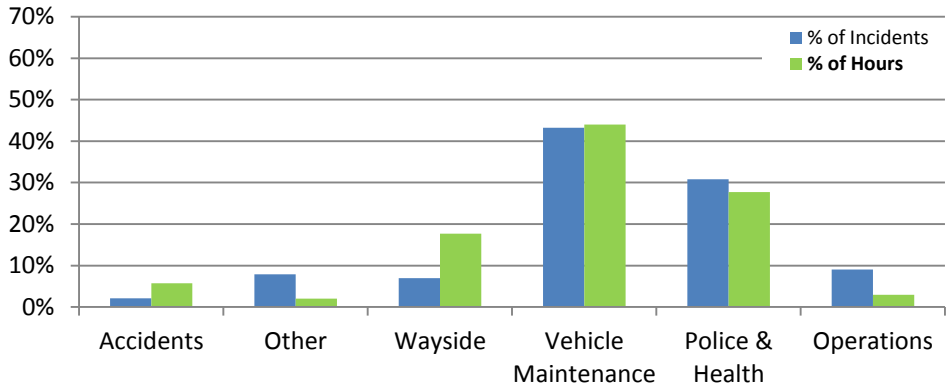




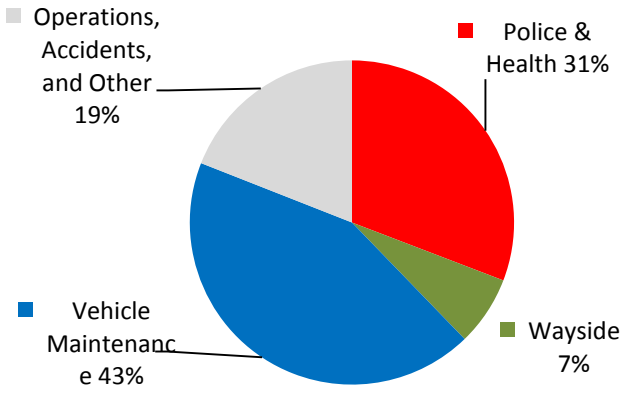
Metro

FY17 HRT INCIDENTS AND LOST HOURS

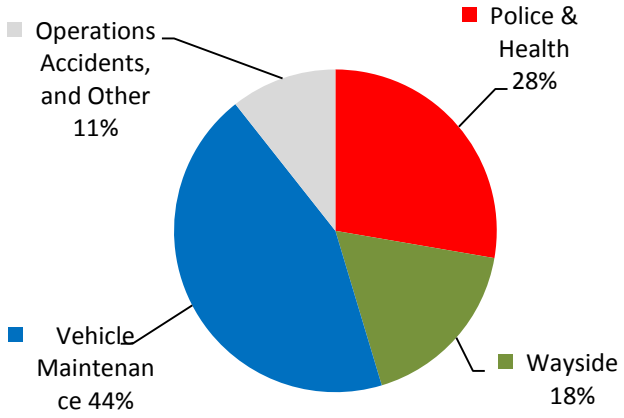
	% Incidents	% Lost Hours
Accidents	2%	6%
Other	8%	2%
Wayside	7%	18%
Vehicle Maintenance	43%	44%
Police & Health	31%	28%
Operations	9%	3%
Total	100%	100.0%



Heavy Rail % of Total Incidents FY2017



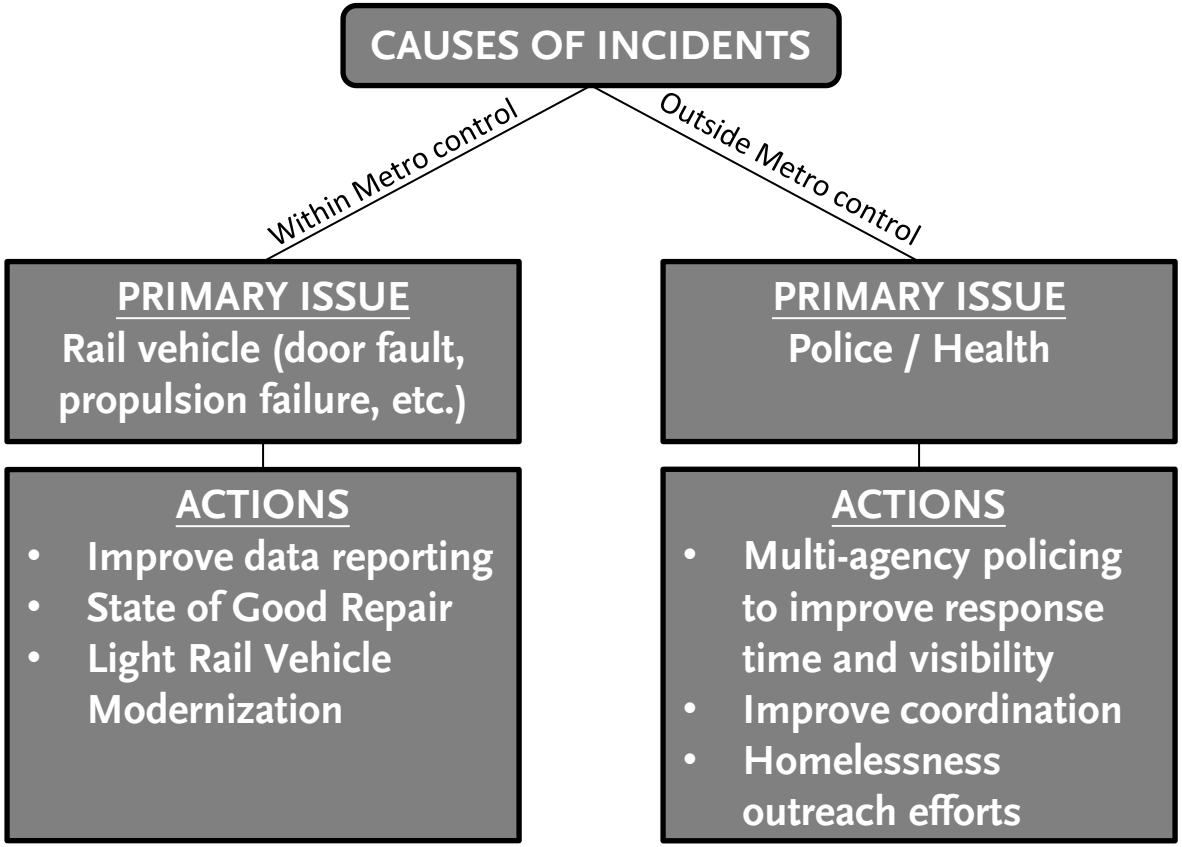
Heavy Rail % of Total Lost Hours FY2017



Metro

PREVENTING INCIDENTS

Minimizing delays caused by incidents is essential to providing safe and reliable transit service for our customers



Metro

MITIGATING INCIDENTS

When incidents occur that delay service, Metro must place customers first by making every effort to get them to their destinations safely with minimal impact.

INCIDENT OCCURS

MINIMIZE DURATION

- Scenario based planning exercises to prepare staff for incidents
- Incident Commander to coordinate/deploy support
- Post incident debrief/ review for major events

COMMUNICATIONS

- Internal coordination between various departments to immediately address incident
- External communications to keep customers updated, answer questions, and assist in customer support

TRANSPORT CUSTOMERS

- Deploy bus bridge to transport customers to the next accessible station to complete their trip

Metro

NEXTGEN Bus Study

Outreach Overview

Metro

Overview

Goal: Reimagine Metro's bus network to be more relevant, reflective of, and attractive to diverse customer needs.

Existing bus network is misaligned with current travel demand:

- Changing travel patterns and access to and from transit
- Shifts in demographics/lifestyles and changing workforce travel behavior
- Slower overall travel times (including wait times) and reliability issues
- New travel options such as mobility on-demand

Outreach to various audiences is critical to success:

- General Public
- Service Councils
- NextGen Working Group
- Technical Advisory Committee
- Internal Working Group

Metro

Project Phases

Project Phase	Objective	Deliverable
Travel Markets	Comprehensive understanding of current and potential riders, what travel attributes are important and what their travel patterns are	Board approval of service priorities based on market needs
Service Concept (network)	Establish service concepts and strategies that most effectively and efficiently address service priorities within available resources	Board approval of a Regional Service Concept and measures of success
Service Plan (line by line)	Restructure routes and schedules based on the guidelines from the Regional Service Concept	Service Council approval of specific route and schedule changes from the redesigned bus network
Implementation	Launch new bus network to current, potential and future riders	Provide information and support to customers navigating the new network

Metro

Collaborate and Involve

Travel Markets:

- Supplement/validate market research and travel demand analysis through public engagement
- Collaborate with Board, Service Councils and NextGen Working Group on identifying various travel markets, and how to prioritize them for transit service
- Coordinate with internal plans and programs (Strategic Plan, LRTP, etc.)

Service Concept:

- Educate the public, Board, Service Councils and NextGen Working Group about service design trade-offs, and collaborate to establish service design guidance
- Involve Board, Service Councils and NextGen Working Group in developing a regional service concept
- Involve groups on establishing measures of success that balance internal (Metro) and external (customer) expectations

Metro

Consult and Inform

Service Plan:

- Consult with the public on specific route and schedule proposals
- Consult with municipal operators and local jurisdictions on service recommendations and transit supportive street improvements
- Inform Board, Service Councils and NextGen Working Group on the expected outcomes based on established measures of success

Implementation:

- Inform the public about upcoming service implementation schedule and support them through the transition to new services
- Coordinate implementation with internal departments, municipal operators, and local jurisdictions
- Provide updates on implementation, issues and initial results to Board, Service Council and NextGen Working Group

Metro

Schedule

Outreach Schedule by Phase

Project Phase	Timeline	Activities
Travel Markets	Winter/Spring 2018	• Public Input (e.g. surveys, focus groups) • Working group meetings (est. 2-3 per quarter)
Service Concept	Spring/Summer 2018	• Public Feedback (e.g. telephone town hall, web based interactive page) • Working group meetings (est. 1-2 per quarter)
Service Plan	Winter/Spring 2019	• Public feedback (e.g. telephone town hall, web based interactive page) • Public hearings (Service Councils) • Briefings to provide updates to working groups
Implementation	Fall 2019	• Targeted promotion (e.g. Take Ones, web based, brochures) • Ambassadors at key locations (e.g. Blue Shirts and other Metro staff) • Coordinate with partner agencies

Thank You

Metro

Los Angeles County
Metropolitan Transportation
Authority
One Gateway Plaza
3rd Floor Board Room
Los Angeles, CA

Metro

Board Report

File #: 2017-0722, **File Type:** Informational Report **Agenda Number:** 28.

**SYSTEM SAFETY, SECURITY AND OPERATIONS COMMITTEE
NOVEMBER 16, 2017**

SUBJECT: MONTHLY UPDATE ON TRANSIT POLICING PERFORMANCE

ACTION: RECEIVE AND FILE

RECOMMENDATION

RECEIVE AND FILE monthly update on Transit Policing Performance.

ISSUE

This report reflects September 2017 performance data as reported under the transit policing deployment strategy which is a combination of in-house fare compliance officers, private security for fixed assets and a multi-agency law enforcement deployment strategy by the Los Angeles Police Department (LAPD), Los Angeles County Sheriff's Department (LASD) and Long Beach Police Department (LBPD). The information in this report summarizes system-wide Part 1 and Part 2 crime data, average emergency response times, assaults on bus operators and Metro's fare compliance and homeless outreach efforts. Six Key Performance Indicators (KPI) which are System Wide Part 1 and Part 2 Crimes, Average Emergency Response Times, Percentage of Time Spent on the System, Ratio of Staffing Levels vs Vacant Assignments, Ratio of Proactive vs Dispatched Activity, and Number of Grade Crossing Operations. (Attachment C).

DISCUSSION

For September 2017, the crime stats are as follows:

Part 1 and Part 2

Part 1 crime activity is up by 4.2% system-wide compared to the same period last year. In a monthly contrast, there were 11 fewer Part 1 crimes in September than in August, resulting in 6.9% decrease.

Part 2 crime activity is down by 21.7% system-wide compared to the same period last year. In a monthly contrast, there were 27 fewer Part 2 crimes in September than in August, resulting in 21% decrease.

As our law enforcement partners, fare compliance officers and private security officers continue their proactive work, crime activity is being addressed in real-time instead of relying solely on citizen

generated 911 calls. Over time, proactive activity will assist in reducing criminal activity across the system.

Bus Operator Assaults
There were a total of 6 Bus Operator Assaults. Comparing the Bus Operator Assaults from the same period last year, there were 8 Bus Operator Assaults, which resulted in a 25% decrease. In a monthly contrast, there was 1 more Bus Operator Assault in September than in August, resulting in 20% increase.

Average Emergency Response Times
Emergency response times averaged 5.86 minutes for the month of September.

Physical Security Improvements:
Metro is moving forward in awarding a physical security contract that will focus on providing an assessment on our facilities. The contractor will provide a baseline assessment of the threats and vulnerabilities that currently exist. We continue to move forward in testing and acquiring new technology to identify threats. In August we tested the Evolv scanner which uses millimeter wave scanners combined with metallic sensors to detect objects. Arrangements are being made to purchase two devices that will scan people entering the Gateway building. TSA and Metro joined in testing a passive millimeter wave anomaly device at the Gateway lobby in July and now will test it under challenging conditions at 7th and Metro in December. Lastly, a test of a drone with video capability will also take place at our rail yards in November.

Significant Activities:

Los Angeles Police Department
- **9/23/17-** Officers were flagged down by a victim of a battery while waiting for a bus along Wilshire Blvd. The officers were able locate the suspect who was detained and arrested.

- **9/24/17-** A patron informed the operator of northbound Blue Line train that they had been punched by another patron. The operator alerted officers who located and arrested the suspect.

- **9/26/17-** A patron waiting at the Green Line Avalon Station flagged down and alerted officers about another patron in possession of a handgun.. The officers were able to take the suspect into custody without incident. A BB gun was recovered from suspect.

Los Angeles County Sheriff's Department
- **9/7/17-** Deputies arrested a suspect that had a warrant at the Blue Line Compton Station. Upon the arrest, deputies discovered that the suspect was in possession of a loaded firearm.

- **9/8/17-** Deputies arrested a suspect at the Green Line El Segundo Station for multiple penal code violations.

- **9/29/17-** Deputies responded to Green Line El Segundo Station regarding two Metro fare compliance officers being threatened with a knife. A suspect was detained and arrested without further incident.

Long Beach Police Department

- **9/1/17-** Officers were dispatched to the Blue Line Anaheim Station regarding a stabbing. A witness guided officers to the suspect's location; the suspect was arrested without incident.

- **9/13/17-** Officers were dispatched to assist a security officer who was attacked while interacting with an intoxicated individual at the Blue Line Pacific Coast Highway Station. The suspect was arrested for battery.

- **9/29/17-** Officer noticed a Blue Line train stopped and blocking the intersection of Wardlow Road and Pacific Place. Officers noted that a pedestrian stepped in front of the train and died as a result of their injuries.

Community and Problem Oriented Policing Activities:

Transit Law Enforcement attended the following community events during the month of September, Metro Regional Law Enforcement Working Group and Ozzie's Birthday Bash (Orthopedic Institute for Children- Expo Line- Ortho Trade Tech Shop).

Metro's Ongoing Homelessness Outreach Efforts:

Metro continues to implement our Transit Homeless Action Plan to address the homelessness on Metro system and properties. The Action Plan places priority on enhancing the customer experience, improving public safety, and providing coordinated and responsive outreach to the homeless community. As noted in the October 2017 Committee Report on Metro's Ongoing Homeless Outreach Efforts, Metro continues to manage the implementation of our two multi-disciplinary County City Community (C3) homeless outreach teams and their coordination with law enforcement.

Metro Encampment Protocol and Actions:

County Council is in the process of reviewing a broad County-wide encampment protocol in consideration of our three law enforcement agencies. Metro's first priority is to address any criminal activity, trailed by establishing a lasting impact when a clean-up occurs-as many encampments jump property lines and require infrastructure amendment so that encampments do not return.

Encampment Clean-Ups for September Include:

- 6700 Marmion Way off the Metro Gold Line
- 7400 Marmion Way off the Metro Gold Line

- 8810 Canoga Station Under Bridge - Metro Asset Property
- 9880 San Fernando - Metro Asset Property

Future Encampment Clean-ups Include:

- Raymer/ Kester - Metro Asset Property

Metro's C3 Homeless Outreach Teams-One Year Pilot Program:

Metro's C3 Outreach Teams began their outreach on May 2017. The C3 teams provide their services on the Red Line exclusively Monday through Friday, 7a.m. to 4p.m. This is due to homeless demand and at the recommendation of the Department of Health Services. The C3 teams' outreach has resulted in the following data reports for the month of September 2017. Fiscal year to date figures identify those whom have been helped from May 2017 through September 2017. Metro is considering expanding the pilot program to include additional outreach teams to cover additional Metro service area.

C3 Homeless Outreach May 22, 2017 through September 30, 2017:

Performance Measure	Monthly Number Served	Fiscal Year to Date Number Served
Number of initiated contacts with unduplicated individuals	142	1610
Number of Unduplicated individuals engaged	149	1254
Number of Unduplicated individuals provided services (obtaining vital documents, follow-up activities, transportation, CES packet, clinical assessment, etc.) or successful referral (supportive services, benefits linkage etc.)	90	493
Number of unduplicated individuals engaged who are successfully linked to an interim housing resource	37	94
Number of unduplicated individuals engaged who are linked to a permanent housing resource	37	166
Number of unduplicated individuals engaged who are permanently housed	4	8

C3 Coordination with Law Enforcement

With Metro System Security and Law Enforcement personnel as the lead, Metro's C3 teams coordinate with LAPD's Homeless Outreach and Protective Engagement (HOPE) Teams, LASD's Mental Evaluation Teams (MET), Long Beach PD, and Metro's Transit Security Officers, in an effort to engage the homeless and provide placement into services. These law enforcement entities provide gap service to Red Line when the C3 Teams are off duty and provide outreach support for the rest of the system that is not part of pilot program. LASD's MET teams consist of Deputies paired with clinicians and the Department of Health LAPD's HOPE teams consist of Officers who partner with LAHSA, the LA City Attorney's Office and the LA City Department of Sanitation for homeless response. Below are their contacts and outreach efforts for September 2017.

Los Angeles Police Department HOPE Teams

The LAPD Transit Bureau homeless outreach totals the HOPE team contacts plus the patrol / Transit Services Division (TSD). Therefore, LAPD's September 2017 homeless outreach is the following:

Action	HOPE	TSD	TOTAL
Contacts	181	165	346
Referrals	57	5	62
5150 Hold	1	6	7
Mental Illness	35	8	43
Substance Abuse	23	2	25
Veterans	9	2	11
Shelter	0	0	0
Motel With Housing Plan	0	0	0
VA Housing	1	1	2
Return To Family	0	0	0
Transitional Long Term Housing	2	0	2
Detox	0	0	0
Rehab	0	0	0

Sheriff Mental Evaluation Team (MET) Contacts and Efforts

Location/Action	Contacts
Bus Contacts	68
Rail Contacts	334
DMS Contacts	00
TOTAL CONTACTS	**402**
MTA Locations Checked	934
Transports to Outreach Services	46
5150 WIC Transports	12

Long Beach Police Department Long Beach Police Department Metro Transportation Section Officers worked additional overtime hours to transport a family to a homeless shelter.

ATTACHMENTS

Attachment A - System-Wide Law Enforcement Overview September 2017
Attachment B - MTA Supporting Data_Sep 2017
Attachment C - Key Performance Indicators September

Prepared by: Alex Z Wiggins, Chief, System Security and Law Enforcement, (213) 922-4433
Reviewed by: Stephanie Wiggins, Deputy Chief Executive Officer, (213) 922-1023

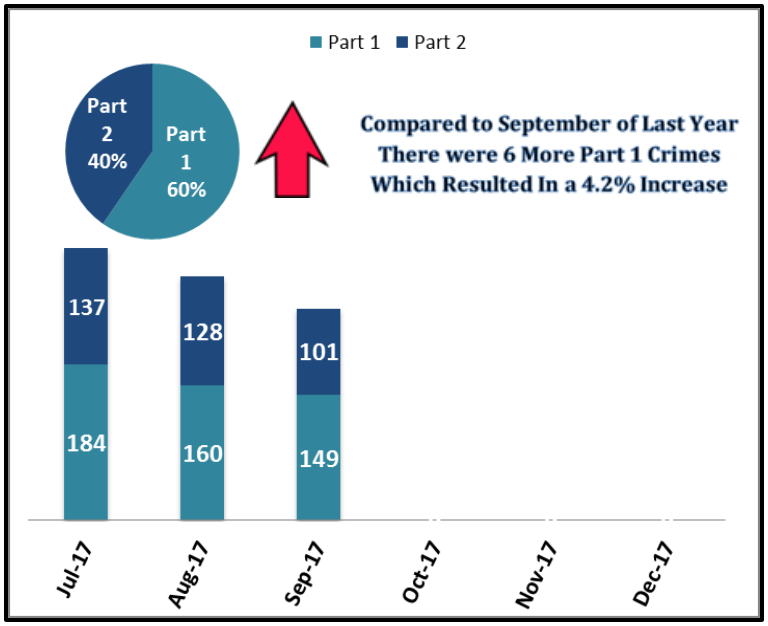
Phillip A. Washington
Chief Executive Officer

SYSTEM-WIDE LAW ENFORCEMENT OVERVIEW

SEPTEMBER 2017

ATTACHMENT A

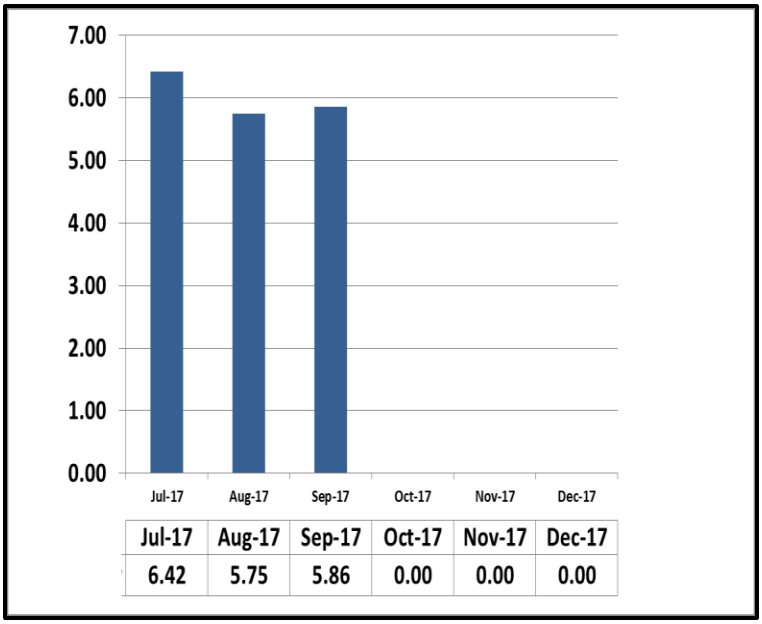
Part 1 & Part 2 Crimes



For the month of September 2017, Part 1 crime activity is up by 4.2% system-wide compared to the same period last year. In a monthly contrast, there were 11 fewer Part 1 crimes in September than in August, resulting in 6.9% decrease.

Part 2 crime activity is down by 21.7% system-wide compared to the same period last year. In a monthly contrast, there were 27 fewer Part 2 crimes in September than in August, resulting in 21% decrease.

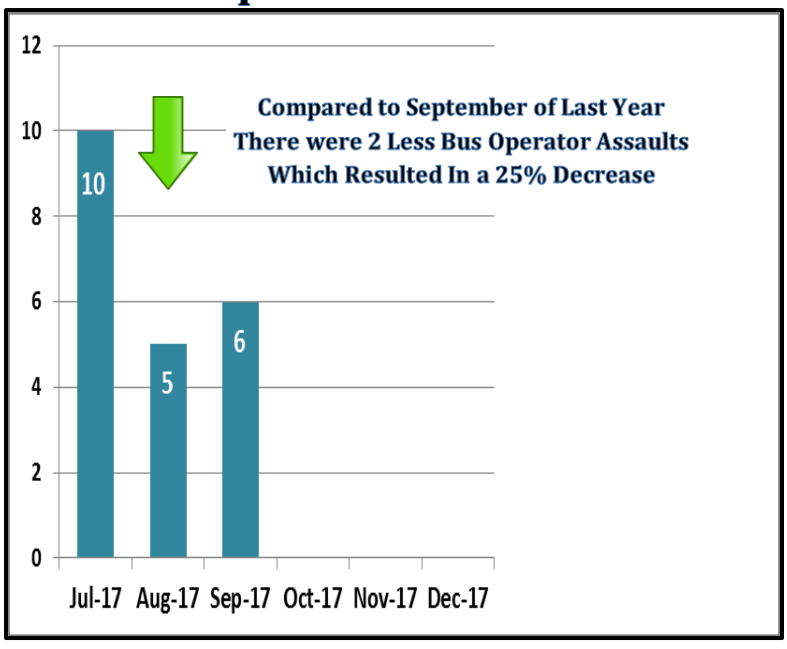
Average Emergency Response Times



Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17
6.42	5.75	5.86	0.00	0.00	0.00

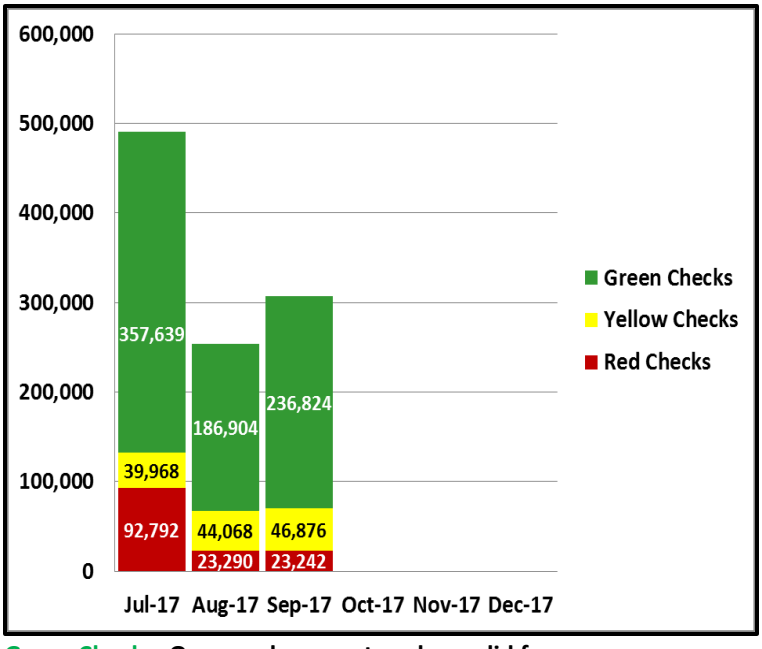
Average emergency response times were 5.86 mins

Bus Operator Assaults



There were a total of 6 Bus Operator Assaults. Comparing the Bus Operator Assaults from the same period last year, there were 8 Operator Assaults last year, which resulted in a 25% decrease.

Fare Compliance



Green Checks- Occurs when a patron has valid fare

Yellow Checks- Occurs when a patron has valid fare, but did not tap at transfer station

Red Checks- Occurs when a patron has invalid fare

Blue Line - September 2017

REVISED

ATTACHMENT B

REPORTED CRIME				
PART 1 CRIMES	**LAPD**	**LASD**	**LBPD**	**FYTD**
Homicide	0	0	0	0
Rape	0	0	0	1
Robbery	0	1	0	14
Agg Assault	0	1	1	17
Agg Assault on Op	0	0	0	0
Burglary	0	0	0	1
Larceny	0	3	5	29
Bike Theft	1	0	0	3
Motor Vehicle Theft	0	3	1	4
Arson	0	0	0	1
SUB-TOTAL	**1**	**8**	**7**	**70**
Selected Part 2 Crimes				
Battery	1	3	4	29
Battery Rail Operator	0	0	0	0
Sex Offenses	0	0	0	4
Weapons	0	2	0	6
Narcotics	0	2	4	17
Trespassing	0	0	0	5
Vandalism	0	0	2	8
SUB-TOTAL	**1**	**7**	**10**	**69**
TOTAL	**2**	**15**	**17**	**139**

PART 1 CRIMES PER STATION		
Station	**SEPTEMBER**	**FYTD**
7th/Metro	**1**	**1**
Pico	**0**	**0**
Grand	**0**	**0**
San Pedro	**0**	**0**
Washington	**0**	**3**
Vernon	**0**	**0**
Slauson	**0**	**2**
Florence	**0**	**5**
Firestone	**0**	**7**
103rd St	**0**	**1**
Willowbrook	**4**	**10**
Compton	**1**	**6**
Artesia	**1**	**7**
Del Amo	**2**	**4**
Wardlow	**1**	**3**
Willow	**2**	**4**
PCH	**1**	**5**
Anaheim	**1**	**5**
5th St	**0**	**1**
1st St	**0**	**0**
Transit Mall	**2**	**6**
Pacific	**0**	**0**
Rail Yard	**0**	**0**
Total	**16**	**70**

Blue Line Highlights

The Blue Line had 12 less Part 1 crimes than the same period last year (28), which is a 42.9% decrease

ARRESTS				
TYPE	**LAPD**	**LASD**	**LBPD**	**FYTD**
Felony	0	5	14	73
Misdemeanor	0	16	105	380
TOTAL	**0**	**21**	**119**	**453**

CITATIONS				
TYPE	**LAPD**	**LASD**	**LBPD**	**FYTD**
Other Citations	12	4	80	587
Vehicle Code Citations	8	28	88	374
TOTAL	**20**	**32**	**168**	**961**

CALLS FOR SERVICE				
TYPE	**LAPD**	**LASD**	**LBPD**	**FYTD**
Routine	**N/A***	78	7	263
Priority	**N/A***	126	72	584
Emergency	**N/A***	16	42	214
TOTAL	**0**	**220**	**121**	**1,061**
*Currently unable to report stats by Rail Line				

DISPATCHED VS. PROACTIVE			
TYPE	**LAPD**	**LASD**	**LBPD**
Dispatched	35%	5%	10%
Proactive	65%	95%	90%
TOTAL	**100%**	**100%**	**100%**

PERCENTAGE OF TIME ON THE RAIL SYSTEM	
LINE	**SEPTEMBER**
Blue Line-LAPD	**98%**
Blue Line-LASD	**91%**
Blue Line-LBPD	**70%**

GRADE CROSSING OPERATIONS				
LOCATION	**LAPD**	**LASD**	**LBPD**	**FYTD**
Washington St	71			73
Flower St	29			32
103rd St	5			5
Wardlow Rd			1	2
Long Beach Blvd			3	4
TOTAL	**105**	**0**	**4**	**116**

LEGEND
Los Angeles Police Department
Los Angeles County Sheriff's Department
Long Beach Police Department

Green Line - September 2017

REPORTED CRIME			
PART 1 CRIMES	**LAPD**	**LASD**	**FYTD**
Homicide	0	0	0
Rape	0	0	0
Robbery	1	1	17
Agg Assault	0	4	6
Agg Assault on Op	0	0	0
Burglary	0	0	2
Larceny	0	4	15
Bike Theft	0	1	2
Motor Vehicle Theft	0	1	10
Arson	0	0	0
SUB-TOTAL	**1**	**11**	**52**
Selected Part 2 Crimes			
Battery	0	4	9
Battery Rail Operator	0	0	0
Sex Offenses	0	0	0
Weapons	0	2	4
Narcotics	0	3	6
Trespassing	0	3	3
Vandalism	0	0	6
SUB-TOTAL	**0**	**12**	**28**
TOTAL	**1**	**23**	**80**

PART 1 CRIMES PER STATION		
Station	**SEPTEMBER**	**FYTD**
Redondo Beach	**2**	**3**
Douglas	**0**	**1**
El Segundo	**0**	**1**
Mariposa	**0**	**0**
Aviation	**0**	**0**
Hawthorne	**1**	**2**
Crenshaw	**0**	**3**
Vermont	**0**	**4**
Harbor	**1**	**5**
Avalon	**0**	**1**
Willowbrook	**1**	**9**
Long Beach	**1**	**7**
Lakewood	**2**	**11**
Norwalk	**4**	**5**
Total	**12**	**52**

ARRESTS			
TYPE	**LAPD**	**LASD**	**FYTD**
Felony	0	6	27
Misdemeanor	0	14	74
TOTAL	**0**	**20**	**101**

CITATIONS			
TYPE	**LAPD**	**LASD**	**FYTD**
Other Citations	13	7	40
Vehicle Code Citations	1	27	112
TOTAL	**14**	**34**	**152**

CALLS FOR SERVICE			
TYPE	**LAPD**	**LASD**	**FYTD**
Routine	**N/A***	70	250
Priority	**N/A***	68	187
Emergency	**N/A***	8	49
TOTAL	**0**	**146**	**486**
*Currently unable to report stats by Rail Line			

DISPATCHED VS. PROACTIVE		
TYPE	**LAPD**	**LASD**
Dispatched	32%	3%
Proactive	68%	97%
TOTAL	**100%**	**100%**

PERCENTAGE OF TIME SPENT ON THE RAIL SYSTEM	
LINE	**SEPTEMBER**
Green Line-LAPD	**99%**
Green Line-LASD	**88%**

LEGEND
Los Angeles Police Department
Los Angeles County Sheriff's Department

Green Line Highlights

There was no change in Part 1 crimes compared to the same period last year

Expo Line - September 2017

REPORTED CRIME			
PART 1 CRIMES	**LAPD**	**LASD**	**FYTD**
Homicide	0	0	0
Rape	0	0	0
Robbery	3	1	8
Agg Assault	2	0	3
Agg Assault on Op	0	0	0
Burglary	0	0	0
Larceny	5	1	27
Bike Thefts	2	2	8
Motor Vehicle Theft	0	0	0
Arson	0	0	0
SUB-TOTAL	**12**	**4**	**46**
Selected Part 2 Crimes			
Battery	4	1	8
Battery Rail Operator	0	0	0
Sex Offenses	0	0	1
Weapons	0	0	0
Narcotics	0	0	0
Trespassing	0	0	0
Vandalism	0	0	1
SUB-TOTAL	**4**	**1**	**10**
TOTAL	**16**	**5**	**56**

PART 1 CRIMES PER STATION		
Station	**SEPTEMBER**	**FYTD**
7th/Metro	**0**	**3**
Pico	**0**	**1**
23rd St	**0**	**0**
Jefferson/USC	**1**	**2**
Expo/USC	**0**	**2**
Expo/Vermont	**1**	**4**
Expo/Western	**5**	**9**
Expo/Crenshaw	**1**	**2**
Farmdale	**2**	**2**
La Brea	**1**	**2**
La Cienega	**0**	**3**
Culver City	**2**	**7**
Palms	**0**	**0**
Expo/Westwood	**0**	**2**
Expo/Sepulveda	**0**	**1**
Expo/Bundy	**1**	**1**
26th St /Bergamot	**1**	**2**
17th St/SMC	**0**	**1**
D/T Santa Monica	**1**	**2**
Expo Rail Yard	**0**	**0**
Total	**16**	**46**

ARRESTS			
TYPE	**LAPD**	**LASD**	**FYTD**
Felony	1	0	6
Misdemeanor	0	0	6
TOTAL	**1**	**0**	**12**

CITATIONS			
TYPE	**LAPD**	**LASD**	**FYTD**
Other Citations	14	0	29
Vehicle Code Citations	0	0	2
TOTAL	**14**	**0**	**31**

CALLS FOR SERVICE			
TYPE	**LAPD**	**LASD**	**FYTD**
Routine	**N/A***	33	103
Priority	**N/A***	28	69
Emergency	**N/A***	0	9
TOTAL	**0**	**61**	**181**
*Currently unable to report stats by Rail Line			

DISPATCHED VS. PROACTIVE		
TYPE	**LAPD**	**LASD**
Dispatched	40%	4%
Proactive	60%	96%
TOTAL	**100%**	**100%**

PERCENTAGE OF TIME SPENT ON THE RAIL SYSTEM	
LINE	**SEPTEMBER**
Expo Line-LAPD	**58%**
Expo Line-LASD	**85%**

GRADE CROSSING OPERATIONS			
LOCATION	**LAPD**	**LASD**	**FYTD**
Exposition Blvd	30		33
TOTAL	**30**	**0**	**33**

LEGEND
Los Angeles Police Department
Los Angeles County Sheriff's Department

Expo Line Highlights

The Expo Line had 13 less Part 1 crimes than the same period last year (29), which is a 44.8% decrease

Red Line - September 2017

REPORTED CRIME		
PART 1 CRIMES	**LAPD**	**FYTD**
Homicide	0	0
Rape	0	1
Robbery	9	16
Agg Assault	1	4
Agg Assault on Op	0	0
Burglary	0	0
Larceny	2	14
Bike Theft	0	0
Motor Vehicle Theft	0	13
Arson	0	0
SUB-TOTAL	**12**	**48**
Selected Part 2 Crimes		
Battery	11	34
Battery Rail Operator	0	0
Sex Offenses	2	6
Weapons	0	0
Narcotics	0	0
Trespassing	0	1
Vandalism	1	2
SUB-TOTAL	**14**	**43**
TOTAL	**26**	**91**

PART 1 CRIMES PER STATION		
Station	**SEPTEMBER**	**FYTD**
Union Station	**0**	**2**
Civic Center	**0**	**2**
Pershing Square	**0**	**2**
7th/Metro	**0**	**0**
Westlake	**7**	**13**
Wilshire/Vermont	**1**	**2**
Wilshire/Normandie	**0**	**0**
Vermont/Beverly	**2**	**3**
Wilshire/Western	**0**	**0**
Vermont/Santa Monica	**0**	**3**
Vermont/Sunset	**0**	**2**
Hollywood/Western	**1**	**1**
Hollywood/Vine	**0**	**3**
Hollywood/Highland	**0**	**6**
Universal	**0**	**3**
North Hollywood	**1**	**6**
Red Line Rail Yard	**0**	**0**
Total	**12**	**48**

ARRESTS		
TYPE	**LAPD**	**FYTD**
Felony	1	5
Misdemeanor	1	13
TOTAL	**2**	**18**

CITATIONS		
TYPE	**LAPD**	**FYTD**
Other Citations	25	38
Vehicle Code Citations	1	1
TOTAL	**13**	**39**

CALLS FOR SERVICE	
TYPE	**LAPD**
Routine	**N/A***
Priority	**N/A***
Emergency	**N/A***
TOTAL	
*Currently unable to report stats by Rail Line	

DISPATCHED VS. PROACTIVE	
TYPE	**LAPD**
Dispatched	41%
Proactive	59%
TOTAL	**100%**

PERCENTAGE OF TIME SPENT ON THE RAIL SYSTEM	
LINE	**SEPTEMBER**
Red Line- LAPD	**99%**

LEGEND
Los Angeles Police Department

Red Line Highlights

The Red Line had 8 less Part 1 crime than the same period last year (20), which is a 40% decrease

Gold Line - September 2017

REPORTED CRIME			
PART 1 CRIMES	**LAPD**	**LASD**	**FYTD**
Homicide	0	0	0
Rape	0	0	0
Robbery	0	0	1
Agg Assault	0	0	1
Agg Assault on Op	0	0	0
Burglary	0	0	0
Larceny	1	2	11
Bike Theft	0	5	8
Motor Vehicle Theft	0	0	2
Arson	0	0	0
SUB-TOTAL	**1**	**7**	**23**
Selected Part 2 Crimes			
Battery	1	2	5
Battery Rail Operator	0	0	0
Sex Offenses	0	0	1
Weapons	0	0	1
Narcotics	0	0	1
Trespassing	0	0	0
Vandalism	1	0	3
SUB-TOTAL	**2**	**2**	**11**
TOTAL	**3**	**9**	**34**

PART 1 CRIMES PER STATION		
Station	**SEPTEMBER**	**FYTD**
APU/Citrus College	**1**	**2**
Azusa Downtown	**0**	**0**
Irwindale	**0**	**0**
Duarte	**0**	**1**
Monrovia	**3**	**5**
Arcadia	**0**	**0**
Sierra Madre	**0**	**0**
Allen	**0**	**0**
Lake	**0**	**0**
Memorial Park	**0**	**0**
Del Mar	**1**	**2**
Fillmore	**0**	**0**
South Pasadena	**0**	**0**
Highland Park	**0**	**1**
SW Museum	**0**	**0**
Heritage Square	**0**	**1**
Lincoln Heights	**0**	**0**
Chinatown	**0**	**1**
Union Station	**0**	**1**
Little Tokyo	**0**	**0**
Pico/Aliso	**0**	**2**
Mariachi	**0**	**0**
Soto	**1**	**0**
Indiana (both LAPD & LASD)	**1**	**1**
Maravilla	**0**	**0**
East La	**0**	**0**
Atlantic	**1**	**6**
Total	**8**	**23**

ARRESTS			
TYPE	**LAPD**	**LASD**	**FYTD**
Felony	0	2	7
Misdemeanor	0	6	41
TOTAL	**0**	**8**	**48**

CITATIONS			
TYPE	**LAPD**	**LASD**	**FYTD**
Other Citations	3	1	47
Vehicle Code Citations	0	21	81
TOTAL	**3**	**22**	**128**

CALLS FOR SERVICE			
TYPE	**LAPD**	**LASD**	**FYTD**
Routine	**N/A***	91	279
Priority	**N/A***	65	221
Emergency	**N/A***	5	23
TOTAL	**0**	**161**	**523**
*Currently unable to report stats by Rail Line			

DISPATCHED VS. PROACTIVE		
TYPE	**LAPD**	**LASD**
Dispatched	31%	5%
Proactive	69%	95%
TOTAL	**100%**	**100%**

PERCENTAGE OF TIME SPENT ON THE RAIL SYSTEM	
LINE	**SEPTEMBER**
Gold Line-LAPD	**99%**
Gold Line-LASD	**81%**

GRADE CROSSING OPERATIONS			
LOCATION	**LAPD**	**LASD**	**FYTD**
Marmion Way	50		57
Monrovia		6	6
TOTAL GOAL= 10	**50**	**6**	**63**

LEGEND
Los Angeles Police Department
Los Angeles County Sheriff's Department

Gold Line Highlights

The Gold Line had 1 more Part 1 crime than the same period last year (7), which is a 14.3% increase

Orange Line - September 2017

REPORTED CRIME		
PART 1 CRIMES	**LAPD**	**FYTD**
Homicide	0	0
Rape	0	0
Robbery	3	4
Agg Assault	0	3
Agg Assault on Op	0	0
Burglary	0	0
Larceny	2	2
Bike Theft	0	0
Motor Vehicle Theft	0	1
Arson	0	0
SUB-TOTAL	**5**	**10**
Selected Part 2 Crimes		
Battery	4	6
Battery Bus Operator	0	0
Sex Offenses	1	1
Weapons	0	0
Narcotics	0	0
Trespassing	0	0
Vandalism	0	1
SUB-TOTAL	**5**	**8**
TOTAL	**10**	**18**

PART 1 CRIMES PER STATION		
Station	**SEPTEMBER**	**FYTD**
North Hollywood	**2**	**5**
Laurel Canyon	**0**	**0**
Valley College	**0**	**0**
Woodman	**0**	**0**
Van Nuys	**2**	**2**
Sepulveda	**0**	**0**
Woodley	**0**	**0**
Balboa	**1**	**2**
Reseda	**0**	**0**
Tampa	**0**	**0**
Pierce College	**0**	**0**
De Soto	**0**	**0**
Canoga	**0**	**1**
Warner Center	**0**	**0**
Sherman Way	**0**	**0**
Roscoe	**0**	**0**
Nordhoff	**0**	**0**
Chatsworth	**0**	**0**
Total	**5**	**10**

ARRESTS		
TYPE	**LAPD**	**FYTD**
Felony	0	0
Misdemeanor	1	3
TOTAL	**1**	**3**

CITATIONS		
TYPE	**LAPD**	**FYTD**
Other Citations	339	367
Vehicle Code Citations	71	156
TOTAL	**410**	**523**

CALLS FOR SERVICE		
TYPE	**LAPD**	**FYTD**
Routine	**N/A***	**N/A***
Priority	**N/A***	**N/A***
Emergency	**N/A***	**N/A***
TOTAL	**0**	**0**

*Currently unable to report stats by Bus Rapid Transit Line

DISPATCHED VS. PROACTIVE	
TYPE	**LAPD**
Dispatched	40%
Proactive	60%
TOTAL	**100%**

PERCENTAGE OF TIME SPENT ON THE BUS SYSTEM	
LINE	**SEPTEMBER**
Orange Line- LAPD	**99%**

LEGEND

Los Angeles Police Department

Orange Line Highlights

The Orange Line had 1 less Part 1 crime than the same period last year (6), which is a 16.7% decrease

Silver Line - September 2017

REPORTED CRIME			
PART 1 CRIMES	**LAPD**	**LASD**	**FYTD**
Homicide	0	0	0
Rape	0	0	0
Robbery	0	0	0
Agg Assault	0	0	0
Agg Assault on Op	0	0	0
Burglary	0	0	0
Larceny	0	0	0
Bike Theft	0	0	0
Motor Vehicle Theft	0	0	0
Arson	0	0	0
SUB-TOTAL	**0**	**0**	**0**
Selected Part 2 Crimes			
Battery	0	0	0
Battery Bus Operator	0	0	0
Sex Offenses	0	0	0
Weapons	0	0	0
Narcotics	0	0	0
Trespassing	0	0	0
Vandalism	0	0	0
SUB-TOTAL	**0**	**0**	**0**
TOTAL	**0**	**0**	**0**

PART 1 CRIMES PER STATION		
Station	**SEPTEMBER**	**FYTD**
El Monte	**0**	**0**
Cal State LA	**0**	**0**
LAC/USC	**0**	**0**
Alameda	**0**	**0**
Downtown	**0**	**0**
37th St/USC	**0**	**0**
Slauson	**0**	**0**
Manchester	**0**	**0**
Harbor Fwy	**0**	**0**
Rosecrans	**0**	**0**
Harbor/Gateway	**0**	**0**
Carson	**0**	**0**
PCH	**0**	**0**
San Pedro	**0**	**0**
Total	**0**	**0**

ARRESTS			
TYPE	**LAPD**	**LASD**	**FYTD**
Felony	0	0	0
Misdemeanor	0	0	5
TOTAL	**0**	**0**	**5**

CITATIONS			
TYPE	**LAPD**	**LASD**	**FYTD**
Other Citations	318	0	361
Vehicle Code Citations	78	0	280
TOTAL	**396**	**0**	**641**

CALLS FOR SERVICE			
TYPE	**LAPD**	**LASD**	**FYTD**
Routine	**N/A***	1	4
Priority	**N/A***	1	4
Emergency	**N/A***	0	1
TOTAL	**0**	**2**	**9**
*Currently unable to report stats by Bus Rapid Transit Line			

DISPATCHED VS. PROACTIVE		
TYPE	**LAPD**	**LASD**
Dispatched	81%	5%
Proactive	19%	95%
TOTAL	**100%**	**100%**

PERCENTAGE OF TIME SPENT ON THE BUS SYSTEM	
LINE	**SEPTEMBER**
Silver Line- LAPD	**35%**
Silver Line- LASD	**58%**

LEGEND
Los Angeles Police Department
Los Angeles County Sheriff Department

Silver Line Highlights

The Silver Line had 1 less Part 1 crime than the same period last year (1), which is a 100% decrease

Bus Patrol - September 2017

REPORTED CRIME			
PART 1 CRIMES	**LASD**	**LAPD**	**FYTD**
Homicide	0	0	0
Rape	0	0	2
Robbery	0	16	69
Agg Assault	1	12	37
Agg Assault on Op	1	0	1
Burglary	0	2	2
Larceny	5	41	111
Bike Theft	1	1	4
Motor Vehicle Theft	0	0	17
Arson	0	0	0
SUB-TOTAL	**8**	**72**	**243**
Selected Part 2 Crimes			
Battery	1	27	122
Battery Bus Operator	1	4	19
Sex Offenses	2	2	24
Weapons	1	0	2
Narcotics	2	0	4
Trespassing	0	1	4
Vandalism	2	0	20
SUB-TOTAL	**9**	**34**	**195**
TOTAL	**17**	**106**	**438**

Bus Patrol

There were 40 more Part 1 crimes than the same period last year (40), which is a 100% increase

LASD's Part 1 Crimes per Sector		
Sector	**SEPTEMBER**	**FYTD**
Westside	2	3
San Fernando	0	0
San Gabriel Valley	5	9
Gateway Cities	0	0
South Bay	1	7
Total	**8**	**19**

LAPD's Part 1 Crimes per Sector		
Sector	**SEPTEMBER**	**FYTD**
Valley Bureau		
Van Nuys	0	4
West Valley	1	7
North Hollywood	2	8
Foothill	1	4
Devonshire	1	1
Mission	1	4
Topanga	0	2
Central Bureau		
Central	3	14
Rampart	6	13
Hollenbeck	1	4
Northeast	0	1
Newton	5	18
West Bureau		
Hollywood	2	3
Wilshire	8	14
West LA	2	5
Pacific	0	4
Olympic	10	23
Southwest Bureau		
Southwest	12	26
Harbor	2	10
77th Street	10	38
Southeast	5	21
Total	**72**	**224**
Total Part 1 Crimes	**80**	**243**

ARRESTS			
TYPE	**LASD**	**LAPD**	**FYTD**
Felony	2	4	16
Misdemeanor	20	4	107
TOTAL	**22**	**8**	**123**

CITATIONS			
TYPE	**LASD**	**LAPD**	**FYTD**
Other Citations	1	42	63
Vehicle Code Citations	80	10	310
TOTAL	**81**	**52**	**373**

CALLS FOR SERVICE			
TYPE	**LASD**	**LAPD**	**FYTD**
Routine	74	281	691
Priority	90	269	1,009
Emergency	7	84	321
TOTAL	**171**	**634**	**2,021**

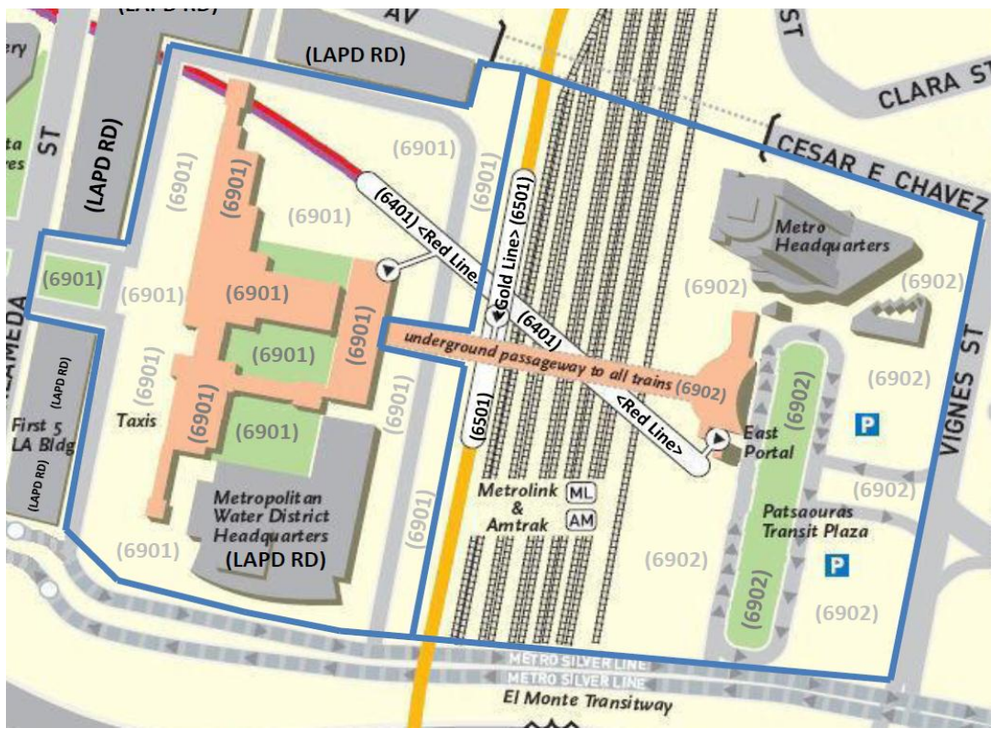
DISPATCHED VS. PROACTIVE		
TYPE	**LASD**	**LAPD**
Dispatched	1%	38%
Proactive	99%	62%
TOTAL	**100%**	**100%**

PERCENTAGE OF TIME SPENT ON THE BUS SYSTEM	
LINE	**SEPTEMBER**
LASD BUS	**85%**
LAPD BUS	**96%**

LEGEND
Los Angeles County Sheriff Department
Los Angeles Police Department

Union Station - September 2017

REPORTED CRIME		
PART 1 CRIMES	**LAPD**	**FYTD**
Homicide	0	0
Rape	0	0
Robbery	0	0
Agg Assault	0	4
Agg Assault on Op	0	0
Burglary	0	0
Larceny	2	12
Bike Theft	0	0
Motor Vehicle Theft	0	4
Arson	0	0
SUB-TOTAL	**2**	**20**
Selected Part 2 Crimes		
Battery	1	2
Battery Rail Operator	0	0
Sex Offenses	0	0
Weapons	0	0
Narcotics	0	0
Trespassing	0	0
Vandalism	0	0
SUB-TOTAL	**1**	**2**
TOTAL	**3**	**22**



Westside

Eastside

ARRESTS		
TYPE	**LAPD**	**FYTD**
Felony	0	6
Misdemeanor	0	15
TOTAL	**0**	**21**

CITATIONS		
TYPE	**LAPD**	**FYTD**
Other Citations	39	58
Vehicle Code Citations	1	1
TOTAL	**40**	**59**

CALLS FOR SERVICE		
TYPE	**LAPD**	**FYTD**
Routine	**N/A***	**N/A***
Priority	**N/A***	**N/A***
Emergency	**N/A***	**N/A***
TOTAL	**0**	**0**

*Currently unable to report stats by Union Station

DISPATCHED VS. PROACTIVE	
TYPE	**LAPD**
Dispatched	43%
Proactive	57%
TOTAL	**100%**

PERCENTAGE OF TIME SPENT AT UNION STATION	
LOCATION	**LAPD**
Union Station	97%
TOTAL	**97%**

Union Station Highlights

There was no change in Part 1 crimes compared to the same period last year

LEGEND

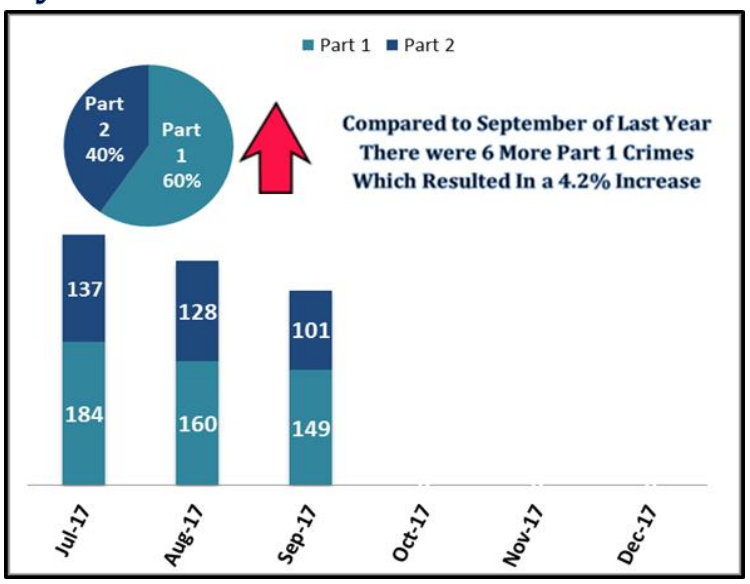
Los Angeles Police Department

Key Performance Indicators

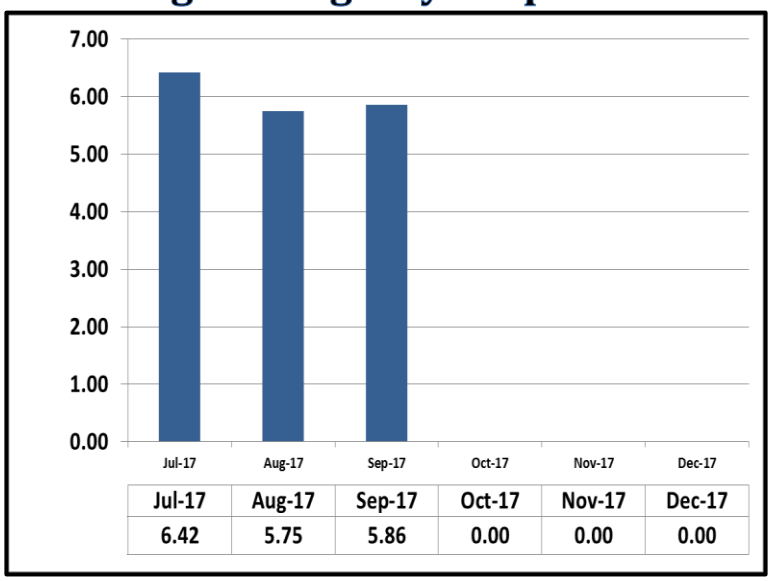
September 2017

ATTACHMENT C

System Wide Part 1 & Part 2 Crimes

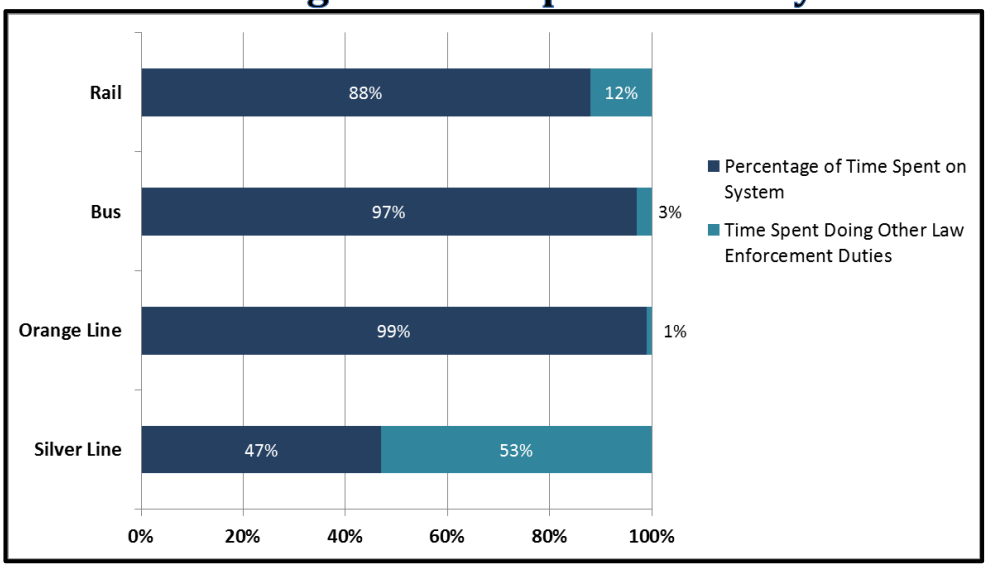


Average Emergency Response Times

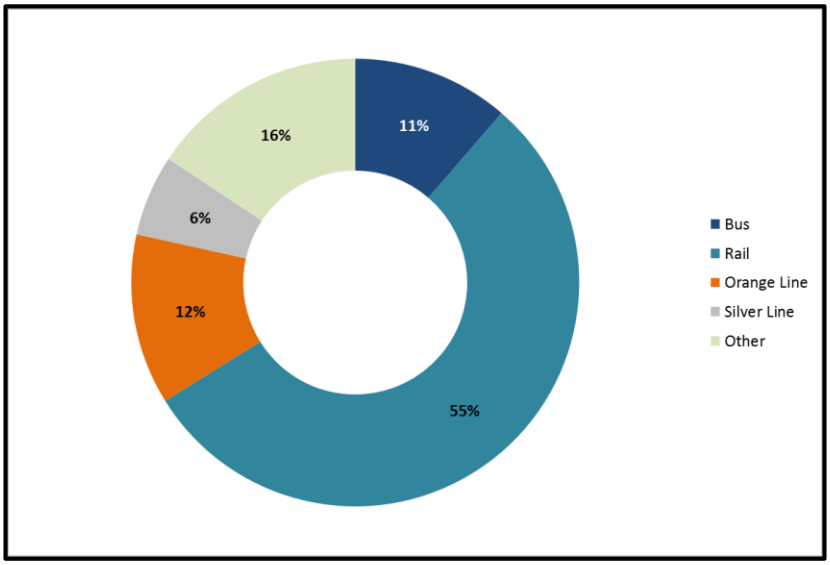


Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17
6.42	5.75	5.86	0.00	0.00	0.00

Percentage of Time Spent on the System

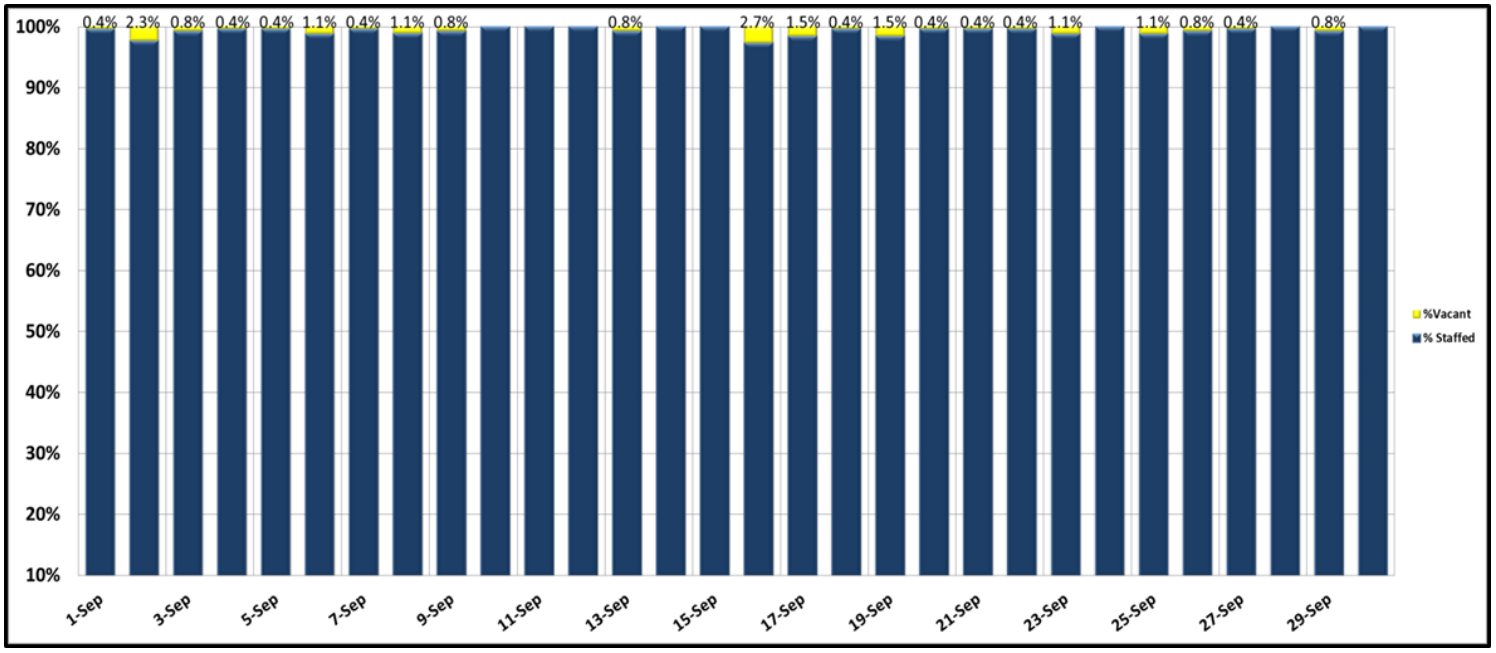


Percentage of Time Spent on the System as a Whole

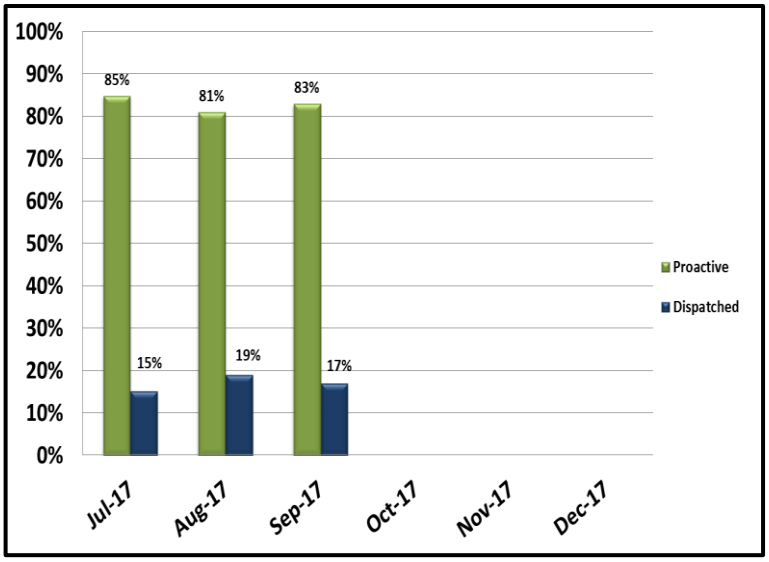


Key Performance Indicators
September 2017

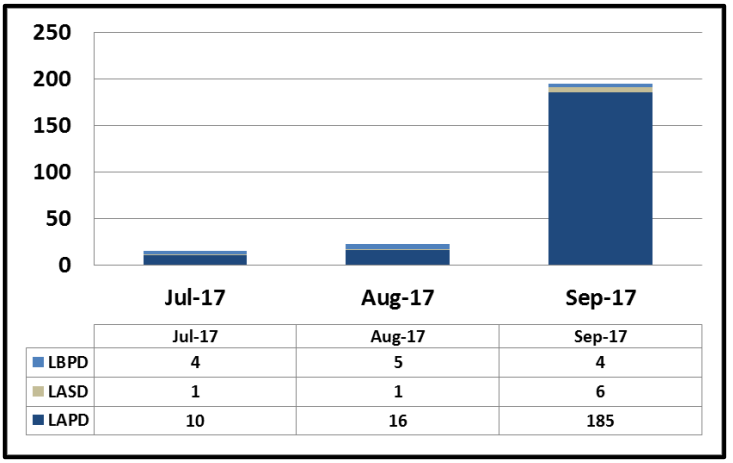
Ratio of Staffing Levels vs Vacant Assignments



Ratio of Proactive vs Dispatched Activity



Grade Crossing Operations



	Jul-17	Aug-17	Sep-17
LBPD	4	5	4
LASD	1	1	6
LAPD	10	16	185

Grade Crossing Operation Locations September:

1. Washington St (71)
2. Flower St (29)
3. 103rd St (5)
4. Wardlow St (1)
5. Long Beach Blvd (3)
6. Exposition Blvd (30)
7. Marmion Way (50)
8. Monrovia (6)

Los Angeles County
Metropolitan Transportation
Authority
One Gateway Plaza
3rd Floor Board Room
Los Angeles, CA

File #: 2017-0623, **File Type:** Contract **Agenda Number:** 29.

SYSTEM SAFETY, SECURITY AND OPERATIONS COMMITTEE
AD HOC CUSTOMER EXPERIENCE COMMITTEE
NOVEMBER 16, 2017

SUBJECT: SYSTEMWIDE BUS NETWORK RESTRUCTURING PLAN

ACTION: AWARD TASK ORDER

RECOMMENDATION

AUTHORIZE the Chief Executive Officer to award an 18-month, firm fixed price Task Order No. PS878320003041 under Countywide Planning Services Bench Contract No. PS4010-3041-F-XX with Cambridge Systematics, Inc., for an amount of $1,295,762, to develop a Systemwide Bus Network Restructuring Plan, subject to resolution of protest(s), if any.

ISSUE

In May 2017, staff briefed the Board of Directors on the need to conduct the Metro Service Study (Systemwide Bus Network Restructuring Study). In August 2017, staff presented a status report to the Board, indicating that a task order Request for Proposals (RFP) was issued to the Countywide Planning Bench contractors to assist in this effort. Board approval of the Contract is needed to proceed with development of the Plan.

DISCUSSION

Background

Metro provides over 1.3 million customer trips per weekday with a fleet of over 2,200 buses, 219 light rail, and 104 heavy rail cars. Service is distributed along an extensive network of 136 bus lines and 102 one way track miles of rail service that span 1,433 square miles of Los Angeles County. In addition, Metro funds local bus services operated by sixteen (16) municipal bus operators and several other community services providing almost 335K trips per day. Together, the municipal operators account for roughly 30% of transit service within the County while Metro provides the remaining 70%. Therefore, coordination of services, fare payment, signage and information is critical to providing seamless services throughout the region.

The Metro bus and rail system will continue to expand with the passage of the County's Measure R in 2008 and Measure M in 2016, both one-half cent sales taxes for transportation improvements. Currently, three mega transit projects are being constructed, including Crenshaw/LAX, Regional Connector, and the Purple Line Extension. Several others, including the Gold Line Foothill Extension to Claremont, East San Fernando Valley Transit Corridor, West Santa Ana Transit Corridor, Sepulveda Pass, and Bus Rapid Transit (BRT) between North Hollywood and Pasadena, and along Vermont Avenue, are planned to be in construction within the next 10 years.

Despite being the second most heavily used bus and seventh most heavily used rail systems in the country, and voter endorsement for continued growth, Metro's sytemwide transit ridership continues to decline, consistent with national trends. A recent survey of past riders found that 19% of respondents stopped using Metro services primarily because their travel patterns changed, and another 12% stated that it is too hard to get to and from transit. Eighteen percent and 11%, respectively, mentioned slow speeds and service reliability were their main reasons for leaving transit. Ridership declines can also be attributed to shifts in customer demographics and lifestyles, changing workforce travel patterns, safety and security concerns, new technology and opportunities for other travel options such as shared mobility on-demand.

Systemwide Bus Network Restructuring Study

Given the transforming landscape of transportation and travel demand within Los Angeles County, Metro is embarking on an effort to restructure the entire bus network into a comprehensive and intuitive system of high quality and integrated transit services that are relevant, reflective of, and attractive to the diverse customer needs within Los Angeles County. More specifically, the service restructuring aims to increase transit use within the County over the next decade by attracting customers to ride more by retaining current customers, reclaiming past customers, and recruiting new customers. In addition, the re-baselined bus network will set the foundation for future growth from transportation investments provided through Measures R and M.

With the diversity and complexity of Metro's governing boards, key stakeholders, customers, and operating environment, the following principles are critical to the success of this project:

- Extensive public input and outreach throughout the project (early buy-in and understanding of tradeoffs from Board and key stakeholders, and inclusive of LA County's diverse communities).

- Integration/coordination with Metro's Strategic Plan and Long Range Transportation Plan (LRTP) update, as well as municipal operator system restructure plans.

- Collaborative process with local jurisdictions and other key stakeholders (implement service

improvements in conjunction with transit supportive infrastructure and programs).

- Openness to creativity and innovation.

To prepare the Plan, the Contractor shall successfully complete the following tasks, inclusive of gathering data to answer the questions noted below, leading up to the implementation of a systemwide bus network restructure.

- **Market Research, Market Segmentation Analysis and Travel Demand -** A comprehensive understanding of who our past, current and potential customers are. For what trip purposes are they willing to use transit? When do they want to travel? What are the service attributes most important to them? Where are they coming from and going to?
- **Existing Service Evaluation -** What are the strengths, deficiencies, gaps and opportunities of the existing Metro bus network? How are customers using the system, and how well do we meet their needs? Where are the gaps and deficiencies in service and service attributes? Where are the opportunities for ridership growth, and how much can ridership grow if we address our gaps and deficiencies?

- **Establish Service Concepts -** Develop a series of preferred service concepts to consider that best match with the travel demand and service attributes most important to each customer group. How do these service concepts address the gaps and deficiencies identified in the Existing Service Evaluation? How will these service concepts create opportunities for ridership growth? What are the tradeoffs between service concepts and how will the benefits outweigh the negatives?

- **Service Design Guidelines -** The service concepts will be translated into a set of service design guidelines and criteria to ensure that any future adjustments to service are consistent with the preferred service concept.

- **Capital Infrastructure Needs -** Transit preferential infrastructure will be identified that will enhance speed and reliability of bus service along key regional corridors, as well as infrastructure to support new service delivery methods, and customer service infrastructure for major transfer points and activity centers.

- **Service Restructuring Plan -** The Contractor and Metro service planning and scheduling staff will work hand in hand to develop a transit network based on the preferred Service Concept and design guidelines that are anticipated to maximize ridership and improve customer experience within: 1) existing resources, 2) 10% fewer resources, and 3) 10% greater resources.

DETERMINATION OF SAFETY IMPACT

Conducting this study will not have any impacts on the safety of our customers and/or employees.

FINANCIAL IMPACT

The FY18 budget includes $1,000,000 in Cost Center 3151, project 306004 to conduct the Systemwide Bus Network Restructuring Study. Since this is a multi-year contract, the Cost Center Manager and Chief Operations Officer will be responsible for budgeting future years for the balance of the remaining project budget.

Impact to Budget

The source of funds for this project will come from regional administration funds earned on Proposition A sales tax. These funds are not eligible for operating or capital functions.

ALTERNATIVES CONSIDERED

The Board could consider not conducting this study and/or completing the study using in-house resources. Neither of these options is recommended as the bus system continues to be misaligned with current day travel demand and travel options and there are insufficient in-house resources to conduct the study and develop a Plan of this magnitude.

NEXT STEPS

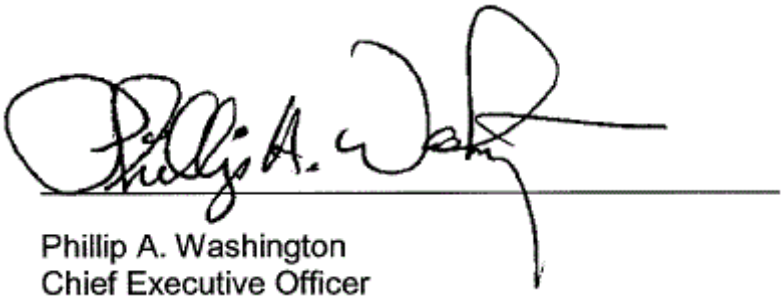
Upon Board approval, staff will execute Task Order No. PS878320003041 with Cambridge Systematics, Inc. to develop a Systemwide Bus Network Restructuring Plan.

ATTACHMENTS

Attachment A - Procurement Summary
Attachment B - Task Order Log
Attachment C - DEOD Summary

Prepared by: Conan Cheung, SEO, Service Planning, Scheduling and Analysis, (213) 418-3034

Reviewed by: James T. Gallagher, Chief Operations Officer, (213) 418-3108
Debra Avila, Chief Vendor/Contract Management Officer, (213) 418-3051



Phillip A. Washington
Chief Executive Officer

PROCUREMENT SUMMARY

SYSTEMWIDE BUS NETWORK RESTRUCTURING PLAN/PS4010-3041-F-XX

1.	**Contract Number**: PS4010-3041-F-XX Task Order No. PS878320003041	
2.	**Recommended Vendor**: Cambridge Systematics, Inc.	
3.	**Type of Procurement (check one):** ☐ **IFB** ☐ **RFP** ☐ **RFP–A&E** ☐ **Non-Competitive** ☐ **Modification** ☒ **Task Order**	
4.	**Procurement Dates**:	
	A. Issued: 6/23/2017 to Discipline 1 (Transportation Planning) of the Countywide Planning Bench	
	B. Advertised/Publicized: N/A	
	C. Pre-Proposal Conference: 7/7/2017	
	D. Proposals Due: 7/24/2017	
	E. Pre-Qualification Completed: 9/5/2017	
	F. Conflict of Interest Form Submitted to Ethics: 9/1/2017	
	G. Protest Period End Date: 11/20/2017	
5.	**Solicitations Picked up/Downloaded**: 17	**Bids/Proposals Received**: 2
6.	**Contract Administrator**: Ana Rodriguez	**Telephone Number**: (213) 922-1076
7.	**Project Manager**: Conan Cheung	**Telephone Number**: (213) 418-3034

A. Procurement Background

This Board Action is to approve Task Order No. PS878320003041 issued under the Countywide Planning Bench Contract No. PS4010-3041-F-XX in support of restructuring Metro's existing bus network to meet the needs of existing and future patrons and increasing transit ridership. Board approval of contract awards are subject to resolution of any properly submitted protest.

In September 2013, Metro's Board of Directors approved the award of 63 contracts under the Countywide Planning Bench (Bench) comprised of 17 disciplines for a period of three years with two one-year options for professional services not-to-exceed a cumulative amount of $30,000,000.

Task Order RFP No. PS43739-3041 was issued on June 23, 2017, in accordance with Metro's Acquisition Policy, to all members of Discipline 1 – Transportation Planning of the Bench and the contract type is a firm fixed price.

One amendment was issued during the solicitation phase of this Task Order RFP:

- Amendment No. 1, issued on June 27, 2017, clarified the pre-proposal conference date.

A pre-proposal conference was held on July 7, 2017 and was attended by ten participants representing nine firms. There were five questions submitted and responses were released prior to the proposal due date.

A total of two proposals were received on July 24, 2017.

B. Evaluation of Proposals

A Proposal Evaluation Team (PET) consisting of staff from Metro departments including the Service Development, Scheduling and Analysis Department, Countywide Planning and Development Department, the Office of Extraordinary Innovation, the Community Relations Department, the Transportation Planning Department, and the Service Operations Department was convened and conducted a comprehensive technical evaluation of the proposals received.

The proposals were evaluated based on the following evaluation criteria and weights:

- Work Plan/Project Approach 35 percent
- Experience and Qualifications of the Proposed Personnel 20 percent
- Experience and Qualifications of the Consulting Team 20 percent
- Cost/Price Effectiveness 15 percent
- Small Business Preference 10 percent

The evaluation criteria are appropriate and consistent with criteria developed for other, similar Task Order RFPs for professional services. Several factors were considered when developing these weights, giving the greatest importance to the Work Plan/Project Approach.

Both proposals received were determined to be within the competitive range and are listed below in alphabetical order:

1. Cambridge Systematics, Inc.
2. Fehr and Peers, Inc.

From July 25, 2017 through August 9, 2017, the PET conducted its independent evaluation of the proposals received. On August 9, 2017, the PET conducted interviews with both firms. The firms' project managers and key team members had an opportunity to present each team's qualifications and respond to the evaluation committee's questions. In general, each team's presentation addressed the requirements of the RFP, specifically their work plan, project approach, and their experience. The teams responded to the questions from the PET that pertained to their market research methodology, their information transference to key stakeholders and other consultants, and their proposed approach to determining service concepts from the market segmentation analysis.

Qualifications Summary of Firms within the Competitive Range:

Cambridge Systematics, Inc.

Cambridge Systematics is an established transportation consulting firm that has extensive public sector experience having worked with a vast number of federal, state, and local agencies throughout the country and internationally. Services provided include modeling and analytics, policy, planning and implementation and technology solutions in the form of software to specifically address issues of transit, planning, modeling, asset management, and mobility.

Cambridge Systematics provided a detailed and thorough response to the Task Order RFP that demonstrated their significant understanding of travel patterns, market segmentation analysis, route planning, service evaluation, forecasting and operations efficiencies. The market segmentation methodology was described in great detail and presented a balanced emphasis on understanding the general service characteristics needed for the core network as well as allowing for specific niche market needs for demand based service planning. Cambridge Systematics also put together a team that has experience completing other similar comprehensive operations analyses for large metropolitan areas across the United States. Cambridge Systematics has four subconsultants, Transportation Management & Design Inc. (TMD), HDR Engineering, Inc., Here Design Studio, and Conifer Research LLC, that will lead or supplement tasks according to their discipline expertise.

During their interview, Cambridge Systematics further exhibited their team's knowledge of transit market research, multimodal system evaluation and forecasting as well as expanded on their approach. The proposed existing service evaluation is robust and TMD will use their proprietary Service Analysis System (SAS) program for analysis of ridership and operating performance at various geographic and temporal levels that will be of great value in the restructuring effort. Cambridge and their team also specifically addressed micro-transit and alternative service concepts in their presentation expanding on the information provided in their proposal and demonstrated some potential interactions between the traditional and emerging public transportation possibilities.

Fehr and Peers, Inc.

Based out of Walnut Creek, CA, Fehr and Peers is a transportation consulting firm which specializes in providing transportation planning and engineering services. Fehr and Peers' services include land use and transportation studies, travel behavior and forecasting, bicycle and pedestrian planning and many others. Fehr and Peers' proposal demonstrated an understanding of the importance of public engagement; however, their proposed service evaluation did not go into sufficient depth to gain an understanding of the different factors affecting ridership. Also, their market research approach seemed to heavily rely on work being conducted through a different study,

namely the Ridership Growth Action Plan and there was not a significant identifiable link between the findings of the market segmentation analysis and the development of the service concepts and design guidelines. Furthermore, their service concept methodology seemed to assume a single concept solution which does not account for alternative service delivery methods named in the RFP such as micro-transit and flex route alternatives. Fehr and Peers was given the opportunity to address this issue at the interview; however, their responses seemed to indicate that other service concepts would not be prominently considered in their restructuring plans.

Following is a summary of the PET evaluation scores:

1	Firm	Average Score	Factor Weight	Weighted Average Score	Rank
2	**Cambridge Systematics, Inc.**				
3	Work Plan/Project Approach	77.73	35.00%	27.21	
4	Experience and Qualifications of the Proposed Personnel	83.62	20.00%	16.72	
5	Experience and Qualifications of the Consulting Team	80.81	20.00%	16.16	
6	Cost/Price Effectiveness	100.00	15.00%	15.00	
7	Small Business Preference	50.00	10.00%	5.00	
8	**Total**		**100.00%**	**80.09**	**1**
9	**Fehr and Peers, Inc.**				
10	Work Plan/Project Approach	68.34	35.00%	23.92	
11	Experience and Qualifications of the Proposed Personnel	76.68	20.00%	15.34	
12	Experience and Qualifications of the Consulting Team	73.03	20.00%	14.61	
13	Cost/Price Effectiveness	78.07	15.00%	11.71	
14	Small Business Preference	50.00	10.00%	5.00	
15	**Total**		**100.00%**	**70.58**	**2**

C. Price Analysis

The recommended price has been determined to be fair and reasonable based upon adequate price competition, an independent cost estimate, price analysis, technical analysis, fact finding, and negotiations.

	Proposer Name	Proposal Amount	Metro ICE	Negotiated Amount
1.	Cambridge Systematics, Inc.	$1,398,085	$1,262,427	$1,295,762
2.	Fehr and Peers, Inc.	$1,798,852		

D. Background on Recommended Contractor

The recommended firm, Cambridge Systematics, Inc., was founded in 1972 in Massachusetts and specializes in applying systematic analysis to problems of transportation, the environment, urban development, and regional planning. Cambridge has locations in nine different states, including two locations in California, and has expanded to service international clients as well. Similar past projects for Cambridge and their team include the Chicago Regional Transportation Authority Market Analysis Study, the Santa Clara Valley Transportation Authority Metropolitan Comprehensive Operational Analysis, and the Nashville Metropolitan Transit Authority Comprehensive Operations Analysis. Cambridge has a history of working with Metro, on projects such as the Long Range Transportation Plan, and the Metro Mobility Matrix assessments for the San Gabriel Valley, North County, and South Bay Cities.

TASK ORDER LOG

COUNTYWIDE PLANNING BENCH/CONTRACT NO. PS4010-3041
TASK ORDER LOG VALUE ISSUED TO DATE

Discipline No./ Description	Contract No.	Contractor	Value of Task Orders Issued to Date
1/Transportation Planning	PS4010-3041-O-XX	David Evans & Associates, Inc.	$459,587.68
	PS4010-3041-BB-XX	IBI Group	$343,471.02
	PS4010-3041-F-XX	Cambridge Systematics, Inc. ***This Pending Action***	$2,870,664.74 ***+$1,295,762.00***
	PS4010-3041-U-XX	Fehr & Peers	$1,978,617.34
	PS4010-3041-YY-XX	STV Corporation	$490,954.00
	PS4010-3041-I-XX	CH2M Hill, Inc.	$286,865.00
	PS4010-3041-DD-XX	Iteris, Inc.	$1,911,605.06
	PS4010-3041-Y1-XX	HDR Engineering, Inc.	$1,641,541.24
	PS4010-3041-Y1-XX	KOA Corporation	$298,142.85
	PS4010-3041-RR-XX	Parsons Transportation Group	$1,832,178.00
	PS4010-3041-EE-XX	Kimley Horn & Associates, Inc.	$291,005.46
	PS4010-3041-A-XX	AECOM Technical Services, Inc.	$1,954,168.96
	PS4010-3041-QQ-XX	Parsons Brinckerhoff, Inc.	$920,819.00
		Subtotal	$16,575,382.35
2/Environmental Planning	PS4010-3041-FF-XX	Kleinfelder, Inc.	$839,361.71
		Subtotal	$839,361.71

6/Architecture	PS4010-3041-RR-XX	Parsons Transportation Group	$115,817.00
	PS4010-3041-W-XX	Gensler	$269,041.34
		Subtotal	$384,858.34
7/Urban Design	PS4010-3041-W-XX	Gensler	$406,905.18
		Subtotal	$406,905.18
9/Environmental Graphic Design	PS4010-3041-WW-09	Selbert Perkins Design	$248,361.00
		Subtotal	$248,361.00
11/Financial Analysis	PS4010-3041-I-XX	CH2M Hill, Inc.	$587,011.00
		Subtotal	$587,011.00
12/Land Use and Regulatory Planning	PS4010-3041-BB-XX	IBI Group	$299,986.00
		Subtotal	$299,986.00
13/Sustainability/Active Transportation	PS4010-3041-U-XX	Fehr & Peers	$1,950,067.67
	PS4010-3041-XX-13	Stantec Consulting Services, Inc.	$618,390.76
		Subtotal	$2,568,458.43
14/Database Technical Services	PS4010-3041-PP-14	Novanis	$1,310,664.93
	PS4010-3041-KKK-14	Accenture LLP	$101,000.00
		Subtotal	$1,411,664.93
17/Community Outreach/ Public Education & Research Services	PS4010-3041-EEE-17	The Robert Group	$771,839.00
	PS4010-3041-D-17	Arellano Associates	$564,877.00
		Subtotal	$1,336,716.00
		Total Task Orders Awarded to Date	**$24,658,704.94**
		Board Authorized Not-To-Exceed (NTE) Cumulative Total Value	**$30,000,000.00**
		Remaining Board Authorized NTE Cumulative Total Value	**$5,341,295.06**

DEOD SUMMARY

SYSTEMWIDE BUS NETWORK RESTRUCTURING PLAN/PS4010-3041-F-XX

A. Small Business Participation

The Diversity and Economic Opportunity Department (DEOD) established a 30% Small Business Enterprise (SBE) goal for this solicitation. Cambridge Systematics, Inc. exceeded the goal by making a 60.43% SBE commitment.

Small Business Goal	30% SBE	Small Business Commitment	60.43% SBE

	SBE Subcontractors	% Committed
1.	Transportation Management & Design	56.57%
2.	Here Design Studio	3.86%
	Total Commitment	**60.43%**

B. Living Wage and Service Contract Worker Retention Policy Applicability

The Living Wage and Service Contract Worker Retention Policy is not applicable to this Contract.

C. Prevailing Wage Applicability

Prevailing wages are not applicable to this Contract.

D. Project Labor Agreement/Construction Careers Policy

Project Labor Agreement/Construction Careers Policy is not applicable to this Contract.

Los Angeles County
Metropolitan Transportation
Authority
One Gateway Plaza
3rd Floor Board Room
Los Angeles, CA

File #: 2017-0643, **File Type:** Contract **Agenda Number:** 30.

**SYSTEM SAFETY, SECURITY AND OPERATIONS COMMITTEE
NOVEMBER 16, 2017**

SUBJECT: P2000 LIGHT RAIL VEHICLE (LRV) MIDLIFE MODERNIZATION PROGRAM

ACTION: EXERCISE OPTIONS

RECOMMENDATION

AUTHORIZE the Chief Executive Officer to:

A. EXERCISE system component Option #3 Communications - New Vestibule Information and Map Displays for the P2000 Light Rail Vehicle Midlife Modernization Program (Contract No. OPP2000) to Alstom Transportation Inc. in the firm fixed amount of $2,803,953, increasing the total Contract Value from $130,673,440 to $133,477,394;

B. EXERCISE system component Option #4 Communications - New Audio Communication System for the P2000 Light Rail Vehicle Midlife Modernization Program (Contract No. OPP2000) to Alstom Transportation Inc. in the firm fixed amount of $3,054,526, increasing the total Contract Value from $133,477,394 to $136,531,920;

C. AMEND and increase the FY18 Budget in Cost Center 3043 in the amount of $31,404,998 for mobilization costs and accelerated project milestones from $13,415,079 to $44,820,077; and

D. EXECUTE Contract Modifications under this Contract for up to $1,000,000 per Contract Modification.

ISSUE

Contract No. OPP2000 approved by the Board in March 2017 with Alstom Transportation Inc. authorized performance of the midlife modernization and replacement of critical components on the fifty-two (52) Siemens P2000 vehicles in order to maintain a State of Good Repair. The recommended actions above authorize Alstom Transport Inc. to perform additional P2000 system component replacements that were defined as Contract Options in the original Contract, as follows:

Recommendation A: This action authorizes Alstom Transportation Inc. to replace the interior announcement signs with larger Thin Film Transistor monitors or a LACMTA approved equivalent, suitable for displaying graphic information as well as multiline, moving text.

Recommendation B: This action authorizes Alstom Transportation Inc. to replace the existing Audio Communication System that integrates identified LACMTA Furnished Equipment and provides the functionality specified as applicable per Technical Specification (TS) Section 13.4.1 Audio System (which shall include: Onboard Audio Controls, PA System, AADS, PIC System, Cab-to-cab Intercom, and LACMTA Furnished Equipment Radio System).

Recommendation C: Within the existing LOP of the project, shift money from the later years forward to FY18. The original FY18 budget was an estimate developed prior to contract award. Subsequent to contract award and Notice to Proceed (NTP) the contractor submitted a schedule which advances several milestones from the later years. To support the contractor's approach the FY18 budget needs to be increased by $31,404,998 from $13,415,079 to $44,820,077; budgets for the later years will be reduced accordingly. Approval of this recommendation will ensure the rail fleet remains in a State of Good Repair by permitting early delivery of a modernized P2000 fleet.

Recommendation D: will allow Metro and the Contractor to negotiate future change orders in a timely manner to ensure that the maximum cost and schedule benefits can be realized. The P2000 Midlife Overhaul delivery schedule is very aggressive. This added delegation of authority will allow staff to mitigate impacts to the program schedule that may arise from change orders currently contemplated. The request for an increase in CMA from $500,000 to $1,000,000 for individual changes is consistent with Board authorized CMA's for other Rolling Stock programs, such as Contracts for A650 Midlife Overhaul, P3010 and P2550, Light Rail Vehicles, and the 45-foot CNG Composite Buses. Staff does not seek any changes to the CMA for aggregate changes, which is 10% of the total Contract value.

DISCUSSION

The P2000 fleet currently operates on Metro's Green, Blue and Expo Lines. The primary objective of the project is to obtain safe, reliable, high quality overhauled LRVs on-time and within budget, and to create new jobs for Los Angeles County that can be tied directly to the Midlife Overhaul Program. This project also includes a training element through which Alstom Transportation will provide training to Metro staff on how to operate and maintain the modernized fleet.

The Scope of Work for the P2000 LRV Midlife Modernization Program is based on a conditioned based assessment (CBA) used to identify the critical systems and components impacting performance. The Scope includes the following critical systems and components: Vehicle Door Systems, Propulsion System, Friction Brake System, Trucks, Automatic Train Control (ATC)/Automatic Train Operation (ATO) System, Heating and Air Conditioning (HVAC) System, and Communication System.

Performing the Midlife Modernization Program is in accordance with the Rail Fleet Management Plan FY2015-FY2040 (Draft, May 24, 2016, v.8). The plan outlines the anticipated program to expand rail fleets to accommodate anticipated growth in ridership; line extensions; and to overhaul or replace vehicles reaching mid-life or end of life, as appropriate. Exercising these two options for the

Communication System during the preliminary design phase is extremely critical to ensure proper trainline integration of the Communication System with the remaining essential systems especially with those linked to passenger and operator interface. Delay in exercising these two (2) Options may potentially impact successful integration of these systems, delay vehicle delivery, and result in increased overhaul costs.

The Diversity and Economic Opportunity Department (DEOD) did not recommend a Disadvantaged Business Enterprise (DBE) goal for this procurement as it is not applicable (please refer to Attachment B). This procurement falls under the Federal Transit Administration's (FTA) Transit Vehicle Manufacturer (TVM) goal in accordance with 49 Code of Federal Regulations (CFR) Part 26.49. Alstom Transportation Inc. reported 9.23% TVM goal and qualifies under the FTA's eligible list.

DETERMINATION OF SAFETY IMPACT

The approval of this Contract award will have a direct and positive impact to system safety, service quality, system reliability, maintainability and overall customer satisfaction. The P2000 Light Rail Vehicle Midlife Modernization Program will permit Metro to maintain the SGR on the LRV fleet.

FINANCIAL IMPACT

The Project LOP not only includes funds for the LRV Midlife Modernization ($140,079,867) Program; there are also funds allocated for Professional Services, Metro Labor, and Project Contingency, totaling $160,800,000. The $5,858,479 needed for Options 3 and 4 has already been included in the LRV Midlife Modernization project budget as options for exercising. The Project LOP is $160,800,000 and will not change. The $31,404,998 FY18 budget amendment is schedule related only and this amount will be redistributed based on updated milestone schedules and expenditure reforecasts reprogrammed during Metro's annual budget process.

The amendment amount will be added to the FY18 budget in Cost Center 3043, under CP 206044. Currently, there is $13,415,079 budgeted in the FY18 budget in Cost Center 3043, under CP 206044, P2000 Light Rail Vehicle Modernization Program.

Since this is a multi-year contract, the cost center manager will be responsible for dispersing the cost for subsequent years.

Impact to Budget

The source of funds for this action is Federal Section 5337 State of Good Repair Funds provided under the Transportation Improvement Program (TIP). Other eligible source of funds include Proposition A 35% and Measure R 2% which is eligible for rail capital activities. Concurrently, staff is actively pursuing additional State and Federal sources such as FAST Act and other eligible federal sources to further supplement this project. Staff is also pursuing additional State and Local funding sources such as Cap and Trade and similar sources as they become available to meet the project funding needs.

ALTERNATIVES CONSIDERED

Staff considered using in-house Metro resources to perform this work. This approach is not recommended as Metro does not have sufficient resources and Subject Matter Experts available to perform this work.

The Board of Directors may choose not to authorize the Options award for this project; however, this alternative is not recommended by Metro staff because the fifty-two Siemens P2000 vehicles are approximately 14-17 years old. The Communication System is experiencing parts obsolescence issues, lack of vendor support and outdated technology. These deficiencies diminish the performance and maintainability of the fleet. Exercising these two options for the Communication System during the preliminary design phase is extremely critical to ensure proper trainline integration of the Communication System with the rest of the essential systems especially with those linked to passenger and operator interface. Delay in exercising these two (2) Options may potentially impact successful integration of these systems, delay vehicle delivery, and result in increased overhaul costs. It is critical to maintaining a SGR on the fifty-two Siemens P2000 LRVs and to enable the Maintenance department to effectively plan and schedule its work.

NEXT STEPS

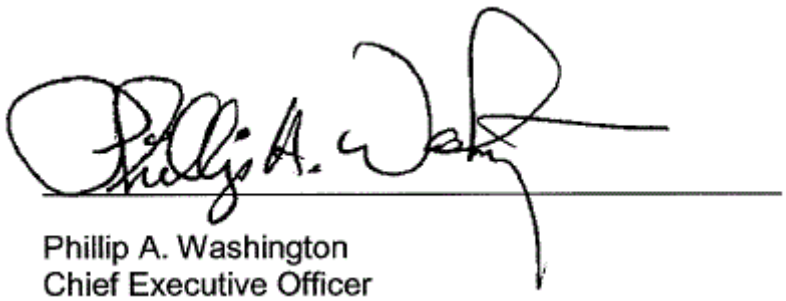
Upon Board approval, the subject Options will be exercised with Alstom Transportation, Inc.

ATTACHMENTS

Attachment A - Funding/Expenditure Plan
Attachment B - Procurement Summary
Attachment C - DEOD Summary

Prepared by: Annie Yang, Sr. Director, Project Control, Rail Vehicle Acquisition, (213) 922-3254
Jesus Montes, Sr. Executive Officer, Vehicle Acquisition, (213) 418-3277

Reviewed by: James T. Gallagher, Chief Operations Officer, (213) 418-3108
Debra Avila, Chief, Vendor/Contract Management Officer, (213) 418-3051



Phillip A. Washington
Chief Executive Officer

ATTACHMENT A

CP206044 P2000 LIGHT RAIL VEHICLE MODERNIZATION PROGRAM
FUNDING / EXPENDITURE PLAN

Uses of Funds	ITD thru FY17	FY18	FY19	FY20	FY21	FY22	Total	% of Total
Midlife Overhaul 52 Siemens LRVs	$7,808,823.09	$43,012,877.02	$19,093,724.17	$30,395,862.82	$33,204,685.90	$6,563,894.00	$140,079,867.00	87.11%
Professional Services	$744,953.74	$1,387,200.00	$1,843,826.34	$1,862,026.34	$1,348,626.33	$268,000.00	$7,454,632.75	4.64%
MTA Administration	$1,313,419.61	$420,000.00	$605,335.55	$605,335.55	$527,667.77	$467,667.77	$3,939,426.25	2.45%
Contingency	$0.00	$0.00	$0.00	$0.00	$0.00	$9,326,074.00	$9,326,074.00	5.80%
Total Project Cost	**$9,867,196.44**	**$44,820,077.02**	**$21,542,886.06**	**$32,863,224.71**	**$35,080,980.00**	**$16,625,635.77**	**$160,800,000.00**	**100.00%**
Sources of Funds								
Local (PA Rail 35%) / State / Federal	$9,867,196.44	$44,820,077.02	$21,542,886.06	$32,863,224.71	$35,080,980.00	$16,625,635.77	$160,800,000.00	100.00%
Total Project Funding	**$9,867,196.44**	**$44,820,077.02**	**$21,542,886.06**	**$32,863,224.71**	**$35,080,980.00**	**$16,625,635.77**	**$160,800,000.00**	**100.00%**

ATTACHMENT B

PROCUREMENT SUMMARY

OPTIONS FOR THE P2000 LIGHT RAIL VEHICLE (LRV) MIDLIFE MODERNIZATION PROGRAM / OPP2000

1.	**Contract Number**: OPP2000			
2.	**Contractor**: Alstom Transportation, Inc.			
3.	**Mod. Work Description**: Exercise Options : **a)** Option No. 3: Communications – New Vestibule Information and Map Displays **b)** Option No. 4: Communications – New Audio Communication System			
4.	**Contract Work Description**: This program is to maintain the light rail vehicles (LRVs) in a state of good repair where the overhaul and component replacement is priority to enhance safety, availability and reliability. The Contractor shall be responsible for transportation of the LRVs from Metro's property to its designated repair facility, performing all necessary tasks and activities described in the Contract Technical Specification and then returning the overhauled vehicles back to Metro ready for revenue service.			
5.	**The following data is current as of October 13, 2017 :**			
6.	**Contract Completion Status**		**Financial Status**	
	Contract Awarded:	March 23, 2017	**Contract Award Amount:**	$130,673,440.72
	Notice to Proceed (NTP):	June 1, 2016	**Total of Modifications Approved:**	None
	Original Complete Date:	August 1, 2021	**Pending Modifications (including this action):**	$ 5,858,479.70
	Current Est. Complete Date:	August 1, 2021	**Current Contract Value (with this action):**	$136,531,920.42
7.	**Contract Administrator**: Nicole Dang		**Telephone Number**: 213-922-7438	
8.	**Project Manager**: Annie Yang		**Telephone Number**: 213-922-3454	

A. Procurement Background

This Board Action is to approve Contract Modification No. 1 issued in support of exercising Option No. 3 for Communications – Vestibule Information Displays for a firm-fixed price of $2,803,953.55, and Option No. 4 for Communications – New Audio Communications System for a firm-fixed price of $3,054,526.15, increasing the total Contract Value from $130,673,440.72 to $136,531,920.51. The firm-fixed price amount for each option was competitively solicited during the procurement phase of the Base Contract Award.

This Contract Modification will be processed in accordance with Metro's Acquisition Policy and the contract type is a firm fixed price.

This Contract with Alstom Transportation Inc. is for a 50 months term and was approved by the Board of Directors on March 23, 2017 under Agenda Number 7. The exercise of these Contract Options will not impact the 50 month term.

B. Cost/Price Analysis

The recommended firm-fixed price amount for these Contract Options was deemed fair and reasonable through adequate price competition and negotiations conducted during the initial solicitation. These Contract Options are being exercised within the validity of the Option price and are not subject to escalation.

ATTACHMENT C

DEOD SUMMARY

OPTIONS FOR P2000 LIGHT RAIL VEHICLE (LRV) MIDLIFE MODERNIZATION PROGRAM / OPP2000

A. Small Business Participation

The Diversity and Economic Opportunity Department (DEOD) did not recommend a Disadvantaged Business Enterprise (DBE) participation goal for this procurement. The contract work will be performed by Alstom Transportation, Inc., Transit Vehicle Manufacturer (TVM). Alstom Transportation, Inc. submitted an FY17 TVM Certification with their proposal, and is currently on Federal Transit Administration's (FTA), T list of eligible TVMs. In compliance with 49 Code of Federal Regulation Part 26.49, TVMs report directly to FTA.

B. Living Wage and Service Contract Worker Retention Policy Applicability

The Living Wage and Service Contract Worker Retention Policy is not applicable to this Contract.

C. Prevailing Wage Applicability

Prevailing wage is not applicable to this Contract.

D. Project Labor Agreement/Construction Careers Policy

Project Labor Agreement/Construction Careers Policy is not applicable to this Contract.

Overview of Items 23, 24, 25 and 30

System Safety, Security & Operations Committee

Metro

November 2017

Rail Vehicle Maintenance, Overhaul & Modernization

Maintenance	• Preserve level of performance
Overhaul	• Heavy maintenance repair/replacement at specific OEM intervals (age/mileage) • No change to the design
Modernization	• Improve systems and performance • Approximate mid-life • Upgrade the system designs

Metro

Fleet Plan 10 Year Horizon

Series	Maintenance	Overhaul	Modernize	Retire	Replace
P865	Yes	No	No	In process	P3010
P2020	Yes	Yes	No	Future	P3010
P2000	Yes	Yes	Yes	Future	Future
P2550	Yes	Yes	Yes	Future	Future
P3010	Yes	To be Scheduled	2030 ±	Future	Future
A650 Base	Yes	No	No	Future	HR4000 Base
A650	Yes	Yes	Yes	Future	HR4000 Option

Fleet Plan

❑ P2020 LRT Car Series

- **Delivered:** 15
- **Lines :** Blue and Expo Lines
- **Overhaul Program**
  - Ten components
  - Program LOP $ 30,000,000
  - Contract for air hose replacement - Completed
  - Contract for axle assembly, gearbox/roller, cab slider, body repair, seat removal for bikes, wheelchair, cameras and propulsion – On-Going
  - Contract for Friction Brake– Nov 2017 (Item 23)

❑ P2000 LRT Car Series

- **Delivered:** 52
- **Lines:** Green, Blue and Expo Lines
- **Overhaul Program**
  - Nine components
  - Program LOP $ 26,360,100
  - Contracts for air hose replacement and non-power axle bearing replacement – Completed 2012
  - Contracts for power axle, car battery, couple, exterior and interior paint – On-going
  - Contracts for Friction Brake and Air Compressor – Nov 2017 (Item 25)
- **Modernization**
  - Renew systems:
    - Carbody; Door; HVAC; Electrical; Propulsion; Trucks; Braking Equipment; Communication; Automatic Train Control; Trainline; Destination Signs
  - Exercise optional features (Item 30)
  - Contract to Alstom
  - LOP $160,800,000
  - Projected Completion August 2021

Metro

Fleet Plan

❑ P2550 LRT Car Series

- **Delivered:** 50
- **Lines :** Gold Line
- **Overhaul Program**
  - Nine components
  - Program LOP $ 35,007,540
  - Contracts for axle assemblies, and coupler awarded – June & Sept 2017
  - Contract for Friction Brake – Nov 2017 (Item 25)
  - Contracts for propulsion, pantograph, battery, doors, truck and suspension systems – Anticipated 2018/2019
- **Modernization**
  - Renew systems:
    - Carbody; Door; HVAC; Electrical; Propulsion; Trucks; Braking Equipment; Couplers; Communication; Battery
  - Specification Prep Phase
  - Contract to STV Incorporated (Item 24)
    - Consultant $1,421,086 –Nov 2017
  - Estimated LOP TBD
  - Projected Start 2020

❑ A650 Subway Car Series

- **Delivered:** 74
- **Lines :** Red Line
- **Overhaul Program**
  - Ten components
  - Program LOP $ 30,000,000
  - Contracts for air compressor, HVAC compressor, passenger door, and car battery replacement – Completed
  - Contracts for friction brake, traction motor, gearbox, coupler, AC, and DC – On-Going
- **Modernization**
  - Renew systems:
    - Propulsion; Trucks; Friction Brakes; Doors; Communication; Interiors; Signal System, HVAC
  - Design and engineering phase
  - Contract to Talgo
  - LOP $72,970,494
  - Projected Completion December 2021


Thank you
Metro

Los Angeles County
Metropolitan Transportation
Authority
One Gateway Plaza
3rd Floor Board Room
Los Angeles, CA

Metro

Board Report

File #: 2017-0606, **File Type:** Informational Report **Agenda Number:** 31.

SYSTEM SAFETY, SECURITY AND OPERATIONS COMMITTEE
AD HOC CUSTOMER EXPERIENCE COMMITTEE
NOVEMBER 16, 2017

SUBJECT: OFFICE OF THE INSPECTOR GENERAL REPORT ON REVIEW OF METRO RAIL SERVICE DISRUPTIONS

ACTION: RECEIVE AND FILE

RECOMMENDATION

RECEIVE AND FILE Report on Review of Metro Rail Service Disruptions.

ISSUE

The Metro Office of the Inspector General conducted a customer impact focused study on rail service disruptions to consider whether state of good repair priorities should be adjusted to improve the customer experience. Historically, Metro has based capital investments on the priorities of the agency, expertise of asset managers, and age of transit assets and infrastructure. Recently, the agency has begun conducting asset condition surveys, which will allow better capital investment priorities. We understand that these efforts may take several years. Therefore, we conducted this study with the assistance of a rail expert, The Wathen Group (TWG), a small woman owned business enterprise, to first identify and evaluate the top incidents causing delay for each rail line, and then determine if the issues causing delays are being addressed and appropriate state of good repair (SGR) investments are being made to reduce their reoccurrence. This customer impact based study is complementary to the agency's on-going asset condition surveys as it re-prioritizes its capital repair and replacement plans.

DISCUSSION

A primary goal of Metro and its Board is to improve the customer experience. For the Operations Department, this includes developing and improving in-service on-time performance, and implementing efficient and effective transit service. The Operations and Risk Management Departments support this agency goal by implementing an industry leading SGR program that will improve reliability, prioritize the performance of scheduled and preventive maintenance of assets, meet SGR goals, reduce breakdowns, and better meet the daily transit needs of customers.

In 2016, the Operations Department reported 2,585 service disruptions on all rail lines. These delay incidents were categorized into 15 major incident types. This review focused on delay incidents within

Metro's control and related to asset maintenance, and therefore excluded 441 delay incidents categorized as Police/Health. Of the remaining 2,144 incidents that were part of this analysis, the major categories of incidents were rail vehicles, rail operations, traction power, yard control, and signals. In 2016, rail vehicle incidents (e.g. speed sensor, mechanical, propulsion, door) and rail operations incidents (e.g. operator absence or errors, service capacity, no equipment, single track delay) were the two most frequent types of service delay incidents across all rail lines, accounting for nearly 82% of the delay incidents. The third leading category of incident delays was different for each line.

- For the Metro Blue Line (MBL), traction power was the third top cause of delays.
- For the Metro Expo Line and Metro Gold Line (MGDL), yard control was the third top cause of delays.
- For the Metro Green Line (MGL) and Metro Red Line (MRL), signal was the third top cause of delays.

A. Key Findings

The report has overall findings include:

- Metro does not currently have a good system or complete information to identify root cause for service delays. The root cause for many delay incidents was not identified in Metro's records.
- Metro lacks asset condition surveys for each asset class. These surveys are essential for identifying and rating the condition of each asset and its component parts as a guidepost to State of Good Repair investment decisions.
- In the absence of consistent root cause information and support from complementary asset condition surveys, the ability to ensure that capital and maintenance programs are adequately and timely addressing critical needs is significantly limited. Once a system is established, it should be maintained.
- For various reasons prior management did not conduct midlife overhauls on the P865/2020 cars (40% of the light rail vehicle (LRV) fleet) and the Base Buy subway cars (29% of subway fleet), which are now the oldest cars in their respective fleets. With these cars remaining in service longer than anticipated, they are experiencing more component failures and are kept in service by as needed maintenance. Current Metro management has already begun the overhaul process and is in various stages of completeness depending on the model of the car.
- Operator non-availability, lateness for schedule pullouts, insufficient Rail Operator Extraboard staffing levels were key contributors to Rail Operations service related delays. However, this is not a SGR issue so we did not focus our study on this matter.
- The top three incidents due to Yard Control were late pull out (46%), no equipment (21%), and operator related (18%), such as not enough operators.
- Traction power failures on the MBL resulted in 357 cancelled trips and 107 late trips.

The review also found that Metro is in the midst of implementing important improvements to its SGR program. In this regard, Metro is:

- Implementing asset condition surveys across all assets, which will allow better investment priorities to be set to address safety and reliability needs.
- Redesigning the M3 maintenance system, which promises to combine diverse incident

databases and provide a platform for tracking root cause of incidents.

B. Mitigating Delay Incidents Through State of Good Repair Investment

The $4.8 billion dedicated to state of good repair over ten years as described in the Short Range Transportation Plan demonstrates Metro's focus on SGR. However, this amount comes to $480 million per year, which needs to cover many assets. In addition to addressing rolling stock for bus and rail, it also must address the needs of an aging infrastructure such as the Blue Line power traction substations. These competing needs are clearly reflected in the FY2018 Adopted Budget. The FY2018 Adopted Capital Program of $2.09 billion includes $1.7 billion for expansions and $394 million for Operating Capital, which covers safety and security projects, bus and rail state of good repair, capital infrastructure and other related investment categories. The total budgeted specifically for Rail State of Good Repair is $224 million. Of this total, $145 million (65%) is for vehicle investments that address the types of issues identified in TWG's analysis of vehicle related service disruption incidents.

Going forward, Metro will need to reevaluate whether its investment strategy is sufficient once the asset condition inventories are completed and priorities for investments to achieve a state of good repair are set. While expansion of the system is critical, it cannot take place at the expense of maintaining the existing system. Specific impact analysis including root causes for service disruptions should be utilized to further refine and prioritize funding allocation.

C. Recommendations:

The report makes 57 recommendations which Metro can take to better identify track, and reduce incidents that result in service disruptions. They are listed in Appendix B of the report.

NEXT STEPS

Metro management should:

- Finish assigning an individual responsible for championing the Agency Operations and SGR review and analysis of the findings and recommendations in the report and taking appropriate actions;
- Further complete the Schedule for Tracking Metro's Proposed Actions in response to the recommendations provided in Appendix B of the report as determinations are made on implementing the recommendations; and
- Periodically report to the Metro Board on the status of actions taken to implement the recommendations.

ATTACHMENTS

Attachment A - Report on Review of Metro Rail Service Disruption
Attachment B - Management Response

Prepared by: Andrew Lin, Audit Manager, (213) 244-7329
Yvonne Zheng, Senior Manager, Audit, (213) 244-7301

Reviewed by: Karen Gorman, Inspector General, (213) 922-2975

Karen Gorman
Inspector General/Chief Ethics Officer/
Chief Hearing Officer

Los Angeles County
Metropolitan Transportation Authority
Office of the Inspector General

Review of Metro Rail Service Disruptions

Report No. 18-AUD-03 **October 24, 2017**

Metro

Los Angeles County
Metropolitan Transportation Authority

Office of the Inspector General
818 West 7th Street, Suite 500
Los Angeles, CA 90017

213.244.7300 Tel

Metro

October 24, 2017

Metro Board

RE: Review of Metro Rail Service Disruptions

Dear Metro Board Directors:

The Office of the Inspector General conducted a customer impact focused study on the State of Good Repair budget to determine if priorities address rail service disruptions and how we might improve the customer experience. Historically, Metro has based capital investments on the priorities of the agency, expertise of asset managers, and age of transit assets and infrastructure. Recently, the agency has begun conducting asset condition surveys, which will allow better capital investment priorities. We understand that these efforts may take several years. Therefore, we conducted this study with the assistance of a rail expert, The Wathen Group, to first identify and evaluate the top three service disruption categories for each rail line, and then determine if the issues causing delays are being addressed and appropriate state of good repair (SGR) investments are being made to reduce their reoccurrence. This study is complementary to the agency's on-going asset condition surveys as it re-prioritizes its capital repair and replacement plans.

The review analyzed service disruption incidents in five major categories: rail vehicles, rail operations, traction power, yard controls, and signals. In 2016, rail vehicle and rail operations incidents were the most frequent categories of service delay incidents accounting for nearly 82% of the total delay incidents. Overall findings include:

- Metro does not currently have a good system or complete information to identify root cause for service delays.
- There is currently a lack of asset condition surveys for each asset class. These surveys are essential for identifying and rating the condition of each asset and its component parts as a guidepost to SGR investment decisions.
- In the absence of consistent root cause information and support from complementary asset condition surveys, the ability to ensure that capital and maintenance programs are adequately and timely addressing critical needs is significantly limited.
- Performing rail vehicle overhauls is critical.
- Traction power failures including the centenaries are causing canceled trips on the Blue Line. There is a budget to address this, but it should be reviewed for adequacy.

The review found that Metro is in the midst of implementing important improvements to its SGR program. In this regard, Metro is:

- Implementing asset condition surveys across all assets, which will allow better investment priorities to be set to address safety and reliability needs.
- Redesigning the M3 maintenance system, which promises to combine diverse incident databases and provide a platform for tracking root cause of incidents.

The report makes 57 recommendations which Metro can take to better identify, track, and reduce incidents that result in service disruptions. Those recommendations can be found in Appendix B of the report.

Metro management will spend several months to fully review the report, but provided a preliminary response (attached) that stated Operations and Risk, Safety & Asset Management Departments will begin the process to implement the recommendations over the coming year.

Sincerely,

Karen Gorman
Inspector General

cc: Phillip Washington
Stephanie Wiggins
James Gallagher
Greg Kildare
Board Deputies

Metro

Interoffice Memo

Date	October 19, 2017
To	Karen Gorman Inspector General
From	James T. Gallagher JTG. Chief Operations Officer
CC	Greg Kildare Chief Risk, Safety & Asset Management Officer
Subject	Management Response to the Draft Rail Service Disruption Review Report

Operations Management has received and reviewed the Rail Service Disruption Review Report issued by the Office of Inspector General. The report includes a total of 57 recommendations relative to Metro assets, State of Good Repair (SGR) efforts and projects, Enterprise Asset Management Plan initiatives, rail vehicles, rail operations, yard control, signals, traction power, and the mitigation, identification, tracking, and investigation processes of incidents that result in service delays.

The Operations and Risk, Safety & Asset Management Departments will begin the process to implement change recommendations over the next year; joining efforts with the Safety Culture Initiative that was launched in May 2017. Staff will provide regular updates to the OIG as recommendations are addressed and/or closed out.

Cc: Phillip Washington, Metro Chief Executive Officer
Metro Board of Directors
Andrew Lin, Audit Manager
Bernard Jackson, Sr. EO, Rail Operations
Errol Taylor, Sr. EO, Rail Maintenance & Engineering
Bob Spadafora, Sr. EO, Rail Fleet Services
Diane Corral-Lopez, EO, Operations Administration
Vijay Khawani, EO, Corporate Safety
Nancy Alberto-Saravia, Sr. Manager, Transportation Planning

24 October 2017

Review of Metro Rail Service Disruptions

THE WATHEN GROUP

Metro

Table of Contents

Executive Summary

Executive Summary

Introduction

The Metro Inspector General retained The Wathen Group (TWG) to first identify and evaluate the top three incident delay categories for each rail line, and then determine if the issues causing delays are being addressed and appropriate state of good repair (SGR) investments are being made to reduce their reoccurrence. Essentially an "impact based" capital assessment. The Inspector General recognized a primary goal of the Los Angeles County Metropolitan Transportation Authority (Metro) and its Board is to improve the customer experience. For the Operations Department, this means developing and improving in-service on-time performance, and implementing efficient and effective transit service. The Operations Department supports this agency goal by implementing an industry leading SGR program that will improve reliability, prioritize the performance of scheduled and preventive maintenance of assets, meet SGR goals, reduce breakdowns, and better meet the daily transit needs of customers.

The data set provided to TWG includes 2,585 service delay incidents within LA Metro Rail in 2016 on all rail lines. These delay incidents were categorized into 15 major incident types. Since the primary goal of this review was to determine whether the capital and maintenance programs are adequately and timely addressing critical needs as identified through incidents that have caused delays on the system, the analysis focused on delay incidents within Metro's control and therefore excluded 441 delay incidents categorized as Police/Health. While these delays were not included in the analysis, it should be noted that Police/Health delay incidents represented 17% of the total delay incidents, 28% of total cancelled trips, and 17% of late trips, with an average maximum delay of nearly 20 minutes. Since Police/Health incidents account for a significant portion of total delay incidents, Metro should review its approach to these incidents in partnership with responding law enforcement agencies to ensure its new transit security focus protects both the health and safety of the public as well as promotes the service reliability on which they depend.

Of the remaining 2,144 incidents that were part of this analysis, the major incidents were those categorized as: rail vehicles, rail operations, traction power, yard control, and signals. In 2016, rail vehicle incidents and rail operations incidents were the top two most frequent service delay incidents across all rail lines, accounting for nearly 82% of the delay incidents. The third leading category of incident delays was different for each line.

- For the Metro Blue Line (MBL), traction power was the third top cause of delays analyzed by TWG; while rail accidents exceeded traction power in frequency on MBL by three incidents,

given the goal of evaluating capital/maintenance related events, TWG reviewed traction power incidents.

- For the Metro Expo Line (Expo) and Metro Gold Line (MGDL), yard control was the third top cause of delays.

- For the Metro Green Line (MGL) and Metro Red Line (MRL), signals were the third top cause of delays.

These incidents all caused delays of varying magnitude, inconveniencing customers at all hours of the day throughout the year. In addition to these delay incidents, Metro managers also recorded hundreds of additional incidents that occurred throughout the year that did not result in delays; but if the underlying causes are not addressed now, delays could occur in the future. Reducing these incidents to the extent they are within Metro's control promises improved service for all riders.

Key Findings

The report findings provide insights into the overall difficulty of evaluating delay data in a meaningful way to assess trends and mitigations. The report also evaluates each of the top three categories of delay by line and discusses specific findings and recommendations. The summary below is structured in six sections: 1. Overall; 2. Rail Vehicle Delays; 3. Rail Operations Delays; 4. Yard Control Delays; 5. Signal Delays; and 6. Traction Power Delays.

1. Overall Findings Applicable to All Delay Incidents

- The root cause for many delay incidents was not identified in Metro's records. In order to achieve a reduction in delay incidents, Metro must identify the root cause of these delays and then ensure that investments, both capital and operating, are in place to address the root cause problems. This presents the primary challenge for Metro to consistently identify the root cause of the problem. Since these incidents typically occur in the field, Metro staff are appropriately focused on returning to normal service as soon as possible. Field and time constraints limit the ability to fully assess the cause of the problem.

- For incidents that generate a work order, further review of the work order often identifies the root cause since the maintainer replaces/repairs the damaged component. However, mining that information from the work order to capture the root cause of the failure is a time consuming process. There is no consistent nomenclature or location for recording this information on the

work order. As a consequence, incidents were grouped into broad and often meaningless categories. Capturing the root cause in a clear and prominent way would create a direct path to understand what, if any, investments would address those causes and mitigate those incidents.

- The difficulty in determining the root cause is further complicated by the current lack of asset condition surveys for each asset class. These surveys identify and rate the condition of each asset and its component parts as a guidepost to state of good repair investment decisions. More specifically, the surveys identify those components most at risk for causing safety and/or service impacts. Pending completion of these surveys, Metro tends to respond to incidents reactively, in response to an actual failure, as opposed to proactively addressing components identified through surveys.

- In the absence of consistent root cause information and support from complementary asset condition inventories, the ability to ensure that the capital and maintenance programs are adequately and timely addressing critical needs is significantly limited. The expertise of Metro's personnel and knowledge of their areas of responsibility ensure that maintenance and investments generally meet their current needs but do not provide an understanding of progress toward State of Good Repair or resolution of root cause failure trends.

- Metro currently does not have a good system to identify root cause for service delays. Therefore, it is difficult to determine if the issues causing the delays are being addressed and appropriate SGR investments are being made to reduce their reoccurrence.

2. Rail Vehicle Incidents Findings

- Rail Vehicle Service Delay Incidents are a small subset of maintenance shop statistics on fleet incidents, indicating that the majority of issues do not result in delay. However, determining failure trends and areas warranting investment should rely on all this available data.

- 27% of Rail Vehicle Incident reports resulted in no problem being found by maintainers trouble shooting the issue. Without a root cause identified in incident reports, the incident data cannot be evaluated for mitigations.

- Midlife overhauls were not conducted on the P865/2020 cars (40% of the light rail vehicle (LRV) fleet) and the Base Buy subway cars (29% of subway fleet), which are now the oldest cars in their respective fleets. With these cars remaining in service longer than anticipated, they are experiencing more component failures and are kept in service by as needed maintenance. These component upgrades will need to continue to ensure fleet reliability until these cars are replaced.

- The P2000 fleet (31% of LRVs) has the most incidents per car (2.48 during 2016) but is about to undergo a midlife overhaul.

- The P2550 cars (29% of LRVs), only 10 years old, are the most reliable LRV vehicles (.84 incidents per car). These cars have a diagnostic system and display, which help reduce incident-causing delays.

3. Rail Operations Incidents Findings

- Service incident delays attributed to Rail Operations represents a small percentage of the total Metro Rail service delays; and even then, not all incidents resulting in service delays that are designated as Rail Operations can be controlled within that Division.

- Operator non-availability and lateness for schedule pullouts were key contributors to those factors attributed to Rail Operations service related delays.

- The impact of service recovery delays (delays due to other problems on the line, such as trains with no movement or terminal delays) creates challenges in managing the Operator workforce. Rail Operations' Operator Extraboard staffing levels may not be sufficient as a mitigation resource to address the scope and impact of Metro service incident delays. The initiation of effective service recovery contingency plans is key to minimizing the impact of all Rail Operations incidents.

4. Yard Control Incidents Findings

- Yard related service delays were largely not specific to the yards.

- The top three incidents due to Yard Control were late pull out (46%), no equipment (21%), and operator related (18%), mostly operator not available.

5. Signal Incidents Findings

- The low number of identified signal incidents (72 during 2016) did not include the estimated hundreds of additional signal failures that did not cause delay. As a result, it is difficult to provide an objective analysis of the root causes and assess the current process for allocating capital funds to progress the state of good repair for signal installations.

- Signal failures that do not cause service disruptions are still likely to impact normal train operation and could require a train to operate in a degraded mode of operation. These failures were not captured in incident reports but should be part of Metro's data analysis of root causes of incidents.

- MGL has a relatively new signal system that should be in a state of good repair. On the MGL, 7 out of the 16 incidents (44%) were attributed to "False Occupancy," which caused 2 cancelled trips and 27 late trips. A "False Occupancy" occurs when a track circuit falsely indicates the presence of a train within its boundaries. The reports and associated work orders did not reveal a systemic issue or a pattern of failures that is out of industry norm.

- The MRL cab-based signaling system, completed in 1993, should be in a state of good repair. On the MRL, there were 10 incidents that caused 11 cancelled trips and 20 late trips during 2016. The incident reports and associated work orders on the MRL did not identify a pattern of failure either in specific components or as part of system functions.

6. Traction Power Incidents Findings

- Traction power failures on the MBL resulted in 357 cancelled trips and 107 late trips.

- The largest contributor to traction power incidents with significant impact on train service was the failures or interference with the catenary infrastructure. The second largest contributor to the incidents was related to failures in the Traction Power Substation equipment. Since catenary failure/interference has a significant impact on train service, it should have a high priority with respect to the State of Good Repair schedule. As part of a State of Good Repair project, Metro should assess the design of the catenary system as well as condition of the installation.

Mitigating Delay Incidents through State of Good Repair Investment

Interviews with the Metro staff described an agency in the midst of implementing important improvements to their State of Good Repair program. Metro is implementing asset condition surveys across all assets, which will allow better investment priorities to be set to address safety and reliability needs. Metro is also redesigning its Maintenance and Material Management System (M3), which promises to combine diverse incident databases and provide a platform for tracking root cause of incidents, and is taking other steps to implement a robust Enterprise Asset Management System. In the interim, maintenance activities address most incidents that occur during daily service; and capital investments are based on the priorities of the agency, departments, and expertise of the asset managers. While this analysis did not find any systemic

failures, opportunities for improvement have been noted, particularly in this interim period before these ongoing improvements are fully implemented.

The $4.8 billion dedicated to state of good repair over ten years as described in the Short Range Transportation Plan demonstrates Metro's focus on SGR. However, this amount comes to $480 million per year, which needs to cover many assets. In addition to addressing new rolling stock for bus and rail, it also must address the needs of an aging infrastructure. Metro will need to reevaluate whether its investment strategy is sufficient once the asset inventories are completed and priorities for investments to achieve a state of good repair are set. While expansion of the system is critical, it cannot take place at the expense of maintaining the existing system. Setting this balance, however, requires a firmer understanding of the condition of the core infrastructure. Expediting the work currently under way will position Metro to better make these tradeoffs.

Recommendations

1. Overall recommendations that cut across all asset classes and all rail lines involve expediting critical projects currently underway. These include:

    - Finish the asset inventories in an expedited fashion, and establish a timely process for their periodic refreshing (every 3 years is Metro's goal).

    - Use these inventories to lay the foundation to revise the SGR plan, supplemented by information on the useful life of installation, failure rate, service needs, and available funding, with clear goals as to the expected reduction in assets not in SGR. This revised plan needs to be multi-year based, recognizing that as assets and their components are brought into SGR, others are falling out.

    - Evaluate funding for state of good repair to ensure that it is enough to cover annual SGR goals, including new rolling stock, as well as tending to the aging infrastructure.

    - Expedite funding for and implement the redesign of the M3 system, so that all databases can be probed for root cause trends allowing Metro to better mitigate causes of incidents and improve reliability.

In the interim, steps can be taken to improve the understanding of root cause and to set investment priorities, including:

- Instruct personnel on providing consistent and complete detailed information related to failures in the work order (WO) reports.

- Perform more thorough investigations and analysis to determine the root causes for high frequency failures (the top three on each line) even if they do not result in service delays to allow Metro to develop mitigations that promise to significantly reduce total delays.

- Establish a procedure for operating personnel to record the cause of any failure in normal operations even if it does not result in a service delay.

- Conduct periodic condition surveys in advance of, and complementary to, the asset inventory that is being undertaken.

- Attend to rail vehicle delays, which were the highest cause of delay across all lines, by setting priorities based on Metro's asset condition assessment as soon as it is complete to reduce these incidents.

During this interim period, improvements can also be made in the Rail Operations Control (ROC) process for recording delay incidents and in the information included in related work orders. These include:

- Improve Operators instruction to report any and all alert indications shown on the console.

- Establish a Mechanical Desk with a dedicated, 24/7 "super-tech" maintenance team in the ROC to provide expert support to the ROC for equipment, systems and infrastructure faults.

- Establish a process that requires the applicable asset department to ascertain and record root cause for failures.

In addition to the above overarching recommendations, the analysis yielded specific recommendations for each of the top three causes of delay incidents by line: rail vehicles, rail operations, yard control, signals, and traction power.

2. Rail Vehicle recommendations for each vehicle fleet follow:

Recommendations for the P865/P2020 Fleet (69 cars representing 40% of all LRVs, deployed on the MBL and Expo line).

- Identify the cars in the worst condition for decommissioning and use them as spare parts supply.

- Keep a large enough base fleet as floats to improve availability of P2000 vehicles for refurbishment, which have a higher delay incident rate.

- Maintain the remaining P865 cars only out of the MBL shop, which has the best logistics to maintain the P865 fleet.

- Continue with the component upgrades to keep a reduced fleet with increased reliability in service until replaced by the P3010 cars.

- Keep the refurbishment program started by Metro to reduce fuse failures. Metro started this program to minimize fuse failures by replacing worn components that can lead to failures.

- No major capital investment is needed for the P865/P2020 fleet.

Recommendations for the P2000 fleet (52 cars representing 31% of the LRVs, deployed on MBL, Expo, and MGL).

- Plan the midlife overhaul to first upgrade the cars in the worst condition.

- Analyze the float vehicle needs for the P2000 midlife overhaul and assure enough cars to expedite the overhaul.

- Improve the diagnostic capabilities of the new propulsion system.

Recommendations for the P2550 fleet (50 cars representing 29% of all LRVs, deployed on MGDL).

- Modify incident reports to include the information provided by the Train Operator Display (TOD).

- Report the time of the incident as shown on the TOD.

- Use the diagnostic system of a car to provide further valuable information to the maintainer investigating the incident.

Recommendations for Base Buy subway cars (30 cars representing 29% of the subway fleet).

- Keep the cars running by continuing funding to maintain this fleet. Even though new cars have been ordered, this funding should not be cut back.

- Assure that the knowledge of the chopper control unit is not lost before the new cars arrive. The chopper converts fixed direct current (DC) input voltage to a variable DC output voltage for the traction motor, which is controlled by these voltage variations. The base buy cars have a chopper

propulsion and DC motors. Since this technology is over 50 years old and not used any more, Metro must maintain the existing expertise of these controls. Modern vehicles use an inverter, which works very differently from a chopper.

- Take Base Buy cars out of service as early as possible to reduce maintenance costs.

Recommendation for the A650 General Electric (GE) subway fleet (74 cars representing 71% of the subway fleet).

- Perform the midlife overhaul as planned.

3. Rail Operations Recommendations:

- Limit the designation of Rail Operations only to incidents that are accountable to that Division.
- Re-assess the level, allocation, and scheduling of Rail Operations Extraboard Operators as an opportunity to mitigate the impact of all service incident related delays resulting from Operator late or no show, Station Terminal and Yard Operator related delays, and "gap trains" staffing (extra trains to supplement capacity when needed).
- Assess the impact of Operator absenteeism and late/missed trips on service and current remedial measures to mitigate the level of occurrences.
- Evaluate Station Terminal operations and staffing needs to support on-time performance.
- Increase Rail Operators' vehicle troubleshooting training as a means to reduce vehicle related defect delays.
- Continue to assess the application of service contingency plans and related staff training required to implement these plans.
- Assess the adequacy of Rail Operations' schedule layover/recovery time at station terminals.

4. Yard Control Recommendations:

- Limit the designation of Yard Control incidents to those actually attributed to yards.
- Apply the Operator availability recommendations noted under "Rail Operations" above to those same issues associated with Yard service delays.

- Review Yard vehicle availability constraints and evaluate options designed to further support the consistent achievement of 100% equipment schedule availability.

5. Signals Recommendations:

- Instruct signal maintenance personnel on providing consistent and complete detailed information related to signal failures in the WO reports.
- Perform more investigations and analysis to determine the root causes for high frequency failures even if they do not result in service delays.
- Establish a procedure for Operations personnel to record the impact of any signal failure on normal operation even if it does not result in service delay.
- Conduct periodic condition surveys on signal installations in advance of, and complementary to, the asset inventory that will be undertaken soon.
- Establish a process and a criterion for replacement of existing signal installations that includes useful life of installation, failure rate, obsolescence, service needs and available funding.

6. Traction Power Recommendations:

- Perform more investigations and analysis to determine the root causes for traction power failures.
- Establish a procedure to instruct traction power maintenance personnel on providing complete detailed information related to traction power failures in the WO reports.
- Investigate the high level of failures that occurred at San Pedro Traction Power Substation.
- Conduct periodic condition surveys on traction power equipment in advance of, and complementary to, the asset inventory that will be undertaken soon.
- Establish a process and a criterion for replacement of existing traction power equipment that includes useful life of installation, failure rate, obsolescence, service needs, and available funding.

Next Steps

This report provides steps that Metro can take to be in a position to better identify, track, and reduce incidents occurring now. In addition, as Metro advances its initiatives related to its Enterprise Asset Management Plan, its ability to mine its data for root cause, track trends, identify mitigations, and prioritize investments will become increasingly effective. Metro should expedite those steps currently underway and the recommendations discussed in this report to yield immediate and long term benefits.

Section I

Background, Objectives, Statement of Work, Methodology

Background

The Metro Inspector General retained The Wathen Group (TWG) to first identify and evaluate the top three incident delay categories for each rail line, and then determine if the issues causing delays are being addressed and appropriate SGR investments are being made to reduce their reoccurrence.

One of the primary goals of Los Angeles County Metropolitan Transportation Authority (Metro) is to improve the customer experience. For the Operations Department, this means developing and improving in-service on-time performance, and implementing efficient and effective bus and rail service. This service goal is supported by the agency's goal to implement an industry leading state of good repair program, which the Operating Department implements by improving reliability, prioritizing the performance of scheduled and preventive maintenance of assets, meeting SGR goals, reducing breakdowns, and better meeting the daily service needs of customers.

Rail System: Metro operates six rail lines including two subway lines (Red and Purple) and four light rail lines (Blue, Green, Gold and Expo lines) serving 93 stations. (For this report, the two subway lines will be treated as one line.) These lines vary in age of infrastructure, rolling stock, and in distance as shown in the table below; these differences affect system service performance.

Table 1: Metro Rail Line Characteristics

Rail Line	Opened	Miles	Type	Stations
Metro Red/Purple Lines (MRL)	1993 MacArthur Park, 1993 Wilshire/ Western, 1996 Hollywood, 1999 North Hollywood, 2000	17.4	Subway/ Subway	16 (Inc. 6 shared)
Metro Blue Line (MBL)	1990	22	Light Rail	22 (Inc. 3 shared)
Metro Green Line (MGL)	1995	20	Light Rail	14 (Inc. 1 shared)
Metro Gold Line (MGDL)	2003 Eastside Extension, 2009 Azusa Extension, 2016	31	Light Rail	27 (Inc. 1 shared)
Metro Expo Line (Expo)	2012 Extension to Santa Monica, 2016	15.1	Light Rail	19 (Inc. 2 shared)

In 2016, 2,144 service disruption/delay incidents were reported on all Metro rail lines from the data set that the OIG provided, with 14 major incident types as listed below:

Table 2: Rail Incidents in 2016

Incident Type	Expo	MBL	MGDL	MGL	Subtotal Light Rail	MRL	Subtotal Subway	Grand Total
Rail Vehicles	237	456	323	272	**1.288**	134	**134**	**1.422**
Rail Operations	76	97	74	57	**304**	26	**26**	**330**
Traction Power	19	30	19	15	**83**	9	**9**	**92**
Yard Control	25	17	25	13	**80**	1	**1**	**81**
Signals	13	18	14	17	**62**	10	**10**	**72**
Rail Accident	13	33	18	4	**68**	4	**4**	**72**
Extra Service/ Missed Car Cut		25			**25**		**0**	**25**
Fire / Emergency		9	4		**13**	4	**4**	**17**
Track	2	2	10		**14**		**0**	**14**
TSE SCADA	1	1		2	**4**	6	**6**	**10**
Communication		1		2	**3**		**0**	**3**
Passenger Conduct			2	1	**3**		**0**	**3**
Fire Equipment					**0**	2	**2**	**2**
FM Contract Svc				1	**1**		**0**	**1**
Grand Total	**386**	**689**	**489**	**384**	**1.948**	**196**	**196**	**2.144**

(This data set excludes 441 incidents related to Police/Health incidents that are not within Metro's control since the primary goal of this review was to determine whether the capital and maintenance program are adequately and timely addressing critical needs as identified through incidents in Metro's control that have caused delays on the system.)

These incidents all caused delays of varying magnitude, inconveniencing customers at all hours of the day throughout the year. Reducing these delay incidents to the extent they are within Metro's control promises improved service for all riders. To achieve a reduction, Metro must identify the root cause of these delays and then ensure that investments, both capital and operating, are in place to address the root cause of problems.

Objectives of Review of Service Delays

The objectives of this project are to conduct a review and analysis of Metro Rail Service Disruptions by determining:

- The three major causes for Metro Rail service disruptions by line from the data provided; and
- Whether the causes are being properly addressed and, if capital, prioritized in Metro's State of Good Repair (SGR) Report.

The primary goal of this review is to ensure that the capital and maintenance programs are adequately and timely addressing critical needs as identified through incidents that have caused delays on the system. Therefore, the focus of this review is on delays caused by incidents involving equipment, systems or infrastructure and not on operations or incidents outside the control of Metro, although this review will include operational issues to the extent they are identified in the top three categories of delay by line.

Statement of Work

TWG was engaged by the Office of the Inspector General (OIG) to perform this review. Pursuant to the Statement of Work prepared by the OIG, TWG performed the following tasks:

- Reviewed the service disruption log and other reports of Metro Rail for calendar year 2016, and determined the top three major causes, including the total number of disruptions per line, the apparent or reported nature of the disruption, the period of disruption and actions taken to remedy the disruption.

- Reviewed the incident reports, work orders, and corrective actions.

- Interviewed Metro management and staff in rail operations, safety, risk management, and other relevant departments to determine root causes and ultimate remedies necessary to resolve the disruptions and if those remedies are in progress.

- Determined whether Metro's vehicle repair or replacement plan and overall SGR schedule adequately prioritized and scheduled replacement or repair of high impact capital equipment.

Methodology

The data on frequency of incidents was used to identify the top three broad causes of delay on each rail line of the system.

1. A statistically significant random sample of incidents for each of the top three causes of delay on each rail line was drawn from the data provided, treating the light rail lines as one for creating samples and the subway lines as a separate data set. While the constraints on this project did not allow for a statistically significant sample to be drawn for each individual line, this distinction between light rail and subway allowed TWG to evaluate potential differences in causes and mitigations between these two distinct operating systems. Furthermore, since light rail lines do not have an equal distribution of specific incidents, the sample size for each line was determined based on the frequency of that incident type on that line. That is, a weighted sample was used to get a better representation of each incident across the four light rail lines. The number of incidents included in this study and the number of incidents sampled (highlighted in gray) are as follows:

Table 3: Sample Size Calculations for Light Rail and Subway Lines at 95% Confidence Level

Top 3 Incident Types	Expo	MBL	MGDL	MGL	Subtotal Light Rail	Sample Light Rail (95% C.I.)	Subway (MRL)	Sample Subway (95% C.I.)
Rail Vehicle	237	456	323	272	1.288		134	
Percent of Total	18%	35%	25%	21%				
Weighed Sample by Line	54	105	74	63		296		100
Rail Operations	76	97	74	57	304		26	
Percent of Total	25%	32%	24%	19%				
Weighed Sample by Line	43	54	41	32		170		24
Traction Power		30			30			
Sample by Line		28				28		
Yard Control	25		25		50			
Sample by Line	22		22			44		
Signals				17	17		10	
Sample by Line				16		16		10
Grand Total						**554**		**134**

2. Incident reports were reviewed for each incident in the sample, which provided a generalized description of the incident, the maximum duration of the delay, and the location of sample incidents. Although this information was attributable only to the sample of incidents under review, these demonstrate the nature of the incident as described by the operator and recorded by the Rail Operations Control (ROC). The findings and recommendations as to the data captured by the Incident Reports are discussed in the next section of the report.

3. When an Incident Report from the sample included a work order, the work order was also reviewed to determine the root cause of the incident. While the next section of the report captures the causes identified in the work orders, a lack of common nomenclature for identifying root cause limited the ability to comprehensively identify common failures and thus limited the ability to evaluate capital investment needs to address and reduce those delay failures. The findings and recommendations as to the data captured by the work orders are discussed in the next section of the report.

4. To better understand the process for generating and populating the incident reports and work orders, TWG conducted interviews with representatives of the ROC and Information Technology (IT) representatives developing a new logging system for the ROC, supplemented by the interviews conducted for each asset class as identified below. Participants in these interviews are shown in Appendix C List of Interview Participants.

5. To evaluate the extent to which Metro's Capital Program includes investments to reduce the causes of delay, TWG reviewed capital investments during its interviews with each asset group; reviewed available material on Metro's Capital Program including the Long-Range Transportation Plan, the Short-Range Transportation Plan and the Annual Budget; and conducted interviews with the Asset Management Group and the Office of Management and Budget, Finance Division. See Appendix C for List of Interview Participants.

This process was then applied to the analysis of each specific cause of delay for the top three causes by line as discussed below.

Top Three Causes of Delays by Line

Based on our review, we identified the following top three causes for each line:

a. Rail vehicle delays on all lines
b. Rail operations delays on all lines
c. Yard control delays on Metro Expo and Gold Lines
d. Signal delays on Metro Green and Red Lines
e. Traction power delays on Metro Blue Line

Based upon these major causes of delays, TWG selected samples for each category. Through interviews and review of Metro documents, TWG assessed the current situation and made recommendations for action.

Specific Methodology for Top Three Causes of Delays by Line

1. Sample Size and Methodology

   a. *Rail Vehicle Delays: First Major Cause of Delays (by frequency) on all five lines.*

   Total rail vehicle incidents: 1,422 identified in the data provided; 1,288 on the light rail lines and 134 on the subway lines.

   TWG conducted a thorough analysis of 296 light rail vehicle delays and 100 subway vehicle delays, both statistically significant samples at the 95% confidence level, to determine specific cause of failure and steps taken to correct. The sample of 296 is from the total number of incidents across all four light rail lines, not a statistically significant sample by each light rail line.

   A review of the incident reports for these delays found a significant number of failures attributable to general faults that provided insufficient information as to the root cause of the problem, e.g. propulsion faults which actually meant door not closed, brake stuck on, no automatic train control signal code, or lack of overhead catenary voltage, but not a propulsion system failure. Therefore, TWG evaluated every work order generated for each incident report to attempt to identify the root cause of the delay incident.

   In addition, TWG conducted interviews with representatives of Rail Vehicles to clarify information, address issues from the data, and describe the process and comprehensiveness of the investment program to address these delay incidents. See Appendix C for List of Interview Participants.

   b. *Rail Operations: Second Major Cause of Delays (by frequency) on all five lines.*

   Total rail operations incidents: 330 identified in the data provided; 304 on the light rail lines and 26 on the subway.

   TWG conducted a thorough analysis of 170 light rail operations delays and 24 subway operations delays, both statistically significant samples at the 95% confidence level, to determine specific causes and steps taken to correct. This does not represent a statistically significant sample by light rail line. Since these incidents did not generate work orders, TWG relied on interviews with representatives of Rail Operations to clarify information, address issues from the data and describe the process for addressing and reducing these delay incidents. See Appendix C for List of Interview Participants.

c. *Yard Control: Third Major Cause of Delays (by frequency) for Expo Line and Metro Gold Line (MGDL).*

Total yard control incidents for these two lines: 50 identified in the data provided; 25 of these incidents from Expo and 25 from MGDL.

TWG conducted a thorough analysis of 44 traction power delays, 22 Expo incidents, and 22 MGDL incidents, statistically significant samples at the 95% confidence level, to determine specific causes and steps taken to correct. The associated work orders were also analyzed.

TWG relied on interviews with representatives of Operations and Yards to clarify information, address issues from the data and describe the process for addressing and reducing these delay incidents. See Appendix C for List of Interview Participants.

d. *Signals: Third Major Cause of Delays (by frequency) for Metro Green Line (MGL) (light rail) and Metro Red Line (MRL) (subway).*

Total signal incidents on these two lines: 27 identified in the data provided; 17 of these incidents on MGL and 10 on MRL.

TWG conducted a thorough analysis of 16 signal delays on MGL and 10 MRL incidents, statistically significant samples at the 95% confidence level, to determine specific causes and steps taken to correct. The associated work orders were also analyzed.

TWG relied on interviews with representatives of Signals to clarify information, address issues from the data, and describe the process for addressing and reducing these delay incidents.

e. *Traction Power: Third Major Cause of Delays (by frequency) for Metro Blue Line (MBL).*

Total Traction Power Incidents for MBL: 30 identified in the data provided.

While rail accidents exceed traction power in frequency on MBL by two incidents, given the goal of evaluating capital/maintenance related events, TWG reviewed traction power incidents.

TWG conducted a thorough analysis of 28 traction power delays on the MBL, a statistically significant sample at the 95% confidence level, to determine specific causes and steps taken to correct. The associated work orders were also analyzed.

TWG relied on interviews with representatives of Traction Power to clarify information, address issues from the data, and describe the process for addressing and reducing these delay incidents. See Appendix C for List of Interview Participants.

2. Mitigations and State of Good Repair Plans

TWG evaluated the mitigations deployed by Metro and attempted to review the mitigations against existing policies, operating rules, and training for operating issues and the SGR capital plan to determine whether they were appropriately funded and prioritized. Data on the investment resources allocated to the specific areas of root cause identified by TWG were not available. However, the approach to capital funding for these asset classes was identified and evaluated for its comprehensiveness in addressing and reducing these failures and their associated delays moving forward.

Section II

Findings and Recommendations

Based on the targeted sample of delays across lines by causes, TWG analyzed incident reports and associated work orders, and conducted interviews to determine root causes of delays to the extent possible. This report summarizes the areas reviewed by TWG, the findings related to those areas and recommendations for addressing those findings.

A. Reporting Root Cause of Service Delay Incidents: Incident Reports and Work Orders

Incident Reports and Work Orders: Incident reports are generated by the ROC from information relayed to them by the Operator. This information may also be supplemented by a supervisor and/or maintenance technician when they arrive on the scene. When an incident report includes an associated work order, additional information is provided by the maintenance crews and the parts summary included in the work order.

Findings Related to Reporting Root Cause of Service Delay Incidents

A1. Generally, the information for the incident report comes from the operator who often just describes the condition experienced (e.g. no movement, no propulsion, etc.), which may be too general to determine the root cause.

A2. The generality of descriptions in the incident reports often results in no specific problem being found when the maintenance crews review the work orders (27% of Rail Vehicle Incidents).

A3. In addition, this system generates variability in what operators report and in what controllers record, compromising the ability to identify common failures and sometimes resulting in the mischaracterization of incidents (e.g. 14.4% of Rail Operator Incidents describe Rail Vehicle faults).

A4. The descriptions of service delay incidents can and should be prompted by alerts displayed on the train console, but often they are not. For example, many reports cited "no movement," but there is no console alert called "no movement." As a problem code, this provided very little information from which to evaluate root cause.

A5. While the technician in the field who has a better sense of the problem could be a resource in the reporting process, the technician is appropriately more focused on getting the problem vehicle out of the

way. In a similar vein, to better respond to incidents by quickly identifying and addressing problems, the ROC is assigning a rail fleet vehicle technician to the ROC, who can ask relevant questions to determine the system where the problem occurred. (The ROC has also invited signals, Maintenance of Way (MOW) and traction power to send personnel to the ROC if personnel levels allow.) However, the ROC is only "borrowing" this one technician from the MBL/MGDL who will continue to have ongoing fleet responsibilities.

A6. Not knowing the root cause of the incident severely limits the ability to determine the best mitigation, whether operating or capital. In addition, while these reports provide the work order number if a work order is generated, they do not provide a mechanism to capture a causal code from the maintenance department's resolution of the incident.

A7. When an incident report includes an associated work order, the root cause of the problem can often be found in the additional information provided in the work order; however, since the incident report generates the introductory information in the work order, the work order may not consistently identify the system, subsystem, and subsystem component that represents the root cause of the incident.

A8. The lack of common nomenclature for identifying root cause limits the ability to comprehensively identify common failures and thus limits the ability to evaluate investment needs to address and reduce those delay failures.

A9. Metro's project to replace the M3 System logging module, used by the ROC to create the chronological entry of each service delay incident, will provide better information on the causes of delay incidents. The Information Technology Services (ITS) department has hired a consultant to develop the requirements for the new system. The requirements design consultant is meeting with ITS to identify the type of system Metro wants, connecting incident reports and work orders. All the asset managers have been meeting with the requirements consultant to provide their specific requirements for the module. For example, Rail Fleet is working with them with the goal of creating a nested drop-down listing with codes for every system on the train, then sub-codes for components within those systems, and sub-sub codes of subcomponents of those components.

Recommendations Related to Reporting Root Cause of Service Delay Incidents: Incident Reports and Work Orders

The effective identification of root cause is key to using the service delay reporting system to identify trends and then developing appropriate capital and operating strategies to reduce the reoccurrence of these incidents. There are several recommendations for improving the process to better capture the cause of the incident; many of these recommendations are currently underway at Metro.

1. Instruct Operators to report all alert indications shown on the console. This is especially important given the amount of information that is available on the console of the new trains. In addition, operators should assess whether passenger behavior caused an indication as opposed to a problem with the equipment. (A door indication, for example, may signal that a passenger is holding the door open.)

2. Establish a dedicated, 24/7 "super-tech" maintenance team full time in the ROC to provide expert support to the ROC for equipment, systems and infrastructure faults. This will improve service with the ability to quickly relay troubleshooting approaches to the operator as well as the expertise to more accurately identify the problem. Unlike the new approach being taken by the ROC to "borrow" a vehicle technician to assist with incidents, this recommendation calls for a technical desk with dedicated full-time staff.

3. Ensure the Rail Vehicle Department records root cause for rail vehicle delay incidents, which are the highest number of incidents across all five rail lines. Instruct the ROC to record "Rail Vehicle Event." After the WO is completed, Fleet Services should add the root cause in a designated location on the form. As an alternative, the root cause can be tracked at a weekly reconciliation meeting between staff from the ROC and staff from Fleet Vehicles or at the regular morning meetings; however, this may be too time consuming to be feasible.

4. Maximize the redesign of the M3 software program logging module. All departments should work with the design expert to create a drop-down listing that would capture the most meaningful root cause categories for their area of responsibility. Ideally, the ITS department should also bring all fault reports into one environment, so that internal department reports of failures can be tracked along with those recorded through the ROC. This redesign of the M3 module should allow for automated tracking of delays and their root causes, reporting delay trends, identifying mitigations, and tracking their impact.

5. Include Train Operator Display (TOD) information, such as time of the incident, in the reporting of incidents.

B. Overall: Top Three Causes of Delay by Line

The original data set provided to TWG recorded 2,585 delay incidents within LA Metro Rail in 2016 on all lines. These delay incidents were categorized into 15 major incident types. Since the primary goal of this review is to determine whether the capital and maintenance program are adequately and timely addressing critical needs as identified through incidents that have caused delays on the system, the analysis focused on delay incidents within Metro's control and therefore excluded the 441 delays categorized as

Police/Health. Therefore, the final data set reviewed by TWG included 2,144 service disruption/delay incidents with 14 major incident types.

Finding Related to Police/Health Incidents

B1. While these delays were not included in the analysis, it should be noted that Police/Health delay incidents represented 17% of the total delay incidents, 28% of total cancelled trips and 17% of late trips, with an average maximum delay of nearly 20 minutes.

This category of delay includes a range of causes such as possible criminal activity, disorder, threats (including bombs/terrorism), weapons, pedestrians/cars on tracks, and sick passengers. The transit industry is implementing and testing various strategies to address these issues. Agencies, including Metro, are using a variety of strategies to reduce these types of delays, such as the use of public service campaigns suggesting passengers not board trains if they feel sick, working with communities around targeted community policing, and making arrangements with local emergency services support.

Since police/health incidents represent 17% of total delay incidents with an average delay of 20 minutes, Metro should strategize with responding law enforcement agencies to ensure the process employed by them protects both the health and safety of the public as well as the service reliability on which they depend. However, without a more in-depth analysis of the specific causes for the delays and the magnitude of those causes, it is a challenge to analyze and identify specific strategies for mitigating Police/Health related delays at this time.

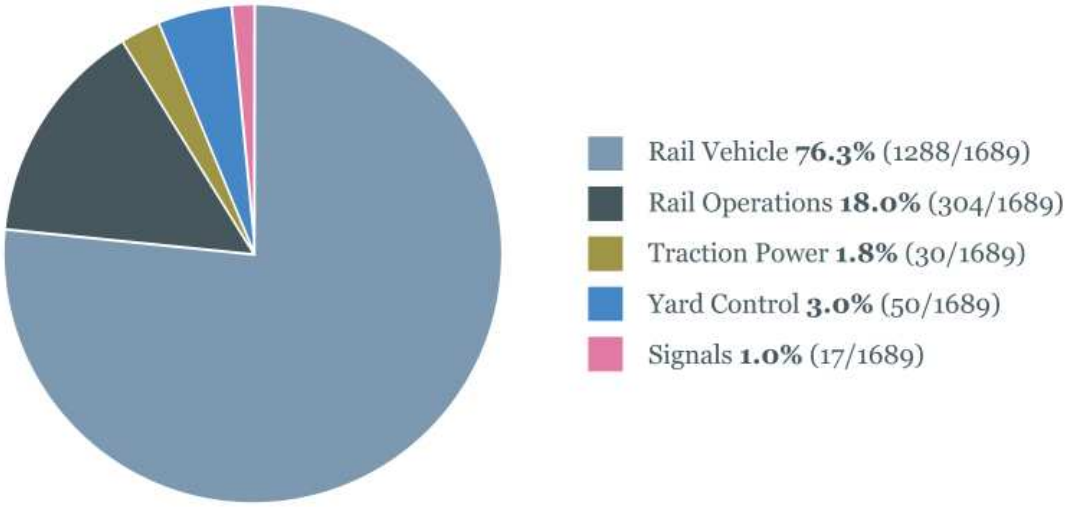
Findings Related to Top Three Categories of Delay

The top three light rail incident categories by line comprised 86.7% of the total number of incidents in calendar year 2016 (less Police/Health incidents) as identified from the data provided (1,689 light rail incidents of the total 1,948 light rail incidents).

B2. Rail vehicle incidents and rail operations incidents were the top two service delay incidents across each of the four light rail lines, accounting for nearly 95% of the 1,689 delay incidents (76.3% rail vehicle incidents and 18.0% rail operations incidents). See Figure 1.

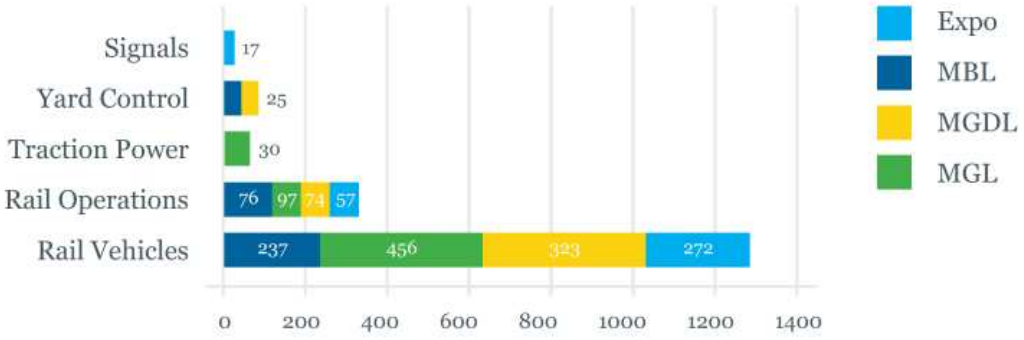
B3. For the MBL, traction power was the third top cause of delay; for the Expo and MGDL, yard controls were the third top cause of delay; and for the MGL, signals were the third top cause of the delay.

Figure 1: Distribution of Top Three Light Rail Incidents



B4. Of all the light rail lines, the MBL had the largest number of rail vehicle incidents and rail operations incidents. (see Figure 2 below.)

Figure 2: Distribution of Top Three Incidents on each Light Rail Line

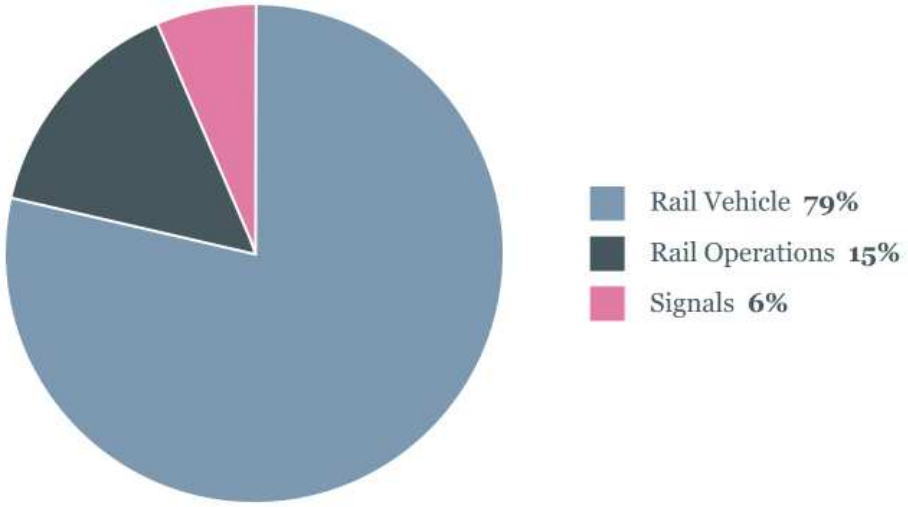


The Metro Red Line presents a similar portrait.

B5. The top three causes of delay on MRL represented 86.7% of total number of MRL delay incidents in 2016 as identified in the data provided (170 incidents of the 196 total).

B6. Rail vehicle delays comprised 79% of the top three causes, as shown in Figure 3:

Figure 3: Distribution of Top Three Subway Incidents



B7. Rail vehicle service delays and rail operation service delays were also the two causes of delay responsible for the largest total number of cancelled and late trains and the highest total of maximum delay minutes. (The ROC records the longest delay from amongst those trains delayed by an incident in the delay incident report as the maximum delay minutes for each incident.) See Figure 4.

Figure 4: Total Cancelled and Late Trains by Top Three Incident Types

Table 4: Total 'Maximum Delay' Minutes for Top Three Incidents Per Line

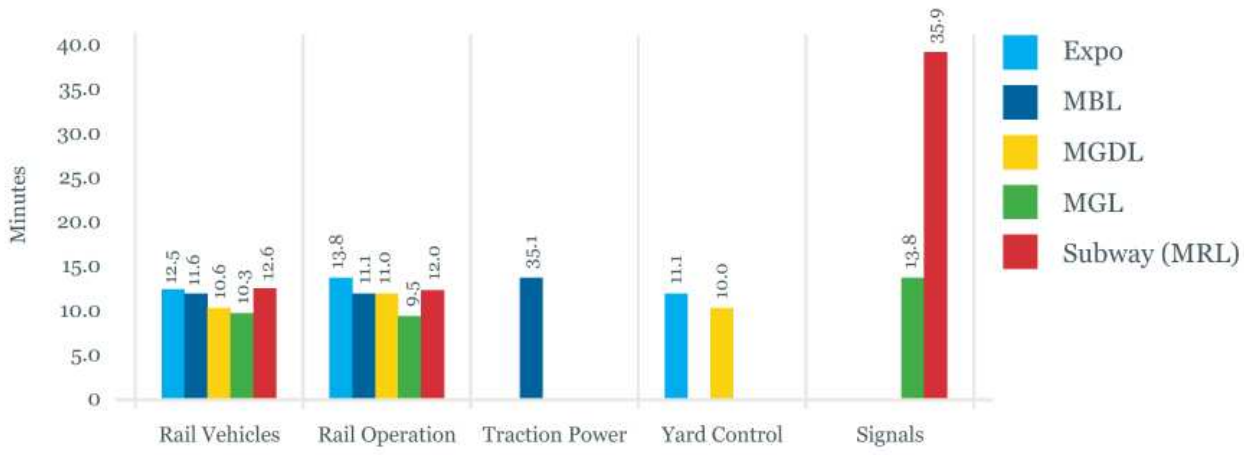
Max Delay by Incident Type	Expo	MBL	MGDL	MGL	Subtotal Light Rail	MRL
Rail Vehicles	2.953	5.295	3.424	2.806	**14.478**	1.682
Rail Operations	1.046	1.081	816	539	**3.482**	312
Traction Power		1.054			**1.054**	
Yard Control	278		215		**529**	
Signals				235	**235**	359
Grand Total	**4.277**	**7.430**	**4.491**	**3.580**	**19.778**	**2.353**

B8. As shown in Table 4 above, Traction power on the MBL caused nearly as much total maximum delay minutes as delays from rail operations incidents despite representing 67 fewer incidents.

B9. On MRL, signals caused more total delay minutes than rail operations incidents despite representing 16 fewer incidents, and the average maximum delay minutes were also highest for this category.

B10. The average maximum delay minutes were also highest for traction power and subway signal incidents. (see Figure 5.)

Figure 5: Average 'Maximum Delay' Minutes for Top Three Incidents Per Line



Recommendations Related to the Overall Review of the Top Three Causes of Delay by Line

While the overall review of incidents evaluated in this study is largely to set the stage for the analysis of each of these top causes of delay, the overall discussion also yields some recommendations.

6. Review the approach of mitigating delay time of Police/Health delay incidents (while not part of this analysis, these delay incidents warrant review based on their frequency and duration).

7. Partner with law enforcement agencies to review the process used for police/health incidents.

8. Identify root cause for the top three categories of delay for each line to allow Metro to develop mitigations that have the potential to significantly reduce total delay incidents.

9. Set priorities based on Metro's asset assessment as soon as it is completed to reduce delay incidents.

C. Rail Vehicle Delay Incidents: Top Cause of Delay on All Lines

Overall

Rail vehicle delay incidents caused by a fleet mechanical issue and evaluated by TWG as shown in the graph below are not the same as those tracked by maintenance. For example, the total vehicle incidents resulting in a delay, recorded for the MGDL, was 323 for 2016, based on the ROC incident logs provided to TWG. This figure included incidents of the P2550 and P3010 vehicles. However, the MGDL maintenance shop recorded 1,118 incidents for only the P2550 fleet in 2016. This would indicate that there are many more incidents for these vehicles than are recorded as resulting in a service delay. Through good maintenance, these incidents are caught before they become service delays. To be consistent with the data reviewed for all fleets, all incidents were based on the logs received from the ROC and the related work orders (WO) indicating how the original issue was addressed.

Based on the information from the ROC, a total of 1,422 rail vehicle incidents were recorded for 2016, 1,288 on the four light rail lines and 134 on the subway. (For subways, Metro Purple Line is incorporated into Metro Red Line for this report.) The MBL, which has the largest fleet, had the most rail vehicle incidents. (see figure 6.)

Figure 6: Rail Vehicle Incidents by Line

From the 1,422 incidents, 296 incident reports for light rail lines and 100 for the subway line were randomly sampled as a statistically significant representation of the data. Since all rail cars with a number higher than 1000 (new P3010 cars) are still under warranty, these vehicles were disregarded in the incidents report. Only causal cars of the P865/2020, P2000, and P2550 series were evaluated by TWG.

At Metro, the vehicle fleets are not restricted to one line. To be able to identify fleet issues leading to operating delays, the review in this section must be based on vehicle fleet and not the operating line. For example, the P2000 fleet operates on three lines, Green, Blue, and Expo lines. Some vehicles are even relocated between lines during the year. To evaluate the P2000 performance, the data from the ROC was filtered by the P2000 vehicle numbers and analyzed independently of where the incident happened.

The fact that a majority of the incidents were reported on the MBL should not be used to judge the quality of work performed at the MBL maintenance shop. In 2016, more vehicles operated on the MBL than any other line. The MBL also maintained the two oldest fleets: P865/2020 and P2000.

The total fleet size of LRVs excluding the new P3010 cars, which are still being delivered, is 171. Final delivery of the P3010 fleet is not before 2020.

Overall Findings for Light Rail Vehicles (which include P865/2020s, P2000s, and P2550s)

C1. Rail Vehicle Service Delay Incidents were a small subset of maintenance shop statistics on fleet incidents, indicating that the majority of issues do not result in delay.

C2. 27% of Rail Vehicle Incident reports often resulted in no problem being found during the maintenance crew's review of the work order. (see Figure 7 below.)

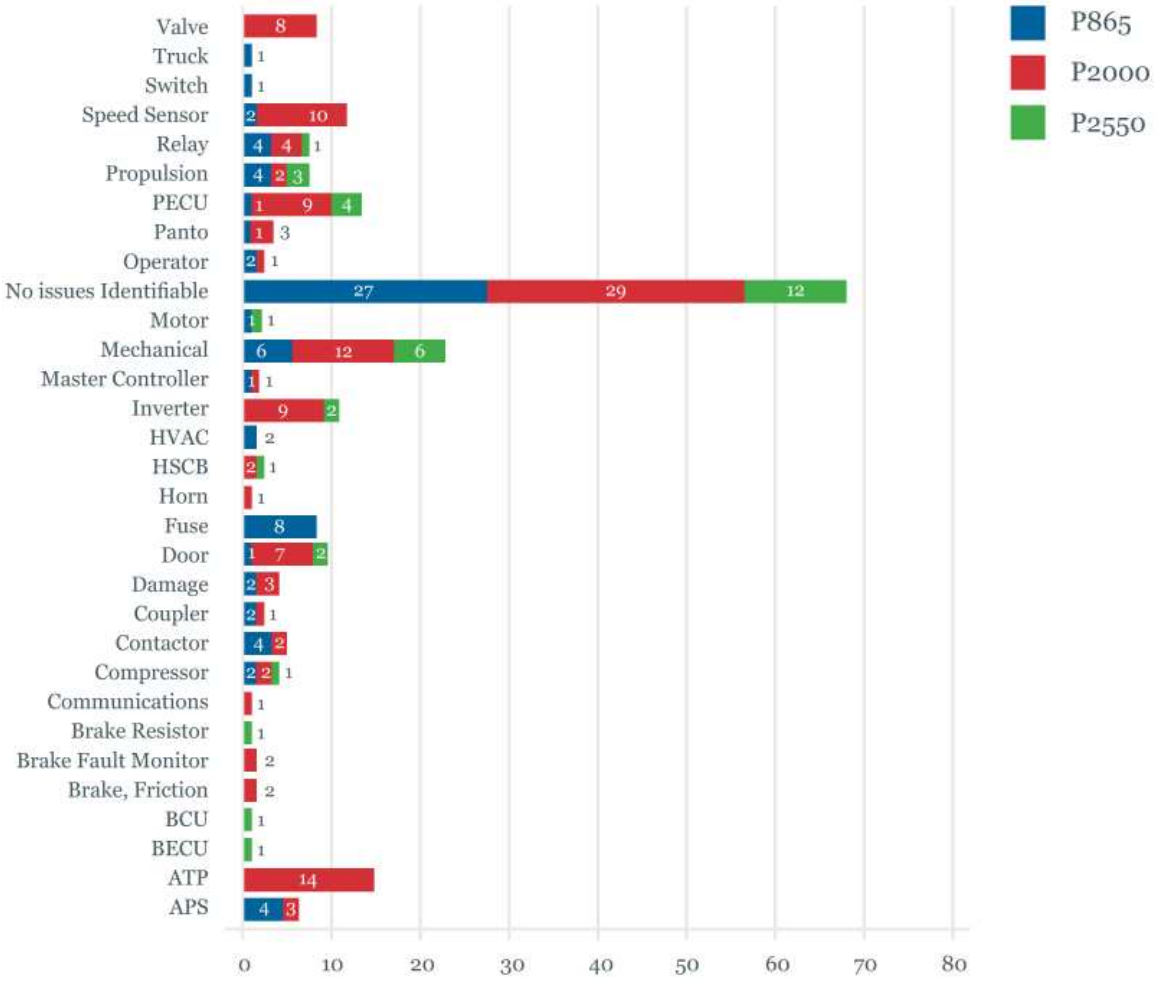
C3. Relative to their fleet size, most of the incidents causing service delays were caused by the P2000 vehicles.

C4. Midlife overhauls were not conducted on all fleets (under new leadership, this practice has changed; Metro now performs midlife overhauls, which are underway or planned for the other fleets).

C5. Incidents per car per fleet as reported by the ROC were:

- P2550 0.84
- P865/2020 1.08
- P2000 2.48

Figure 7: Causes of Rail Vehicle Incidents - Light Rail



Recommendations to Address Rail Vehicle Related Delays

10. Given the large number of incidents where no root cause was identifiable, establish a procedure to instruct vehicle maintenance personnel on providing consistent and complete detailed information related to vehicle failures in the WO reports. While awaiting a new log-in system with a consistent and nested drop down of primary causes of vehicle failure on incident reports, redesign work order forms along these lines, with a consistent section and checklist for identifying root cause.

11. Identify the funding and timeline for the new M3 system and move the project forward expeditiously. The new M3 module includes a more robust system for logging incident reports and will allow for more consistent and robust reporting of root causes of vehicle failures.

12. Establish a procedure for collecting the root cause of every vehicle failure even if it does not result in a service delay so that robust trends can be generated, tracked and mitigated.

13. Conduct periodic condition surveys on vehicles and components in advance of and complementary to the asset inventory that will be undertaken soon and refreshed every three years.

14. Establish a process and a criterion for replacement of existing vehicles and vehicle components that include useful life, failure rate, obsolescence, service needs, and available funding. While the Metro asset inventory will provide an important resource to this end when it is finished, this system of prioritization should be formalized and implemented in current vehicle procedures.

P865/2020; MBL and Expo

- Vehicles: total 69 cars or 40% of all LRVs; Serial numbers 100 to 168.
- Currently, 49 cars operate on the MBL (72% of the service) and 20 cars on the Expo line. Since the Expo line has a varying amount of P3010 vehicles in operation, a percentage of P865 service on the Expo line cannot be given.
- Several of the P865 vehicles operated on both the MBL and Expo line.
- These vehicles are the oldest LRVs in service (P865 cars are 27-years old and P2020 cars are 23-years old).
- The propulsion system is a 40-year old, thyristor controlled DC chopper control technology that is over 50 years old and not used any more.

Finding for P865/2020

C6. The P865/2020 fleets never went through a midlife overhaul. With an adequate midlife overhaul, subsystems with a relatively high percentage of issues, such as control relays, contactors, and mechanical issues, could have been reduced. Improved reliability of these components also might have reduced some of the subsequent failures, such as the number of failed fuses (10.5%).

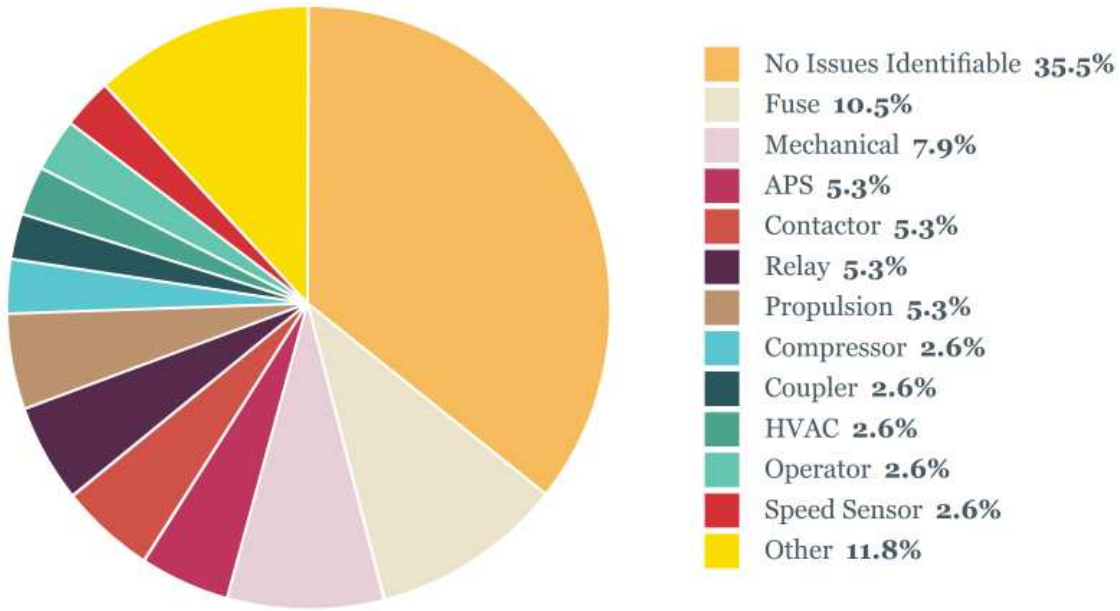
- The only subsystem replaced on some of the cars is the motor alternator (MA) set, which was responsible for 5.3% of the delay incidents in 2016. It is being replaced by a static Auxiliary Power Supply (APS).

- This fleet has been maintained since 1989 at the MBL shop, but recently Metro has been assigning some vehicles to the Expo shop, which may unnecessarily stretch resources. The knowledge for maintaining the 50-year old chopper design is concentrated in the MBL shop and all spare parts are at the MBL shop. It creates a logistics problem if a fleet needs to be maintained at different locations.

Findings on Subsystem Causes of P865/2020 Incidents

The causes of incidents leading to service disruptions have been categorized into the 13 areas shown in the following chart:

Figure 8: Causes of Rail Vehicle Incidents - Light Rail (P865 & P2020)



C7. 11.8% of the incidents categorized as "Other" were single incidents caused by the following subsystems:

- Automatic Train Protection (ATP)
- Brake Electric Control Unit (BECU)
- Friction brakes
- Propulsion Electric Control Unit (PECU)
- Doors
- Master controller
- Pantograph (Panto)
- Control switch
- Truck

C8. 10.5% of the incidents were caused by fuse failures. These fuses protect the high voltage chopper circuit. The fuse is never the root cause of this incident. Pantograph bouncing, PECU (control electronics) or contactor malfunctions are the most likely causes for fuse failures. The average maximum delay was 10.5 minutes.

C9. 7.9% of the incidents were caused by mechanical failures.

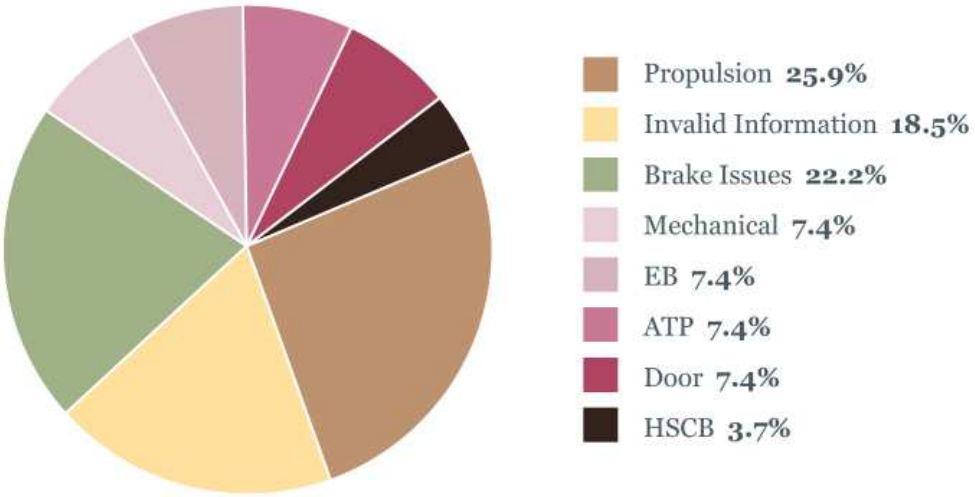
C10. 5.3% of the incidents were caused by Auxiliary Power Supply (APS) failures. APS incidents are caused by either a faulty MA set (which is being replaced) or the new static APS. No issues with the new APS were reported.

C11. No cause was identifiable for 35.5% of incidents. In such cases, the "Cause" cited was, for example, "no movement" and the WO showed "no issue found" or "pre-excitation unit changed," which could not be the cause for the vehicle not moving, since this device is used to initiate dynamic braking only. The cause, in this case, would have been no "dynamic brakes." Another example is the cause "door not closing" with the WO showing "no issue found." In this case, a passenger might have kept the door open.

- Figure 9 below classifies "No Issue Identifiable" incidents by the "Cause" of the delay as reported to the ROC.

- The average maximum delay of these "unidentifiable" incidents was 10.8 minutes.

Figure 9: No Issues Identifiable (P865 & P2020)



Findings on Specific P865/P2020 Vehicle Analysis

Over the whole 69 P865/P2020 fleet, the ROC reported 1.08 incidents per car during 2016.

C12. Cars with the most incident reports are from the first series of P865 cars (age 27 years).

- Car #130; four issues: The average maximum delay was 10.5 minutes.
  Incidents reported were failed ATP, PECU, Propulsion, and No Issues Identifiable.

- Car #142; four issues: The average maximum delay was 9.75 minutes.
  Incidents reported were failed BECU, Relay, and two instances of "No Issues" found.

C13. The cars with the most incidents from the second series of P2020 are:

- Car #163; three issues: The average maximum delay was seven minutes.
  Incidents reported were failed Contactor and Relay, Propulsion, and No Issues Identifiable.

- Car #165; two issues: The average maximum delay was 15 minutes. The cause of one incident was a failed MA set and the second incident was unidentifiable.

- The following list shows the 69 P865/P2020 car numbers and the corresponding number of incidents which led to a service delay:

Table 5: Number of Incidents Per P865/P2020 Car

Car #	Incidents	Car #	Incidents	Car #	Incidents
130	4	106	1	168	1
142	4	109	1	103	0
110	3	112	1	107	0
125	3	113	1	108	0
140	3	114	1	111	0
163	3	116	1	115	0
166	3	118	1	117	0
105	2	120	1	119	0
124	2	121	1	128	0
131	2	122	1	129	0
132	2	123	1	133	0
137	2	126	1	134	0
138	2	127	1	136	0
141	2	135	1	143	0
147	2	139	1	144	0
150	2	145	1	148	0
153	2	146	1	149	0
159	2	154	1	151	0
165	2	157	1	152	0
100	1	158	1	155	0
101	1	160	1	156	0
102	1	162	1	161	0
104	1	164	1	167	0

Findings on the Impact on Capital Programs/Investment

The analysis considered the impact of capital investment on each fleet.

C14. The P865/2020 fleets never went through a midlife overhaul. In 2005 when the P2550 vehicles were ordered, the P865 vehicles were already 15-years old. At that time, Metro determined that buying new vehicles would be more cost effective than investing in 15-year old ones. The intention was to order more P2550 vehicles and then replace the P865s, rather than overhauling them. Unfortunately, the P2550 order did not result in option cars. A new light rail specification was issued. This and, to some extent, the success of the light rail system in Los Angeles made it impossible to retire or sell the P865 as planned.

C15. These cars have been kept in service by "as needed" maintenance and investments for more than 10 additional years. Only the arrival of the new generation of LRVs (P3010) will allow Metro to retire the vehicles of the P865 fleet but still keep the slightly younger P2020 fleet, which are identical to the P865.

C16. Since 1989, these cars have been maintained out of the MBL shop, but recently some have been assigned to the Expo shop, requiring inefficient dispersion of knowledge and parts especially given the planned reduction in fleet size.

C17. When it became obvious that the P865 fleet was still needed, Metro started to invest in some component upgrades, such as replacing capacitors which were well past the expected service life of 15 years, replacing contactors, and upgrading the propulsion control power supply among other as needed components. Major subsystems, such as traction motors, gears, and brakes were maintained preventively as required by the manuals. On some cars, the MA set as the auxiliary power supply was replaced, or is being replaced, by a static Insulated Gate Bipolar Transistor (IGBT) APS.

Recommendations for Addressing All Findings on the P865/2020 Fleets

15. Continue funding for daily maintenance and up-keep of the P865/2020 fleets although no major capital investment is recommended at this time.

16. Identify the P865 cars in the worst condition for decommissioning and use them as spare part suppliers to support more reliable cars. This is only for the transitional period until the P3010 vehicles are delivered and the P2000s are overhauled. By doing this, spare parts will become available to keep the remainder of the fleet running for a while at reasonable costs. Since these vehicles are well known to Metro, problems could be resolved quickly by having these replacement parts available.

17. Keep enough P865 cars as floats to improve the availability of P2000 vehicles for refurbishment. The P2000 fleet has a higher incident rate than the P865 (2.5 incidents per car compared to 1 incident per car). Therefore, the priority should be to make enough P2000 cars available for refurbishment.

18. Review the decommissioning process of the P865 fleet given the lower incident rate for the P865 fleet. P865 cars with low or no incidents should be kept in service during the P2000 overhaul to expedite the overhaul, replacing some P2000 services with P865 cars to increase the vehicle availability during the overhaul.

19. Maintain the remaining P865 cars only out of the MBL maintenance shop, which has the best expertise, logistics and parts inventory to maintain the P865 fleet.

20. Continue with the P865 component upgrades to keep a reduced fleet with increased reliability in service until they are replaced by the P3010. Areas of upgrades still useful are contactors, relay panel and electronic control unit (ECU) power supply.

21. Evaluate overhaul needs of select main components. Depending on how long Metro intends to keep cars of the P865/2020 fleet, some of the main components, such as gears and traction motors, of selected well-performing cars might have to be overhauled.

22. Continue the refurbishment program begun by Metro to reduce fuse failures, such as upgrades to the chopper control unit, contactor and relay replacements, in place as needed for some of the P865 cars, which might remain in service for a few more years.

P2000; MBL, Expo & MGL

- P2000 vehicles total 52 cars or 31% of all LRVs, serial numbers 201 to 250 and 301 & 302.
- 29 cars (55%) run on the MGL; automatic train operation; cars 201 to 228 and 243.
- 19 cars (37%) run on the MBL.
- Four cars (8%) run on the Expo line.
- Several of the P2000 vehicles are known to have operated on both the MBL and the Expo lines.
- These vehicles are the second oldest LRVs in service with Metro. The average years in operation is 15 years.
- The propulsion system is an obsolete Gate Turn-Off Thyristor (GTO) inverter drive.

The vehicles are just starting to go through a midlife overhaul, replacing the propulsion system with modern IGBT 3 phase drives. Also, the Auxiliary Power Supply (APS), Low Voltage Power Supply (LVPS), and Automatic Train Control/Automatic Train Protection (ATC/ATP) will be replaced.

Subsystem Analysis

The difference between operation on the MGL and other lines is that on the MGL, the P2000 cars runs mostly in Automatic Train Operation (ATO). Therefore, the incident distribution between the two different services can be compared. The fleet is split into 55% of the cars for MGL and 45% on other, manually operated lines, or roughly half the fleet per lines.

Table 6: Incident Distribution

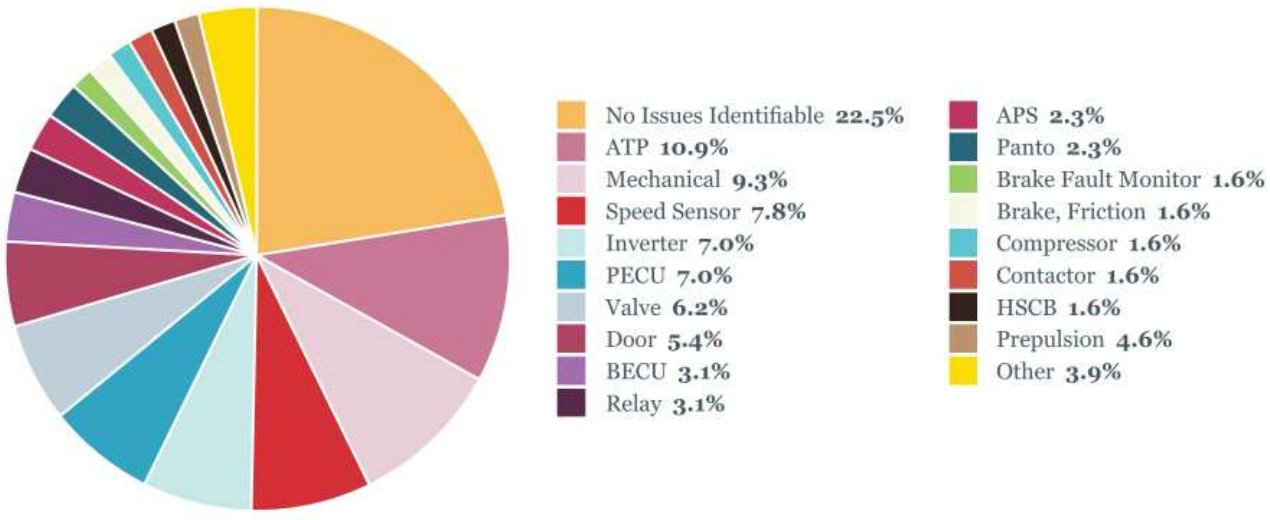
	MGL	MBL & Expo
Incidents leading to a delay	63	65
ATP/ATO Incidents	9 (64%)	5 (36%)
No Issue Identifiable	16 (53%)	14 (47%)

As shown in the above table, the statistics indicate that the P2000 car incidents do not vary much between the MGL operated in ATO and the lines operated manually. The major incident reported, "no issues identifiable," are about the same for both services. Therefore, it can be concluded that the ATO operation, which reduces the effect of human interference in the vehicle control to some extent, does not result in an improved service reliability.

Findings on Subsystem Causes of P2000; MBL, Expo & MGL Incidents

The causes of incidents leading to service disruptions have been categorized into 19 areas shown in the following chart:

Figure 10: Causes of Rail Vehicle Incidents - Light Rail (P2000)



C18. 14% of the incidents were propulsion related (Inverter 7% and PECU 7%) and resulted in an average maximum delay of 10.1 minutes per car.

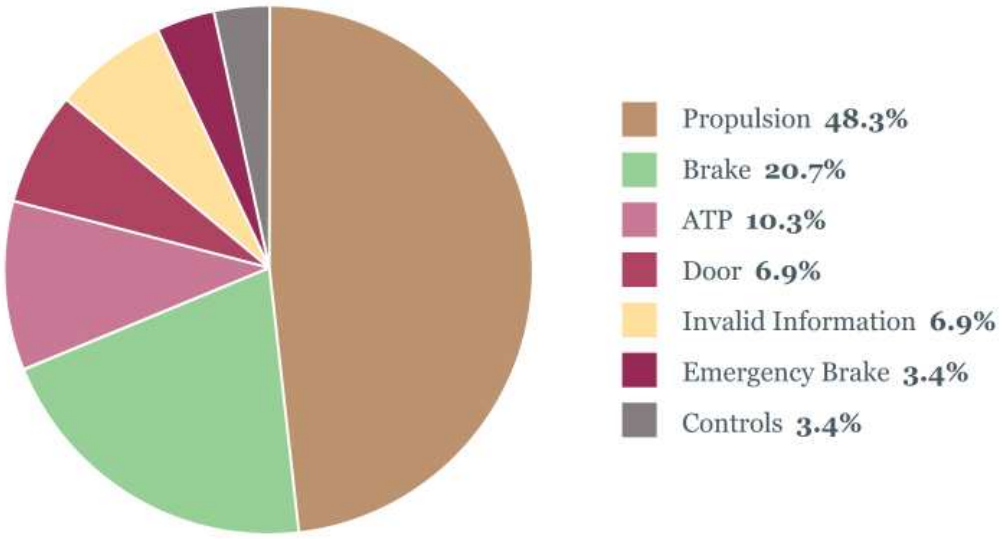
C19. 10.9% of the incidents were ATP/ATO related issues and generated an average maximum delay was 10.2 minutes per car.

C20. 9.3% of the incidents were mechanical issues, mostly related to the doors being misaligned, getting off rollers, or simply jammed, broken mirror, or a propulsion fault due to the air channels being clogged up.

C21. The cause for 22.5% of the incidents could not be identified from the incident reports and the work orders because there was inconclusive or contradictory information. This is 13% less than for the P865/2020 fleet. This could indicate that the P2000 fleet issues are easier to identify and investigate than for the P865/2020 fleet.

- The chart below categorizes "No Issue Identifiable" incidents by the cause of the delay reported to the ROC:

Figure 11: No Issues Identifiable (P2000)



- The chart above shows that 48.3% of no issue identifiable incidents were reported as propulsion issues. This indicates that the propulsion system diagnostics are more complicated than on the P865 and P2550 cars.

- The average maximum delay of these incidents was: 9.6 minutes per car.

Findings on Specific Vehicle Analysis

Over the entire 52 P2000 fleet, the ROC reported 2.48 incidents per car for the review period. This was more than twice as many as for the P865/2020 fleet.

C22. Car #222 (MGL) had the most incidents reported. This car had seven reports that included problems relating to APS, ATP, Compressor, PECU, Relay, and two instances of No Issues Identifiable. This should be the first car to run through the refurbishing process. On average, each incident caused an 8.6 minute delay.

C23. Six cars had five incidents each (MGL cars #205, 208. 212, 229 and on the MBL/Expo cars #242 and 247). On average, each incident on these cars caused a 10 minute delay.

C24. Six other cars had four incidents each (two for MGL and three for MBL/Expo).

C25. Eleven cars had three incidents each. The MBL/Expo lines had more of these cars than the MGL.

C26. The following table shows the 52 P2000 car numbers and the corresponding number of incidents which led to a service delay:

Table 7: Number of Incidents Per P2000 Car

Car #	Incidents	Car #	Incidents	Car #	Incidents
222	7	239	3	217	1
205	5	240	3	221	1
208	5	244	3	223	1
212	5	249	3	225	1
229	5	209	2	228	1
242	5	211	2	246	1
247	5	213	2	250	1
207	4	215	2	206	0
214	4	218	2	220	0
237	4	219	2	224	0
238	4	227	2	232	0
248	4	234	2	241	0
301	4	235	2		
203	3	243	2		
210	3	245	2		

Car #	Incidents	Car #	Incidents	Car #	Incidents
226	3	302	2		
230	3	201	1		
231	3	202	1		
233	3	204	1		
236	3	216	1		

Finding on the Impact on Capital Programs/Investment

The analysis considered the impact of capital investment on the P2000 fleet.

C27. The P2000 fleet is scheduled for a major overhaul. Considering the high incident rate per car and the relatively young age of these vehicle, this is the correct approach.

Recommendations to Address Findings on the P2000 Fleet

23. Plan the midlife overhaul to first upgrade the worst vehicles, such as cars #220, 205, 208, 212, 229, 242 and 247.

24. Analyze the float vehicle needs for the P2000 vehicle midlife overhaul and ensure that the overhaul contractor has enough cars to expedite the overhaul. On the MBL, P865 vehicles can replace P2000 vehicles, therefore if there is a shortage of vehicles for service, the number of P865 vehicles being decommissioned could be reduced temporarily, since statistics show in general that P865 vehicles are more reliable than P2000 vehicles. This will expedite the overhaul process by being able to provide enough vehicles to the overhaul contractor.

25. Consider converting some P2000 cars running on the MBL/Expo lines back to the MGL operation. The critical float will be the P2000 MGL cars with their line specific ATO/ATP equipment. These cars cannot be substituted with P865 cars. Converting some P2000 vehicles currently running on the MBL/Expo lines back to the MGL operation if the ATO/ATP packages removed earlier are still available would reduce the risk of service disruptions on the MGL during the overhaul.

26. Improve the diagnostic capabilities of the propulsion system.

P2550 MGDL

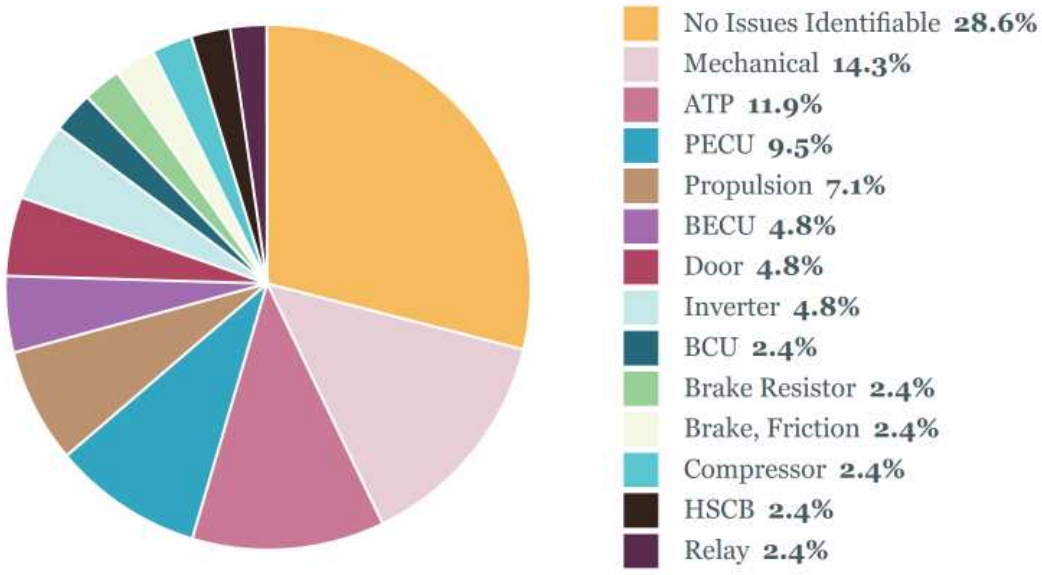
- P2550 vehicles total 50 cars or 29% of all 171 LRVs, serial numbers 701 to 750.
- All cars operate on the MGDL.
- These vehicles have been in service for about 10 years.
- The propulsion system is a modular 3 phase IGBT design.
- The condition of the vehicles is currently being assessed in anticipation of a midlife overhaul within the next five years.

Only recently did Metro management change their approach towards midlife overhauls of their fleets. Previously it was thought that ordering new cars instead of overhauling or upgrading existing ones was more economical. This change in approach came too late for the P865 fleet and just in time for the P2000 fleet. For the P2550 fleet, the midlife overhaul is now being planned proactively. Metro already has started a program to assess the condition of the P2550 vehicles after only 10 years in service and has established a comprehensive overhaul program.

Findings on Subsystem Causes of P2550 MGDL Delay Incidents

The causes of incidents leading to service disruptions of the P2550 vehicles have been categorized into fourteen areas shown in the following chart:

Figure 12: Causes of Rail Vehicle Incidents - Light Rail (P2550)



C28. 16.6% of the incidents were propulsion related (categorized as 7.1% propulsion and 9.5% PECU), caused by either inverter, sensors or electronic (PECU) failures. The average maximum delay for propulsion related incidents was 8 minutes.

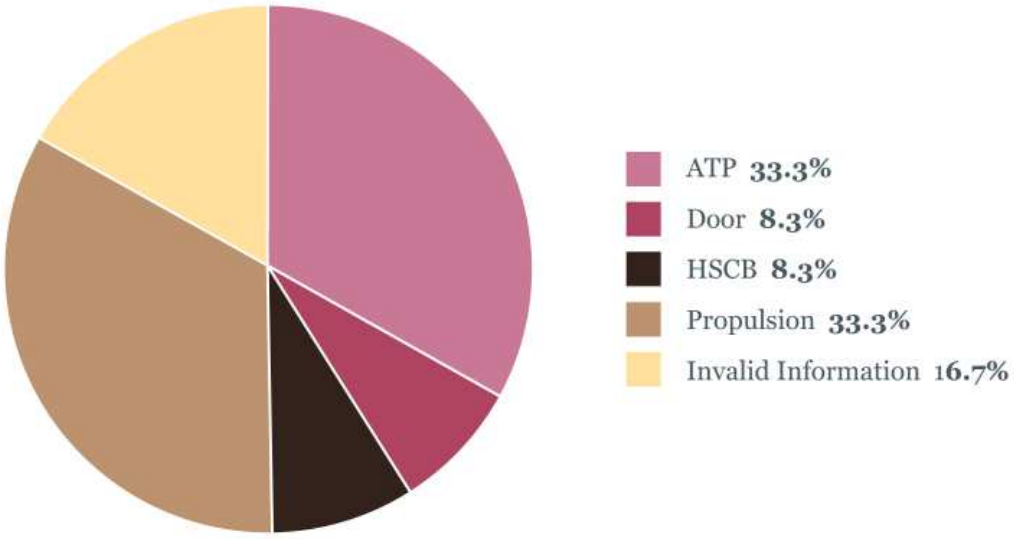
C29. 14.3% of the incidents were mechanical in nature, such as misaligned speed sensors, clogged air ducts, misaligned doors, and misaligned hinges. The average maximum delay of these incidents was 9.3 minutes per incident.

C30. 11.9% were categorized as ATP issues, suggesting that the Ansaldo Signaling and Transportation Systems (ASTS) and Hanning & Kahl (H&K) interface, which caused significant problems during the commissioning, might still have some issues. The average maximum delay caused by ATP issues was 12.4 minutes per incident.

C31. The cause for 28.6% of the incidents could not be identified from the incident reports and work orders because of inconclusive or contradictory information. This is comparable to the P2000 fleet.

- The chart below categorizes "No Issue Identifiable" incidents by the cause of the delay reported to the ROC:

Figure 13: No Issues Identifiable (P2550)



- The average maximum delay of these "unidentifiable" incidents was 11.4 minutes.

Findings of Specific Vehicle Analysis

For the 50 car P2550 fleet, the ROC reported 0.84 incidents per car during 2016. This makes the P2550 the most reliable LRV. This is within expectations on cars with only 10 years or less of service.

C32. Car 739 is the only car which shows an excessive number of incidents that caused a delay. This car had seven incidents that resulted in an average maximum delay of 8.6 minutes per incident. The causal subsystems were mostly related to brakes and ATP.

C33. The following table shows the 50 P2550 car numbers and the corresponding number of incidents leading to a service delay:

Table 8: Number of Incidents Per 2550 Car

Car #	Incidents	Car #	Incidents	Car #	Incidents
739	7	726	1	720	0
705	2	728	1	721	0
710	2	730	1	722	0
714	2	731	1	723	0
717	2	733	1	724	0
734	2	736	1	725	0
743	2	738	1	727	0
745	2	740	1	729	0
701	1	741	1	732	0
702	1	744	1	735	0
704	1	749	1	737	0
706	1	703	0	742	0
708	1	707	0	746	0
713	1	709	0	747	0
715	1	711	0	748	0
718	1	712	0	750	0
719	1	716	0		

Findings on the Impact on Capital Programs/Investment

The analysis considered the impact of capital investment on each fleet.

C34. The P2550 fleet is the youngest of all Metro fleets other than the P3010 vehicles, which are still being delivered. P2550 vehicles had the lowest incidence of service delays per car (0.84 during 2016). The P2550 cars have a train operator display (TOD) and an elaborate diagnostic system, which reduces incident-causing delays. This demonstrates the value of investing in diagnostics to improve vehicle availability.

C35. Metro keeps a list of all incidents experienced by these vehicles, even if they do not cause a service delay. The component health statistics and the vehicle inspections, currently performed by Metro, facilitate maintaining a reliable overhaul process.

C36. It seems that Metro is providing the needed funds to finance a useful midlife overhaul for the P2550 fleet.

Recommendations for All Findings on the P2550 Fleet

27. Use information from the TODs on the P2550 vehicles for improved incident reporting. The P2550 cars are the first Metro vehicles that have a sophisticated TOD and diagnostics.

28. Modify the incident reports for P2550 vehicles to include the information provided by the TOD at the time of the incident, in addition to the Operator reports.

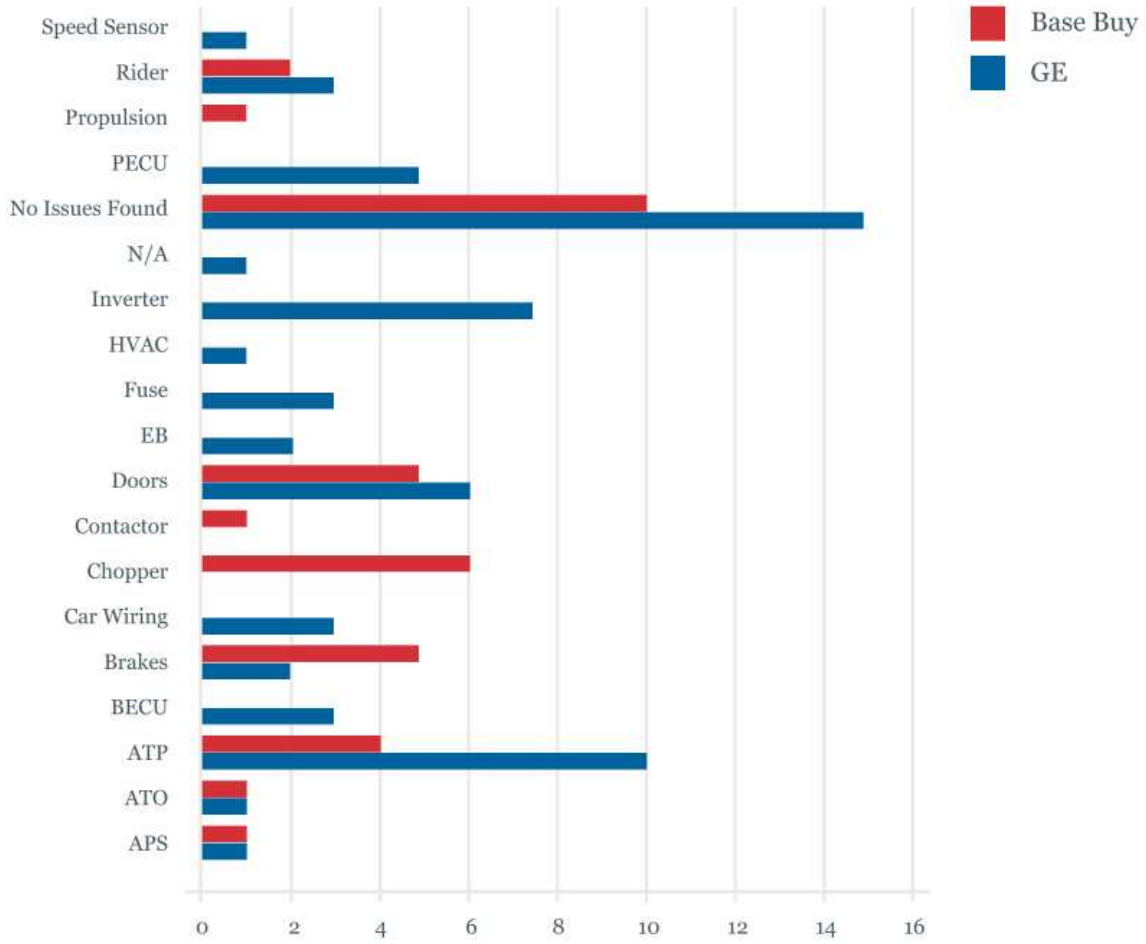
29. Accurately report the time of the incidents as shown on the TOD, not by the system time at the ROC.

30. Use the time of the incident displayed on the TOD in evaluating the delay incident to improve accuracy and turnaround time of the affected vehicle.

Review of Subway Events

The subway fleet consists of 30 Base Buy cars and 74 newer A650 General Electric (GE) cars. Review of sample incident reports for 2016 revealed that the Base Buy cars had a higher incident rate per vehicle than the GE cars. GE cars had more total incidents since they consist of 71% of the total subway fleet. Most of the vehicle components for the GE and Base Buy fleets are identical, other than the propulsion system and vehicle controls. Figure 14 below shows the number of rail vehicle incidents by causes.

Figure 14: Causes of Rail Vehicle Incidents - Subway



Incidents per car per fleet as reported by the ROC:

1. Base Buy 1.2
2. GE 0.82

Based on these figures, the A605 GE fleet of subway cars is the most reliable vehicle fleet Metro operates.

Base Buy Cars

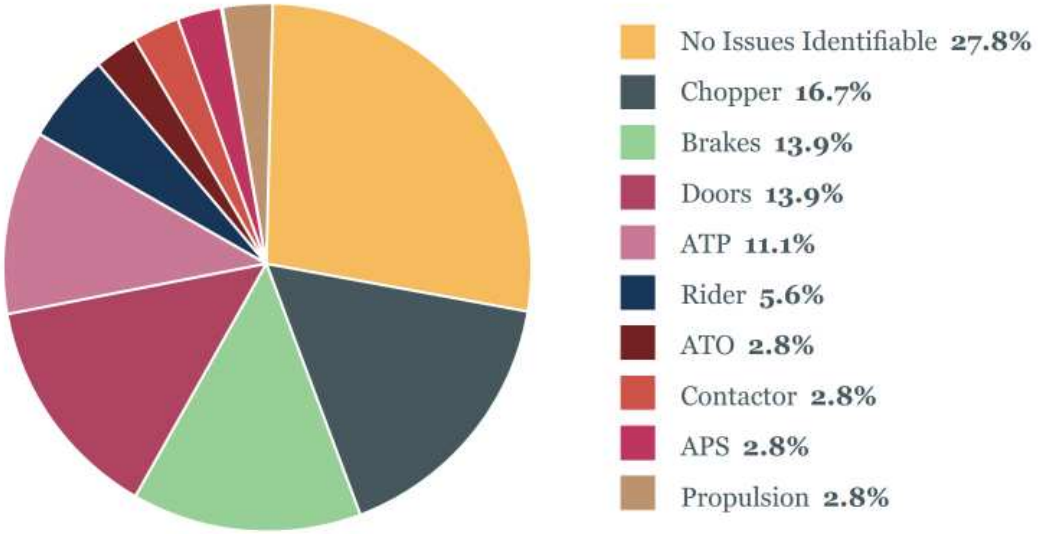
- Base Buy vehicles total 30 cars or 29% of all subway cars, serial numbers: 501 to 530.
- Base Buy and GE cars operate in mixed fleets and on all subway lines (Red and Purple)
- The Base Buy cars are the oldest Metro subway cars, in service for 24 years.
- As with the P865 fleet, these cars never went through a midlife overhaul.
- Some propulsion spare parts from similar cars, decommissioned by the Metropolitan Atlanta Rapid Transit Authority (MARTA), were acquired to improve maintainability.

- The propulsion system technology is more than 40-years old. It is a forced commutated thyristor controlled DC chopper design based on analog controls; no microprocessor is used.

Findings on Subsystem Causes of Base Buy Subway Car Delay Incidents

The causes of incidents leading to service disruptions have been categorized into ten areas shown on the following chart:

Figure 15: Causes of Rail Vehicle Incidents - Subway (Base Buy)



C37. 19.5% of the incidents were caused by the Chopper and other propulsion related issues. The average maximum delay was 19.4 minutes per incident.

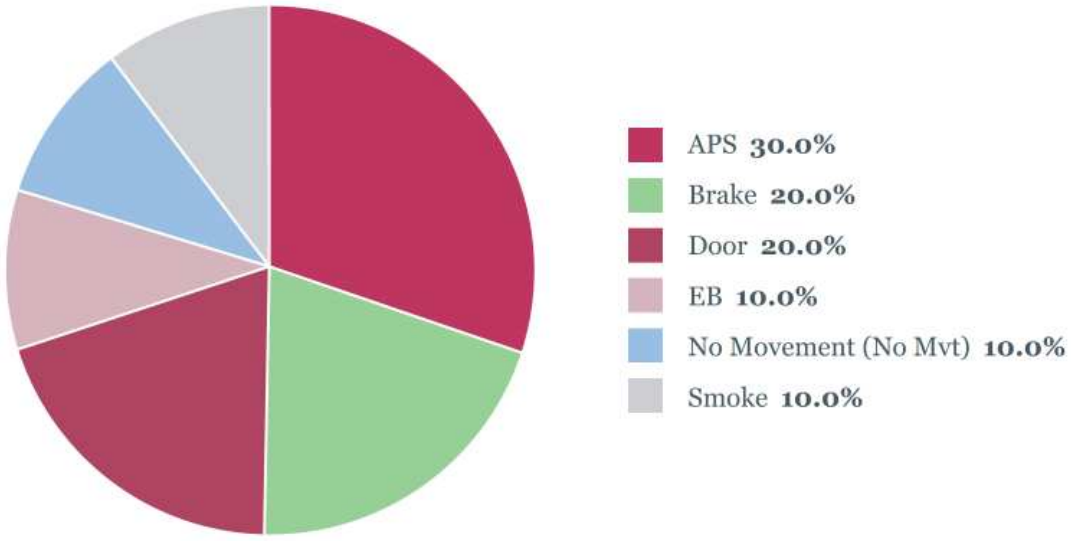
C38. 13.9% of the incidents were caused by the brake system. The average maximum delay was 8.4 minutes per incident. The much lower percentage of brake incidents on the GE vehicle suggests that the issues might be an interface issue with propulsion/vehicle controls since the GE vehicles use the same brake components.

C39. 13.9% of the incidents were caused by the door system. This is similar to the GE vehicles, which have the same doors. The average maximum delay was 8.2 minutes per incident.

C40. The cause for 27.8% of the incidents could not be identified from the incident reports and work orders because of contradictory information or because no issues were found.

- The chart below categorizes "No Issue Identifiable" incidents by the cause of the delay reported to the ROC:

Figure 16: No Issues Identifiable (Base Buy)



- The average maximum delay of these incidents was 10.8 minutes. APS, brakes, and doors caused 70% of the incidents where no issues were identifiable as shown in the above chart.

Findings of Specific Vehicle Analysis

For the entire Base Buy fleet, the ROC reported 1.2 incidents per car during 2016.

C41. Car #512 had the worst reliability record.

C42. This car had seven reported incidents. The average maximum delay was 17.4 minutes per incident. Incidents reported were mostly for brake issues, two ATO/ATP, and one door issue.

C43. Cars #505, 521, 523 and 527 had 3 issues each. The average maximum delay was seven minutes per incident. Incidents reported were mostly door issues and three propulsion issues.

C44. The following table shows the 30 Base Buy car numbers and the corresponding number of incidents which led to a service delay:

Table 9: Number of Incidents Per Base Buy Car

Car #	Incidents	Car #	Incidents	Car #	Incidents
512	7	525	2	508	0
505	3	509	1	513	0
521	3	510	1	515	0
523	3	514	1	518	0
527	3	516	1	519	0
503	2	526	1	520	0
506	2	501	1	522	0
511	2	502	1	528	0
517	2	504	1	529	0
524	2	507	1	530	0

Findings on the Impact on Capital Programs/Investment

The analysis considered the impact of capital investment on the Base Buy subway fleet.

C45. Similar to the P865 cars, the Base Buy cars have an obsolete propulsion and control system. The Base Buy cars never went through a refurbishment process, although capital funding was available a few years ago. Consequently, the Base Buy cars have an obsolescence problem, but not as severe as the P865 cars.

- Most of the control and chopper components are very old but still available, because no microprocessors are used.
- Also, the analog control boards are of a classic design, which can be maintained with regular tools and control knowledge.

C46. Base Buy cars are maintainable for a few more years, although this might not be cost effective. Metro intends to keep these vehicles in service until the new HR400 subway cars are delivered. With the correct funding in place, this approach is feasible.

Recommendations for Base Buy Cars

31. Keep the Base Buy subway cars running by continuing to ensure enough funding for Rail Fleet Services to maintain this fleet.

32. Ensure that the knowledge of the chopper controls, a technology that is 50 years old and no longer used, is not lost before the new cars arrive.

33. As the new HR4000 vehicles arrive, take the Base Buy cars out of service as early as possible to reduce maintenance costs. The cars in the worst condition should be replaced first.

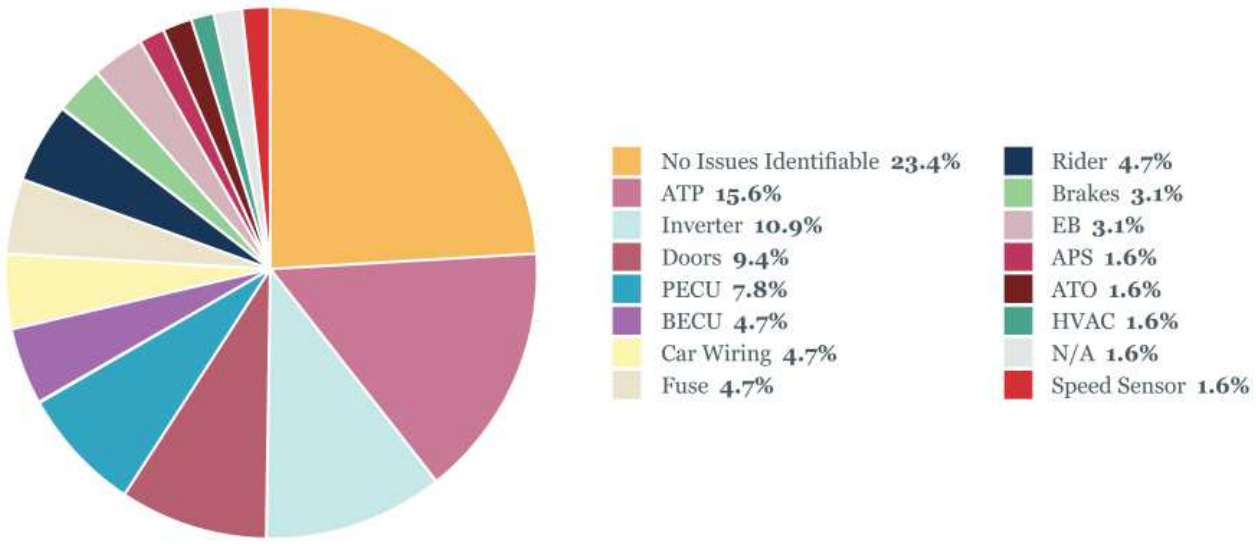
A650 GE Fleet

- GE vehicles total 74 cars or 71% of all subway cars, serial numbers 531 to 604.
- The GE fleet is about 18 years old.
- Base Buy cars and GE cars operate in mixed fleets and on all subway lines.
- The GE cars are mostly the same subway cars as the Base Buy cars, but have newer propulsion equipment, based on a GTO 3 Phase (ph) drive system.
- The GE fleet just started a midlife overhaul program.

Findings Based on GE Fleet Subsystem Analysis

The causes of incidents leading to service disruptions have been categorized into 16 areas shown in Figure 17 below.

Figure 17: Causes of Rail Vehicle Incidents - Subway (GE)



C47. 18.7% of the incidents were caused by the propulsion system, mainly the inverter modules and the controls PECU. The average maximum delay was 9.25 minutes per incident.

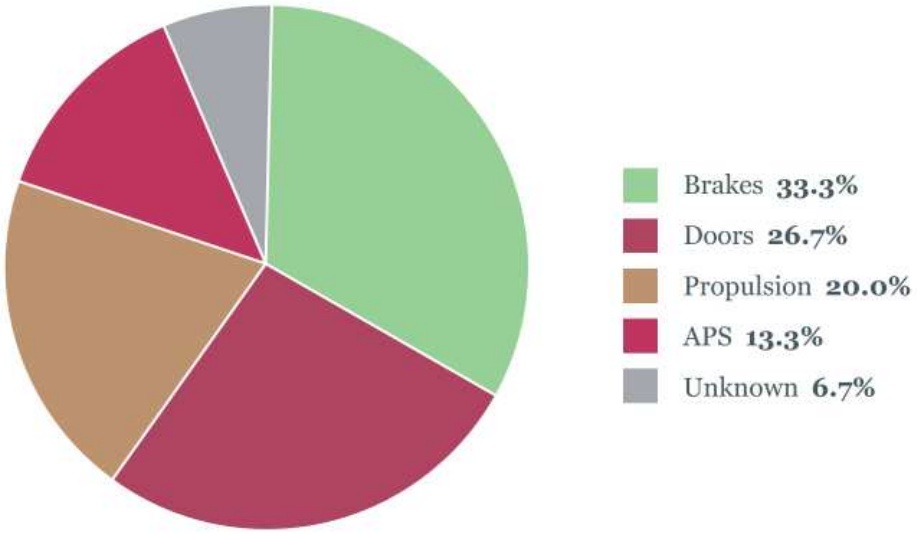
C48. 15.6% of incidents were due to equipment failures of the ATO/ATP system. The average maximum delay was 9.6 minutes per incident.

C49. 9.4% of the incidents were caused by the doors, which are the same as for the Base Buy cars. The average maximum delay was 12 minutes per incident.

C50. The cause for 23.4% of the incidents on the GE series could not be identified from the incident reports and work orders because of contradictory information or because no issues were found.

- The chart below categorizes "No Issue Identifiable" incidents by the cause of the delay reported to the ROC:

Figure 18: No Issues Identifiable - Subway (GE)



- The average maximum delay for incidents with no issue identifiable was 12.5 minutes per incident. Brakes, doors, and propulsion were reported in 80% of the incidents as the "cause" where no issues were identifiable.

Findings on Specific Vehicle Analysis

For the GE fleet, the ROC reported 0.82 incidents per car for 2016.

C51. Car #595 had significantly more incidents reported than any other cars. This car had 6 reported incidents that included problems relating to ATP, BECU, PECU, and three instances where no issues could be identified. Through closer review of work orders, the cases where "no issues found" were actually due to brakes and propulsion issues (two instances).

C52. The following table shows the GE car numbers and the corresponding number of incidents which led to a service delay:

Table 10: Number of Incidents Per GE Car

Car #	Incidents	Car #	Incidents	Car #	Incidents
595	6	563	1	559	0
539	3	566	1	560	0
540	3	567	1	561	0
557	3	575	1	562	0
565	3	577	1	564	0
576	3	580	1	568	0
537	2	582	1	569	0
542	2	587	1	570	0
543	2	592	1	572	0
550	2	593	1	573	0
555	2	594	1	574	0
571	2	596	1	578	0
585	2	598	1	579	0
588	2	599	1	581	0
531	1	604	1	583	0
533	1	532	0	584	0
536	1	534	0	586	0
538	1	535	0	589	0
545	1	541	0	590	0
546	1	544	0	591	0
551	1	547	0	597	0
553	1	548	0	600	0
556	1	549	0	601	0
		552	0	602	0
		554	0	603	0
		558	0		

Findings on Impact on Capital Programs/Investment

The analysis considered the impact of capital investment on the GE subway fleet.

C53. Metro just began the midlife overhaul for the A650 GE fleet. The obsolete GTO inverter is being replaced with a state of the art IGBT inverter. Other equipment is also being replaced, such as the APS and the Heating, Ventilation and Air Conditioning (HVAC) units. In addition, other major components, such as the doors, are being refurbished.

C54. The GE and the P2000 fleets are the first fleets to undergo a major midlife overhaul.

C55. The GE fleet will remain in service even after the new HR4000 vehicles are delivered.

Recommendation for GE Cars

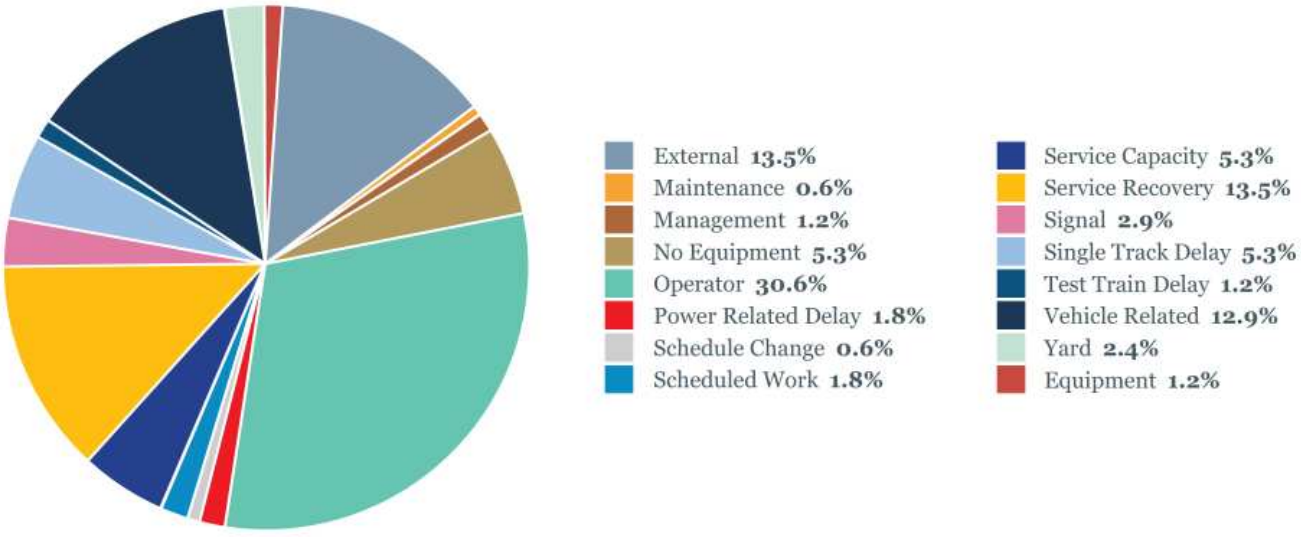
34. Perform the midlife overhaul on GE subway vehicles as planned.

D. Rail Operations Service Delay Incidents: Second Most Frequent Cause of Delay on All Lines

The 2016 the data provided to TWG reported 2,144 delay incidents (excluding police/health delay incidents) on all five lines of the LA Metro Rail. (Metro Purple Line is incorporated into Metro Red Line for this report.) These incident reports indicated that Rail Operations accounted for 330 incident delays (304 Light Rail; 26 Subway), which was the second leading incident type on all five lines. A review of the causes of the Rail Operation delay incidents follows with a focus on ways to mitigate those causes to reduce these delay impacts.

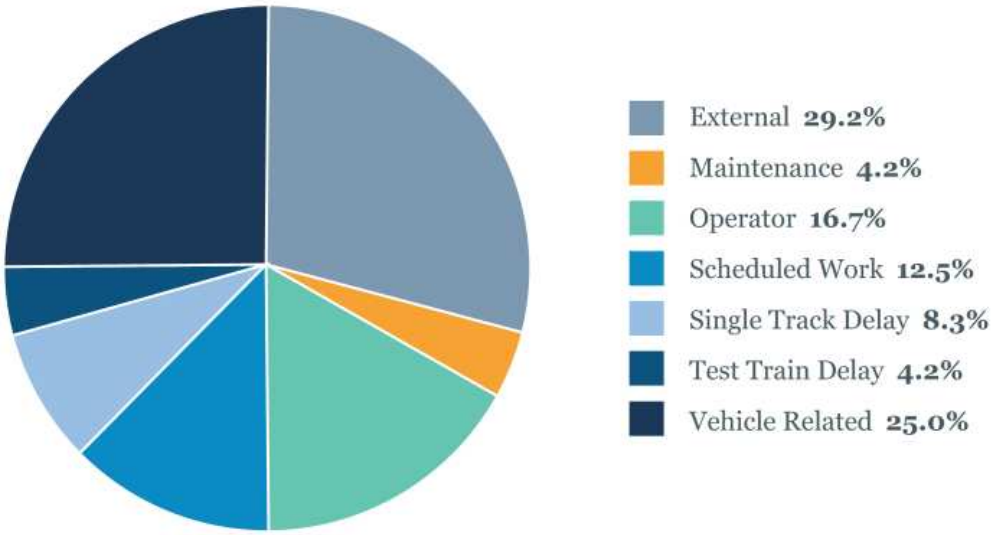
A sampling of 170 of the Light Rail Operations incidents were examined to further assess the types and related causes of incidents. These incidents were categorized into 16 primary causes of Light Rail Operations delay incidents. (see Figure 19.)

Figure 19: Causes of Rail Operations Incidents (Light Rail)



Similarly, the 26 delay incidents attributable to rail operations on the MRL were categorized into seven primary causes. (see Figure 20 below.)

Figure 20: Causes of Rail Operations Incidents (Subway)



Our analysis found that the 330 rail delay incidents resulted in a total of 3,794 maximum delay minutes or an average of 11.5 minutes per incident. The average maximum delay minutes per line ranged from 9.5 to 13.8 minutes as shown in the table below:

Table 11: Total 'Maximum Delay' Minutes and Average Delay Minutes for Rail Operations Delays

Line	No. of Incidents	Total Max Delay Min	Average Max Delay Min
Expo	76	1046	13.8
MBL	97	1081	11.1
MGDL	74	816	11.0
MGL	57	539	9.5
MRL	26	312	12.0
Grand Total	**330**	**3794**	**11.5**

Findings Related to Rail Operations Service Delay Incidents

D1. Service incident delays attributed to Rail Operations represents approximately 15% of the total 2,144 Metro Rail service delays.

D2. Operator caused incidents were the largest light rail category, accounting for 30.6% of the 170 incidents reviewed; this category included operators not being available because of absence, late arrival, restroom breaks, and operator error.

D3. On the MRL, operator caused incidents accounted for 16.7% of the 26 Operator related incidents. (see Figure 20 above.)

D4. Extrapolating to the total 330 Rail Operations related incidents for all lines, TWG estimates that 97 of the total incidents were attributed to Operators. However, this represents only 4.5% of the 2,144 total delay incidents reported in 2016.

D5. The causes of the remaining service delay incidents designated as Rail Operations cannot be controlled within that Division; these included externally caused delays, service recovery delays, vehicle caused delays, and other causes of delay.

Findings for Operator Caused Delays

D6. Of the Operator caused incidents, most (42.2%) were attributed to no operator available at the time of scheduled departure. Maintaining consistent operator availability to meet scheduled pullouts is a challenge throughout the industry. The incident reports indicated that some operators were either late or not available for their scheduled pullout resulting in the trip being either dropped or delayed with a replacement operator. This constrains Metro's ability to effectively maintain schedule requirements and service recovery efficiencies. Metro staff indicated that Extraboard staff are used to mitigate such impacts.

- Operator Extraboard staff was approximately 20% to 30% of the total scheduled operators. The Extraboard Operators are assigned by line but can operate on other rail lines as currently trained and qualified to do so. Although Metro does adequately budget for Extraboard Operators to address operator scheduled and unscheduled absences, the high frequency of Metro delays can exhaust available operator resources to support service recovery capabilities. Rail Operations' Operator Extraboard staffing levels may not be sufficient as a mitigation resource to address the scope and impact of Metro service incident delays.

D7. Slightly more than a quarter of the operator caused delays (26.9%) were related to restroom breaks (as identified by the code 10-100) at the end station terminal. In these cases, the lack of train layover time resulted in the train leaving later than the scheduled departure. Metro staff indicated that extra operators are built into the schedule and assigned to end station terminals to assist in operating the train to the vehicle turnback tracks and back into the station to facilitate the turnback operations. The reasons for the late train departures from the station terminals may involve no layover time due to in-service delays from a previous incident, schedule constraints, or no operator available to assist in moving the train to the opposite platform for the code 10-100 operator.

D8. Operator error was a factor in nearly one quarter of the operator related delays. These incidents involved operators who may not have applied vehicle troubleshooting measures effectively, were inadvertently locked out of the vehicle compartment, selected the wrong route, or didn't follow procedures resulting in a service delay. Operators involved in such incidents are provided reinstruction.

Recommendations to Mitigate Operator Caused Delays

35. Assess current mitigation measures to address operator absenteeism and late reports, and initiate management enhancements as appropriate.

36. Re-assess the level, allocation, and scheduling of Rail Operations Extraboard Operators as an opportunity to mitigate the impact of all service incident related delays resulting from service

recovery, operator late or no show, station terminal and yard operator related delays, "gap trains" staffing (extra trains added to the schedule to supplement service capacity as needed), etc.

37. Reinforce desired practices to mitigate future "Operator Error" service impact events including additional focus on operator vehicle troubleshooting tactics. Given that vehicle defects represent the most significant factor impacting Metro Rail service delays, assess operator awareness of common vehicle troubleshooting methods to expedite the safe movement of the vehicle and reduce service delays resulting from vehicle defects.

38. Consider the development of an Operations pocket size vehicle defect troubleshooting guide that reinforces what operators are trained to perform and summarizes the desired tactics to follow when confronted with vehicle related defects. Common vehicle troubleshooting methods and other lessons learned from operator errors that resulted in service delays should continue to be reinforced in current operator training programs.

39. Continue to hone service recovery contingency plans, which are key to minimizing the impact of all Rail Operations incidents.

Findings for Externally Caused Rail Operations Delay Incidents

D9. This category of delay, which includes such things as police action, service capacity, and grade crossing vehicular traffic impacts, was the second largest cause of Light Rail Operations Delay Incidents (13.5%) and the largest cause of MRL Rail Operations Delay Incidents (29.2%).

D10. While these incidents are characterized as Rail Operations incidents, they cannot be controlled within that division and should not be categorized as such.

Recommendation for Rail Operations Related Delays

40. Assess the designation of Rail Operations incidents and allocate accordingly to reflect only those accountable to that Division.

Findings for Service Recovery Caused Delays

D11. Service Recovery delays, which accounted for 13.5% of Light Rail Operations delays, reflected managing the impact of service incidents primarily caused by other factors, such as vehicle or infrastructure equipment defects, overcrowding, and external factors such as police action. Rail Operations reviews service delays on an ongoing basis to identify opportunities to reduce future occurrences and minimize the impact

of those that do occur. Due to the high-level occurrence of service incidents and subsequent delays, Rail Operations has developed an effective toolbox of service restoration options to initiate as appropriate. Metro is always trying to minimize the delay and recover service as quickly as possible by adding a train from the yard or a gap train (or making up service recovery time to the terminal or "bumping the line," sending the next train out early) to stay as close as possible to the train schedule. Unique to Metro is that gap trains are built into the schedule, moved onto tail tracks in the morning, and are ready for service with Extraboard Operators on standby in the yard.

D12. It was not clear as to the adequacy of the Rail Operations schedule layover/recovery time at station terminals as ongoing service delays often impact on time schedule departures. Having insufficient layover time at terminal stations can also result in increased service delays from Operators requiring a restroom break (10-100).

Recommendations to Mitigate Service Recovery Caused Delays

41. Continue to assess service contingency plans and related staff training to implement the service restoration contingency provisions. Document current effective service restoration practices and reinforce staff awareness through training. The initiation of effective service recovery contingency plans such as these are key to minimizing the impact of all Rail Operations incidents and should be formalized to support their timely and consistent application.

42. Assess running time schedule needs by Line to confirm the adequacy of layover time at station terminals.

Findings for Vehicle Caused Delays

D13. Vehicle related delays caused a significant percentage of Rail Operations Delay Incidents, including 12.9% of the light rail incidents and 25% of the subway incidents.

D14. Some vehicle related delays were probably due to operator error, but many were not; the available information was not sufficient to determine the root cause. To the extent that these vehicle related delays reflect operator error in troubleshooting the problem, they are appropriately assigned to Rail Operations. But if they are in fact vehicle failures, the mischaracterization of these incidents has two negative effects: first, it assigns accountability to rail operations which is not accountable for vehicle failures; and second, it does not ensure that vehicle maintenance is apprised of the problem for appropriate correction and tracking.

Recommendation for Vehicle Caused Delays

43. Utilize the recommendations (numbers 1-4 and 7) relative to determining root cause to better instruct operators in troubleshooting and to identify the cause of the vehicle related incident. Allocate cause accordingly so that rail vehicle incidents are not characterized as rail operations. Vehicle related delays attributed to Operator error while troubleshooting vehicle defects should continue to be allocated to Rail Operations so that appropriate mitigations can be undertaken.

Finding for the Remaining Causes of Rail Operations Incidents

D15. Similar to vehicle-caused delays, the remaining causes of Rail Operations Delay Incidents reflected categories that involved limited control by Rail Operations, such as no equipment, single track operations, scheduled maintenance/capital work, and test train. These are not primarily attributed to Rail Operations' scope of responsibilities.

Recommendation for Remaining Causes of Rail Operations Incidents

44. Utilize recommendations (numbers 1-4 and 7) relative to determining root cause to better identify the cause of the incident. Allocate accordingly so that incidents not caused by the operator are appropriately characterized and not attributed to rail operations so that appropriate mitigations can be undertaken.

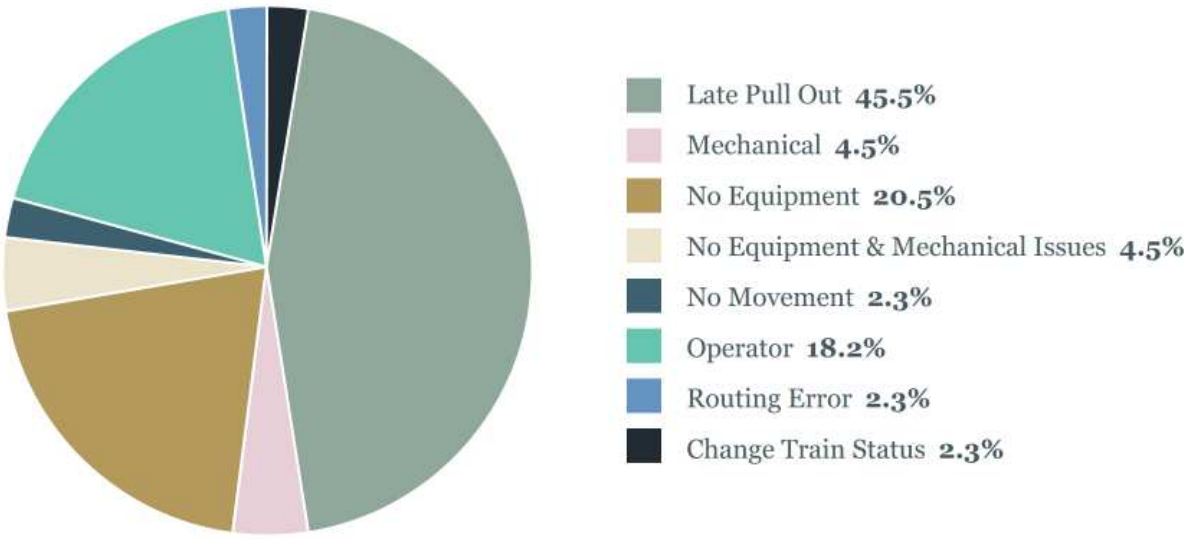
E. Yard Control Service Delay Incidents: Third Highest Cause of Delay on the Expo and Metro Gold Lines (MGDL)

Yard Control incidents were the third highest cause of delay, with 50 incidents on the Expo and MGDL; 22 incidents each for Expo and MGDL were randomly sampled as a statistically significant representation of the data.

Findings for Yard Control Related Delays

These incidents were categorized into 8 primary causes of Light Rail Operations delay incidents. (see Figure 21.)

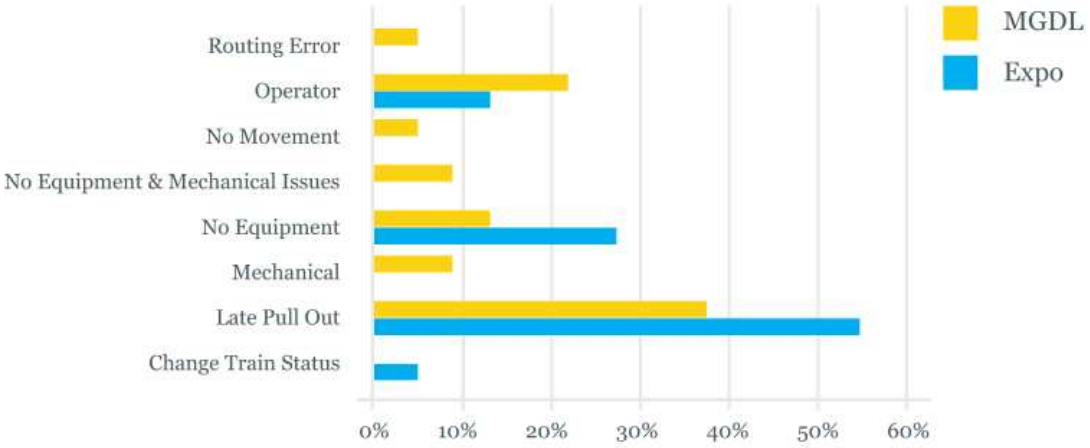
Figure 21: Causes of Yard Control Incidents (Light Rail)



E1. As shown in the above chart, the top three incidents due to Yard Control were late pull out (45.5%), no equipment (20.5%), and operator (18.2%) (mostly operator not available).

E2. The analysis in Figure 22 shows that Yard Control related service delays were largely not specific to the yards.

Figure 22: Causes of Yard Control Incidents by Line



Recommendations to Mitigate Yard Control Related Delays

45. Limit the designation of Yard Control incidents to those actually attributed to yard issues.

46. Review Yard vehicle availability constraints and evaluate options designed to further support the consistent achievement of 100% equipment schedule availability.

F. Signal Service Delay Incidents: Third Highest Cause of Delay on the Metro Green Line (MGL) and the Metro Red Line (MRL)

This part of the review and analysis of service delays focused on delays to train service that were caused by failures in the existing signal installations, which were the third highest frequency cause of delay on MGL and MRL from the data provided.

In a prior study on LA Metro's Safety Culture and Rail Operations Review completed in 2016, the OIG tasked TWG with the review of signal records to determine whether signal equipment downtime is promptly recorded and corrected.

The main relevant findings from the previous study include the following:

- MBL had the highest failure rate per track mile due to having the oldest equipment and an operating environment that includes grade crossings.
- The time to repair 39% of the signal failures was more than two hours.
- The largest three contributors to signal failures were grade crossing equipment (29.8%), track circuit equipment (25.6%) and signal equipment (18.1%).
- The impact of signal failures on train operation was not clearly and consistently reflected in the Main Line Incident Status Log Reports. The majority of the Main Line Incident Status Log Reports (169 out of 215) did not discuss the impact on train service or any train delays resulting from the maintenance failures. Further, 15 maintenance incidents were missing from the Main Line Incident Status Log Reports.
- There was a high failure rate of maintenance equipment at the MGL Marine Interlocking (57% of the signal failures on MGL occurred at this interlocking).

TWG made many recommendations related to these findings, which are currently being addressed by Metro. In view of the relevancy of the prior study to the current task of assessing the impact of signal failures on train service, TWG will leverage the findings and recommendations from the 2016 report in this analysis.

Findings on Frequency of Signal Incidents

With respect to the current study, TWG analyzed incident reports and work orders by line for delays to train service attributed to signal failures during 2016. Overall, 72 signal delay incidents affected the five Metro lines. Based on the methodology employed for this delay analysis, the top three broad causes of delay on each line system were analyzed in depth. As such, signal failures were identified as the third major cause of delays on MGL and MRL with 17 and 10 incidents respectively. Therefore, this report focused on the signal incidents that affected service on these two lines.

F1. In this analysis, MGL and MRL signal incidents comprise only 27 signal incidents in total, a surprisingly small number. In view of the finding in the 2016 study that signal failures are not consistently reflected in incident reports and do not report the impact on train service, it appears that the signal failure data identified by Metro in 2016 may not reflect the full extent of signal failure issues. This is evident from the low number of identified signal incidents (72 for an entire year for all lines) compared to the data analyzed in the prior study (215 for two months). If we extrapolate the number of total signal failures for 2016 based on the signal failure data provided for two months in 2015, the result would be about 1,290 incidents.

F2. While the 2016 data may not have identified a significant delay impact, without a full assessment and analysis of all signal failures on a line, it is difficult to provide an objective analysis of the root causes for signal failures, and to also assess the current process for allocating capital funds to progress the state of good repair for signal installations.

F3. Further, even if signal failures do not cause service delays, it is likely that a signal failure will impact normal train operation and may require a train to operate in a degraded mode of operation pursuant to operating rules and procedures. Such degraded mode of operation should be reflected in the incident report. Any time a train loses signal protection and operates under rules and procedures, a record should be made because it is related to safety.

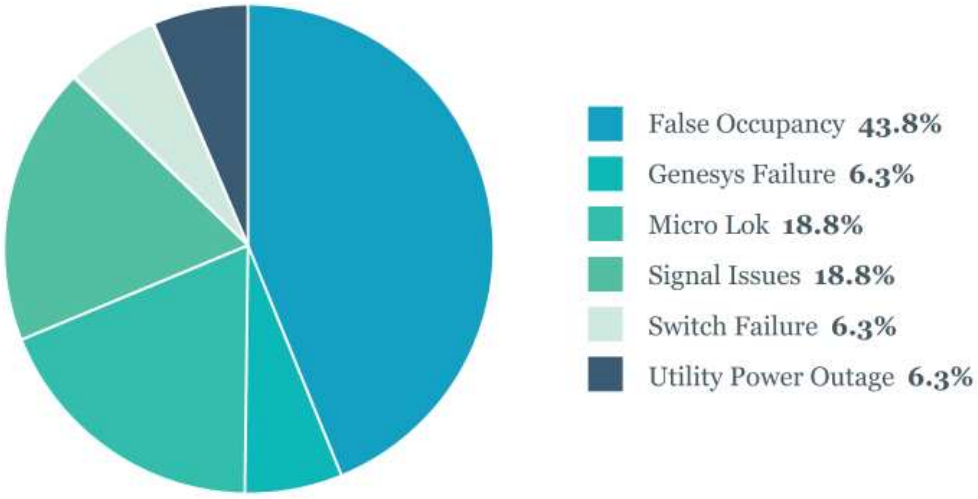
F4. According to interviews with Metro staff, as part of its Enterprise Asset Management program, the agency is moving toward a system that is expected to centralize diverse databases so that all information about signal failures would be available in one place and allow for more thorough root cause identification, tracking, and mitigation. While this would be ideal, steps can be taken in the interim to improve the existing data.

It should be noted that under this task, TWG did not perform any physical inspection of signal installations, and did not review any existing design or installation drawings. TWG relied entirely on the information reflected in the incident reports, associated work orders, and interviews with Metro personnel.

Findings on Signal Incidents

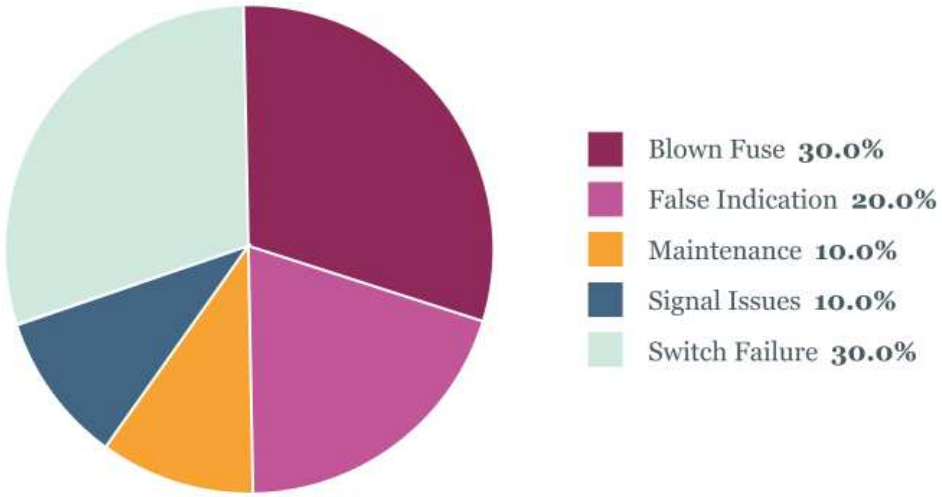
Six causal categories were identified for Signal delays on MGL. As shown in the chart below, false occupancy, Micro Lok (an interlocking control system, manufactured by Ansaldo), and Signal issues accounted for 81.4% of all signal incidents on the MGL, although many of these did not identify root cause.

Figure 23: Causes of Signal Incidents - Light Rail (MGL)



Five causal categories were identified for signal delays on MRL. As shown on the chart below, blown fuse, switch failure and false occupancy accounted for 80% of these MRL signal delay incidents, although no systemic failure could be identified based on the low incidence of these delays and the information provided on the work orders.

Figure 24: Causes of Signal Incidents - Subway Line (MRL)



MGL Findings

A review of the causes of signal delay incidents on MGL found:

F5. The low number of identified signal incidents (72 for all lines for an entire year) does not include the estimated hundreds of additional signal failures that did not cause delay. This makes it difficult to provide an objective analysis of the root causes and to assess the current process for allocating capital funds to progress the state of good repair for signal installations.

F6. Signal failures that do not cause service delays but likely impact normal train operation and may require a train to operate in a degraded mode of operation are not captured in incident reports.

F7. On the MGL, 7 out of the 16 incidents (44%) were attributed to "False Occupancy," which caused 2 cancelled trips and 27 late trips. A "False Occupancy" occurs when a track circuit falsely indicates the presence of a train within its boundaries.

F8. The magnitude of the delays on the MGL ranged from 5 to 30 minutes. Our analysis of these delays showed the following:

- Signal issues resulted in the longest delays, ranging from 8 to 30 minutes.
- Failed circuit or connection issues under false occupancy were the most common cause for delays. These delays lasted between 5 and 20 minutes.

F9. Review of reports and associated work orders did not reveal a systemic issue or a pattern of failures that is out of industry norm.

F10. The signal system on the MGL, which was completed in April 1995 and is controlled by an advanced cab-signaling system provided by Ansaldo, is not beyond its useful life and should be in a state of good repair.

MRL Findings

A review of the causes of signal delay incidents on MRL found:

F11. On the MRL, 10 incidents caused 11 cancelled trips and 20 late trips during 2016.

F12. The magnitude of the delays on the MRL ranged from 5 to 220 minutes.

- The longest delay of 220 minutes was due to false indication related to the supervisory control and data acquisition (SCADA) system.

- Two-thirds of the blown fuses occurred at the North Hollywood Station and took between 8 and 12 minutes to replace.

- Repair and replacement of switches took 8-20 minutes.

F13. The incident reports and associated work orders on MRL did not reveal a systemic pattern of failure.

F14. The first phase of the MRL opened in January 1993. Its cab-signaling based on audio frequency track circuits is not beyond its useful life and should be in a state of good repair.

Findings Related to Work Orders and Capital Investment

F15. Work orders for signal incidents often lack details and specificity related to the cause of failure and the repair action taken. It is difficult to analyze root causes for various failures without details and specificity.

- For example, in WO #6027766 the failure is identified as "MICRO-LOK FAILURE" that was repaired, without indicating the details of this failure. Similarly, WO #5936399 reflects that the failure was "LOSS OF CAB SIGNALING" without indicating what caused this failure.

F16. Currently, Metro does not perform structured periodic condition surveys for the purpose of prioritizing existing signal installations to receive capital funds for the state of good repair.

F17. Currently, according to interviews, service delays caused by signal equipment failures are not linked to the level of funding needed for a state of good repair.

F18. As such, Metro does not currently have a criterion for allocating capital funds to various assets based on condition survey, impact of failures on train service, and obsolescence of equipment.

F19. TWG did not find any evidence that the capital and maintenance programs for signals adequately and timely addressed critical needs identified through incidents that cause delays to train service.

Recommendations to Mitigate Signal Incidents

47. Establish a procedure to instruct signal maintenance personnel on providing consistent and complete detailed information on the cause of signal failures and the repair action taken in the WO reports. While awaiting a new log-in system with a consistent and nested drop down of primary causes of signal failures on incident reports, redesign work order forms along these lines, with a consistent section and checklist for identifying root cause. This will better allow trends to be identified and mitigated.

48. Identify the funding and timeline for the new M3 system and move the project forward expeditiously. The requirements for the design of the new M3 module includes a more robust system for logging incident reports that can be expected to allow for more consistent and robust reporting of root causes of signal failures.

49. Perform more investigations and analysis to determine the root causes for high frequency failures even if they do not result in service delays.

50. Establish a procedure for operating personnel to reflect the impact of any signal failure on normal operation even if it does not result in a service delay. This is necessary to ensure that operating personnel comply with operating rules and procedures.

51. Conduct periodic condition surveys on signal installations in advance of, and complementary to, the asset inventory that will be undertaken soon and refreshed every three years.

52. Establish a process and a criterion for replacement of existing signal installations that includes useful life of installation, failure rate, obsolescence, service needs, and available funding. While the Metro asset inventory will provide an important resource to this end when it is finished, this system of prioritization should be formalized and implemented in current signal procedures.

G. Traction Power Service Delay Incidents: Third Highest Cause of Delay on the Metro Blue Line (MBL)

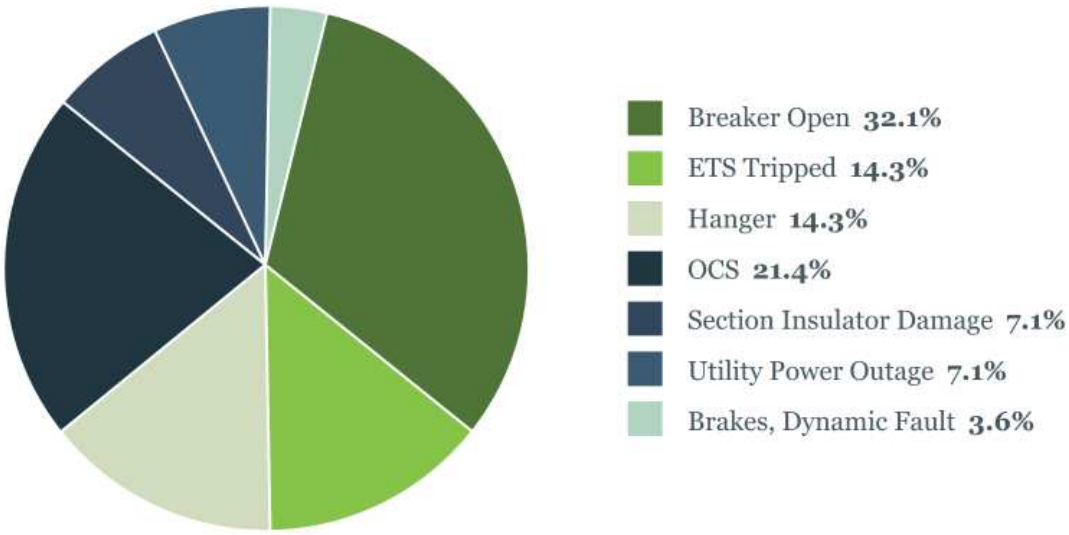
This part of the review and analysis is focused on delays to train service that were caused by failures in the existing traction power installations. TWG analyzed incident reports and work orders for delays attributed to traction power failures during 2016. The reports and work orders are grouped by line. Overall, 92 traction power delay incidents affected the five Metro lines. Based on the methodology employed for this delay analysis, the top three broad causes of delay on each line were analyzed in depth. As such, traction power

failures were identified as the third major cause of delays on MBL with 30 incidents. Therefore, this report focused on the traction power incidents that affected service on MBL during 2016. (It should be noted that TWG did not perform any physical inspection of traction power installations, and did not review any existing design or installation drawings.) TWG relied entirely on the information reflected in the incident reports, associated work orders, and interviews with Metro personnel.

Findings on Traction Power Related Delays

Twenty-eight incident reports were randomly sampled as a statistically significant representation of the traction power delays on the MBL. Seven causal categories were identified for these traction power delays as shown in the chart below.

Figure 25: Causes of Traction Power Incidents - Light Rail (MBL)



A review of these causes of traction power delay incidents found:

G1. Traction power failures on the MBL resulted in 358 cancelled trips and 113 late trips in 2016.

G2. 12 out of 28 (43%) incidents were related to failures or interference with the catenary infrastructure (21.4% Overhead Contact System (OCS) failure, 7.1% section insulator damage, and 14.3% hanger interference and broken wires). The catenary failures resulted in 191 cancelled trips and 48 late trips.

G3. 9 out of 28 (32.1%) incidents were related to open breakers due to hardware failures or undetermined causes. The breaker failures resulted in 115 cancelled trips and 24 late trips.

G4. 4 out of 28 (14%) incidents were due to tripping of the Emergency Trip System (ETS). The ETS failures resulted in 23 cancelled trips and 20 late trips.

G5. 6 out of 28 (21%) incidents occurred at San Pedro Traction Power Substation (TPSS).

G6. The magnitude of the delays ranged from 7 to 197 minutes.

- The largest contributor to traction power incidents with significant impact on train service was the failures or interference with the catenary infrastructure. The longest delay was a result of a broken contact wire with OCS down. Traction power was repaired and service was restored after 197 minutes. Other OCS repairs took between 10 and 20 minutes.

- The second largest contributor to traction power incidents with significant impact on train service was related to failures in the TPSS equipment. This could have been caused by design or installation issues or related to state of good repair, but there was insufficient information to determine this. (It should be noted that MBL is the oldest line in the LA Metro Rail Network.)

G7. Similar to signal failures, a number of work orders for traction power lacked the details of the specific cause of failure and the repair action taken. Detailed failure information is required for proper analysis of failures and determination of root causes. Consequently, there is no process in place that links service delays caused by traction power equipment failures to the level of funding needed for state of good repair.

G8. There are currently no periodic condition surveys for the purpose of identifying traction power elements that need capital funds for the state of good repair so it is not clear how priorities for capital expenditures are established.

G9. As such, TWG did not find any evidence that the capital and maintenance programs for traction power were adequately and timely addressing critical needs that were identified through incidents that caused delays to train service.

Recommendations to Mitigate Traction Power Related Delays

53. Perform more investigations and analysis to determine the root causes for traction power failures, including a review of the catenary design, installation standards, and operating condition of TPSS equipment.

54. Establish a procedure to instruct traction power maintenance personnel on providing complete detailed information related to traction power failures in the WO reports. While awaiting a new log-in system with a consistent and nested drop down of primary causes of traction power failures on incident reports, redesign work order forms along these lines, with a consistent section and checklist for identifying root cause.

55. Investigate the high level of failures that occurred at San Pedro Traction Power Substation.

56. Conduct periodic condition surveys on traction power equipment in advance of, and complementary to, the asset inventory that will be undertaken soon and refreshed every three years.

57. Establish a process and a criterion for replacement of existing traction power equipment that includes useful life of installation, failure rate, obsolescence, service needs, and available funding. While the Metro asset inventory will provide an important resource when it is finished, this system of prioritization should be formalized and implemented in current signal procedures.

Next Steps

As Metro advances its initiatives related to its Enterprise Asset Management Plan, its ability to mine its data for root cause, track trends, identify mitigations and prioritize investments will become increasingly effective. Expediting those steps currently underway promises to yield immediate and long-term benefits. In the interim, this report provides steps that Metro can take to be able to better identify, track, and reduce incidents occurring now.

Section III

Mitigating Delay Incidents Through State of Good Repair Investment

Interviews with Metro staff described an agency in the midst of implementing important improvements to their State of Good Repair program. Metro is implementing asset condition surveys across all assets, which will allow better investment priorities to be set to address safety and reliability needs. Metro is also redesigning its M3 maintenance system, which promises to combine diverse service disruption incident databases and provide a platform for tracking root cause of incidents, and is taking other steps to implement a robust Enterprise Asset Management System. In the interim, maintenance activities address most incidents that occur during daily service; and capital investments are based on the priorities of the agency, departments, and expertise of the asset managers. While this analysis did not find any systemic failures, opportunities for improvement have been noted, particularly in this interim period before these ongoing improvements are fully implemented.

The $4.8 billion dedicated to state of good repair over ten years as described in the Short Range Transportation Plan demonstrates Metro's focus on SGR. However, this amount comes to about $480 million per year, which needs to cover many assets. In addition to addressing new rolling stock for bus and rail, it also must address the needs of an aging infrastructure. These competing needs are clearly reflected in the FY 2018 Adopted Budget. The FY 2018 Adopted Capital Program budget of $2.09 billion includes $1.7 billion for expansions and $394 million for Operating Capital, which covers safety and security projects, bus and rail state of good repair, capital infrastructure and other related investment categories. The total budgeted specifically for Rail State of Good Repair is $224 million. Of this total, $145 million (65%) is for vehicle investments that address the types of issues identified in TWG's analysis of vehicle related service disruption incidents. These include:

MBL P865/2020 Mid-life Overhaul	$2,601,000
MGDL P2550 Vehicle Component Overhaul	$2,563,000
MGDL P2550 Mid-life Overhaul	$ 615,000
MRL Heavy Rail Mid-life Overhaul	$9,912,000
MRL Heavy Rail Procurement	$5,793,000
Subway Railcar Component Replacement	$3,043,000
Multiple Lines P2000 Light Rail Mid-life Overhaul	$13,406,000
Multiple Lines Light Rail Fleet Replacement	$102,080,000
Multiple Lines P2000 Component Replacement	$2,984,000
Professional Service to Support P3010 Buy	$2,014,000
TOTAL	**$145,011,000**

Vehicle Related Service Delay Incidents. These investments are consistent with needs to address the findings of TWG's review of vehicle related service disruption incidents, the most frequent cause of delay across all Metro lines. TWG's review of the P865/2020 fleets identified issues associated with a fleet that never went through a midlife overhaul. In 2005 when the P2550 vehicles were ordered, the P865 vehicles were already 15-years old. Rather than overhauling the P865s, the intention was to replace them with the P2550 vehicles. The P2550 order did not result \in option cars; instead a new light rail specification was issued. When it became obvious that the P865 fleet was still needed, Metro started to invest in some component upgrades, such as replacing capacitors which were well past the expected service life of 15 years, replacing contactors, and upgrading the propulsion control power supply as well as other critical components. This necessary investment is included in the FY 2018 SGR budget.

TWG's review also confirmed that a major overhaul was the correct approach for the P2000 series fleet considering the high service disruption incident rate per car and the relatively young age of these vehicles. It is appropriate for Metro to provide the needed funds to finance a useful midlife overhaul for the P2550 fleet.

Similar to the P865 cars, the Base Buy subway cars have obsolete propulsion and control systems that have never gone through a refurbishment process. Metro intends to keep these vehicles in service until the new HR4000 subway cars are delivered. The funding in the SGR budget makes this approach feasible. Metro just began the major midlife overhaul for the A650 GE fleet, replacing the obsolete GTO inverter and other equipment. The GE fleet will remain in service even after the new HR4000 vehicles are delivered beginning 2021. In April 2017, Metro contracted to purchase 64 HR4000 subway cars for $178 million.

In addition to vehicle investments, the FY 2018 Rail SGR budget includes about $80 million for all remaining rail SGR needs system-wide. Whether this level of investment is sufficient for the other top causes of service delay is not clear as discussed below relative to each of the top causes of delay incidents.

Rail Operations and Yard Related Service Delay Incidents. The service disruptions attributable to Rail Operations, the second most frequent cause of delay across all lines, do not involve infrastructure and do not require capital investments. Similarly, Yard Control, the third largest cause of service disruption on MGDL and Expo Line, were not specifically caused by yard related infrastructure issues. They were more often associated with lack of equipment, and do not require capital investments beyond the rail car purchases and upgrades discussed above.

Signal Related Service Delay Incidents. For Signal service disruption incidents, the third most frequent cause of delay on MGL and MRL, the low number of identified signal incidents does not include the estimated hundreds of additional signal failures that did not cause delay and were not reflected in the incident log reports maintained by the ROC. This makes it difficult to provide an objective analysis of

the root causes and to assess the current process for allocating capital funds to progress the state of good repair for signal installations.

The signal system on the Metro Green Line, which was completed in April 1995 and is controlled by an advanced cab-signaling system provided by Ansaldo, is not beyond its useful life and should be in a state of good repair. That being said, the FY 2018 Budget does not include a budget for MGL Signal System Rehabilitation Phase II.

MRL was completed in January 1993. Its cab-signaling based on audio frequency track circuits is not beyond its useful life and should also be in a state of good repair. While the Adopted Capital Program budget did not contain any investments for MRL signal work, based on the data available, TWG cannot evaluate this decision.

While signal issues were not identified as among the top causes of delay for MBL, the FY 2018 program includes $19.8 million for MBL Signal System Rehabilitation and Operations Improvement, which includes funding for MBL Overhead Catenary System Rehabilitation.

Also, there are a number of diverse signal technologies in use on the various light rail and heavy rail lines. Metro should consider the development of a strategic plan for signal modernization that will minimize these differences. This should result in operational and maintenance benefits, including achieving interoperability between light rail lines. The current funding approach is on a per line basis, which will maintain the differences between the lines.

Traction Power Related Delay Incidents. Disruptions related to Traction Power were the third highest cause of delay on MBL. A number of work orders lacked the details of the specific cause of failure and the repair action taken. Detailed failure information is required for proper analysis of failures and determination of root causes. Consequently, there is no process in place that links service delays caused by traction power equipment failures to the level of funding needed for state of good repair. Although the FY 2018 Capital Program includes $600,000 for MBL Emergency Trip System Replacement as well as $785,000 for MGL's Emergency Trip System, TWG cannot evaluate the adequacy of this funding.

There are currently no periodic condition surveys for the purpose of identifying asset components that need capital funds to maintain state of good repair so priorities for capital expenditures are established primarily based on priorities of the agency, departments, and expertise of the asset managers. As such, Metro does not currently have a criterion for allocating capital funds to various assets based on condition surveys, impact of failures on train service, and obsolescence of equipment.

Metro will need to reevaluate whether its investment strategy is sufficient once the asset condition inventories currently underway are completed and priorities for investments to achieve a state of good repair are set. Metro will then be positioned to establish a process and a criterion for replacement of existing assets that includes useful life of the asset, failure rate, impact on service delays, obsolescence, service needs, and available funding. While the Metro asset condition inventory will provide an important resource to this end when it is finished, this system of prioritization should be formalized and implemented in current procedures for all asset classes.

While expansion of the system is critical, it cannot take place at the expense of maintaining the existing system. Setting this balance, however, requires a firmer understanding of the condition of the core infrastructure. Expediting the work currently underway will position Metro to better make these tradeoffs.

Appendices

Appendix A

Abbreviations

APS	Auxiliary Power Supply
ASTS	Ansaldo Signaling and Transportation Systems
ATC	Automatic Train Control
ATO	Automatic Train Operation
ATP	Automatic Train Protection
BCU	Brake Control Unit
BECU	Brake Electric Control Unit
DC	Direct Current
EB	Emergency Brake
ECU	Electronic Control Unit
ETS	Emergency Trip System
Expo	Metro Expo Line
GE	General Electric
GTO	Gate Turn-Off Thyristor
H&K	Hanning and Kahl
HSCB	High Speed Circuit Breaker
HVAC	Heating, Ventilation and Air Conditioning
IGBT	Insulated Gate Bipolar Transistor
IT/ITS	Information Technology/Information Technology Services
LRV	Light Rail Vehicle
LVPS	Low Voltage Power Supply
M3	Maintenance and Material Management System
MA	Motor Alternator
MARTA	Metropolitan Atlanta Rapid Transit Authority
MBL	Metro Blue Line
Metro	Los Angeles County Metropolitan Transportation Authority
MGDL	Metro Gold Line
MGL	Metro Green Line
MOW	Maintenance of Way
MRL	Metro Red Line
OCS	Overhead Contact System

OIG	Office of the Inspector General
Panto	Pantograph
PECU	Propulsion Electric Control Unit
Ph	Phase
ROC	Rail Operations Center
SCADA	Supervisory Control and Data Acquisition
SGR	State of Good Repair
TOD	Train Operator Display
TPSS	Traction Power Substation
TWG	The Wathen Group
WO	Work Order

Appendix B

Schedule of Recommendations and Metro's Proposed Actions to Implement LA Metro Service Disruption Review - Report

Rec. #	Recommendation Description	Related Finding #	Delay Category	Line	Assigned Staff in Charge	Agree or Disagree	Proposed Action	Est. Date of Completion
1	Instruct operators to report all alert indications shown on the console. This is especially important given the amount of information that is available on the console of the new trains. In addition, operators should assess whether passenger behavior caused an indication as opposed to a problem with the equipment.	A1 A2 A3 A4	Root Cause	System-wide				
2	Establish a dedicated, 24/7 "super-tech" maintenance team full time in the ROC to provide expert support to the ROC for equipment, systems and infrastructure faults.	A5	Root Cause	System-wide				
3	Ensure the Rail Vehicle Department records root cause for rail vehicle delay incidents, which are the highest number of incidents across all five rail lines. Instruct the ROC to record "Rail Vehicle Event" for subsequent update by the Rail Vehicle Department.	A6 A7 A8	Root Cause	System-wide				
4	Maximize the redesign of the M3 software program logging module. All departments should work with the design expert to create a drop-down listing that would capture the most meaningful root cause categories for their area of responsibility. Ideally, the ITS department should also bring all fault reports into one environment, so that internal department reports of failures can be tracked along with those recorded through the ROC. This redesign of the M3 module should allow for automated tracking of delays and their root causes, reporting delay trends, identifying mitigations and tracking their impact.	A9	Root Cause	System-wide				
5	Include Train Operator Display (TOD) information, such as time of the incident, in the reporting of incidents.	A4	Root Cause	System-wide				
6	Review approach to Police/Health delay incidents (while not part of this analysis, these delay incidents warrant review based on their frequency and duration).	B1	Police/ Health	System-wide				
7	Partner with law enforcement agencies to review process used for police/health incidents.		Police/ Health	System-wide				

Rec. #	Recommendation Description	Related Finding #	Delay Category	Line	Assigned Staff in Charge	Agree or Disagree	Proposed Action	Est. Date of Completion
8	Identify root cause for the top three categories of delay for each line to allow Metro to develop mitigations that have the potential to significantly reduce total delay incidents.	B2-B10	Top 3 causes by line overall	System-wide				
9	Set priorities based on Metro's asset assessment as soon as it is completed to reduce delay incidents.	B2-B10	Top 3 causes by line overall	System-wide				
10	Given the large number of incidents where no root cause was identifiable, establish a procedure to instruct vehicle maintenance personnel on providing consistent and complete detailed information related to vehicle failures in the WO reports. While awaiting a new log-in system with a consistent and nested drop down of primary causes of vehicle failure on incident reports, redesign work order forms along these lines, with a consistent section and checklist for identifying root cause.	C2	Rail Vehicle	System-wide				
11	Identify the funding and timeline for the new M3 system and move the project forward expeditiously.	C1-C5	Rail Vehicle	System-wide				
12	Establish a procedure for collecting the root cause of every vehicle failure even if it does not result in a service delay so that robust trends can be generated, tracked and mitigated.	C1	Rail Vehicle	System-wide				
13	Conduct periodic condition surveys on vehicles and components in advance of and complementary to the asset inventory that will be undertaken soon and refreshed every three years.	C1-C5	Rail Vehicle	System-wide				
14	Establish a process and a criterion for replacement of existing vehicles and vehicle components that include useful life, failure rate, obsolescence, service needs, and available funding. While the Metro asset inventory will provide an important resource to this end when it is finished, this system of prioritization should be formalized and implemented in current vehicle procedures.	C1-C5	Rail Vehicle	System-wide				
15	Continue funding for daily maintenance and up-keep of the P865/2020 fleets although no major capital investment is recommended at this time.	C15-C18	Light Rail Vehicle	MBL, Expo Line				
16	Identify the P865 cars in the worst condition for decommissioning and use them as spare part suppliers to support more reliable cars.	C12-C14	Light Rail Vehicle	MBL, Expo Line				
17	Keep enough P865 cars as floats to improve the availability of P2000 vehicles, which have a higher incident rate, for refurbishment.	C5	Light Rail Vehicle	MBL, Expo Line				

Rec. #	Recommendation Description	Related Finding #	Delay Category	Line	Assigned Staff in Charge	Agree or Disagree	Proposed Action	Est. Date of Completion
18	Review the decommissioning process of the P865 fleet given the lower incident rate for the P865 fleet. P865 cars with low to no incidents should be kept in service during the P2000 overhaul to expedite the overhaul, replacing some P2000 services with P865 cars to increase the vehicle availability during the overhaul.	C5 C14	Light Rail Vehicle	MBL, Expo Line				
19	Maintain the remaining P865 cars only out of the MBL maintenance shop, which has the best expertise, logistics and parts inventory to maintain the P865 fleet.	C6 C17	Light Rail Vehicle	MBL, Expo Line				
20	Continue with the P865 component upgrades to keep a reduced fleet with increased reliability in service until replaced by the P3010. Areas of upgrades still useful are contactors, relay panel and ECU power supply.	C7-C11 C15 C16 C18	Light Rail Vehicle	MBL, Expo Line				
21	Evaluate overhaul needs of select main components. Depending on how long Metro intends to keep cars of the P865/2020 fleet, some of the main components, such as gears and traction motors, of selected well-performing cars might have to be overhauled.	C7-C11 C15 C16 C18	Light Rail Vehicle	MBL, Expo Line				
22	Continue the refurbishment program to reduce fuse failures, such as upgrades to the chopper control unity, contactor and relay replacements, in place as needed for some of the P865 cars.	C16 C18	Light Rail Vehicle	MBL, Expo Line				
23	Plan the midlife overhaul to first upgrade the worst vehicles, such as cars #220, 205, 208. 212, 229, 242 & 247.	C23-C28	Light Rail Vehicle	MGL, MBL, Expo Line				
24	Analyze the float vehicle needs for the P2000 vehicle midlife overhaul and ensure that the overhaul contractor has enough cars to expedite the overhaul. On the MBL, P865 vehicles being decommissioned could be reduced temporarily to provide enough vehicles to the overhaul contractor.	C5 C14 C28	Light Rail Vehicle	MGL, MBL, Expo Line				
25	Consider converting some P2000 cars running on the MBL/Expo lines back to the MGL operation if the ATO/ATP packages removed earlier are still available. The critical float will be the P2000 MGL cars with their line specific ATO/ATP equipment.	C5 C14 C28	Light Rail Vehicle	MGL, MBL, Expo Line				
26	Improve the diagnostic capabilities of the propulsion system.	C19	Light Rail Vehicle	MGL, MBL, Expo Line				
27	Use information from TODs on the P2550 vehicles for improved incident reporting. The P2550 cars are the first Metro vehicles that have a sophisticated TOD and diagnostics.	C35	Light Rail Vehicle	MGDL				

Rec. #	Recommendation Description	Related Finding #	Delay Category	Line	Assigned Staff in Charge	Agree or Disagree	Proposed Action	Est. Date of Completion
28	Modify the incident reports for P2550 vehicles to include the information provided by the TOD at the time of the incident, in addition to the Operator reports.	C35-C36	Light Rail Vehicle	MGDL				
29	Accurately report the time of the incidents as shown on the TOD, not by the system time at the ROC.	C35-C36	Light Rail Vehicle	MGDL				
30	Use the time of the incident displayed on the TOD in evaluating the delay incident to improve accuracy and turnaround time of the affected vehicle.	C35-C36	Light Rail Vehicle	MGDL				
31	Keep the Base Buy subway cars running by planning enough funding for Rail Fleet Services to maintain this fleet.	C46-C47	Subway Vehicle	Subway				
32	Ensure that the knowledge of the chopper controls is not lost before the new cars arrive.	C38 C46	Subway Vehicle	Subway				
33	As the new HR4000 vehicles arrive, take the Base Buy cars out of service as early as possible to reduce maintenance costs. The cars in the worst condition should be replaced first.	C42-C45 C47	Subway Vehicle	Subway				
34	Perform the midlife overhaul on GE subway vehicles as planned.	C53-C55	Subway Vehicle	Subway				
35	Assess current mitigation measures to address operator absenteeism and late reports, and initiate management enhancements as appropriate.	D3 D7 D8	Rail Ops					
36	Re-assess the level, allocation, and scheduling of Rail Operations Extraboard Operators as an opportunity to mitigate the impact of all service incident related delays resulting from service recovery, operator late or no show, station terminal and yard operator related delays, "gap trains" staffing (extra trains added to the schedule to supplement service capacity as needed), etc.	D7 D8	Rail Ops					
37	Reinforce desired practices to mitigate future "Operator Error" service impact events including additional focus on operator vehicle troubleshooting tactics. Given that vehicle defects represent the most significant factor impacting Metro Rail service delays, assess operator awareness of common vehicle troubleshooting methods to expedite the safe movement of the vehicle and reduce service delays resulting from vehicle defects.	D9	Rail Ops					

Rec. #	Recommendation Description	Related Finding #	Delay Category	Line	Assigned Staff in Charge	Agree or Disagree	Proposed Action	Est. Date of Completion
38	Consider the development of an Operations pocket size vehicle defect troubleshooting guide that reinforces what operators are trained to perform and summarizes the desired tactics to follow when confronted with vehicle related defects. Common vehicle troubleshooting methods and other lessons learned from operator errors that resulted in service delays should continue to be reinforced in current operator training programs.	D9	Rail Ops					
39	Continue to hone service recovery contingency plans, which are key to minimizing the impact of all Rail Operations incidents.	D7 D8	Rail Ops					
40	Assess the designation of Rail Operations incidents and allocate accordingly to reflect only those accountable to that Division.	D10 D11	Rail Ops					
41	Continue to assess service contingency plans and related staff training to implement the service restoration contingency provisions. Document current effective service restoration practices and reinforce staff awareness through training.	D12	Rail Ops					
42	Assess running time schedule needs by Line to confirm the adequacy of layover time at station terminals.	D13	Rail Ops					
43	Utilize the recommendations (numbers 1-4 and 7) relative to determining root cause for vehicle caused operations delays to better instruct operators in troubleshooting and to identify the cause of the vehicle related incident. Allocate cause accordingly.	D14 D15	Rail Ops					
44	Utilize the recommendations (numbers 1-4 and 7) relative to determining root cause to better identify the cause of the incident. Allocate accordingly so that incidents not caused by the operator are appropriately characterized and mitigated.	D16	Rail Ops					
45	Limit the designation of Yard Control incidents to those actually attributed to yard issues.	E1 E2	Yard Control	Yards				
46	Review Yard vehicle availability constraints and evaluate options designed to further support the consistent achievement of 100% equipment schedule availability.	E1	Yard Control	Yards				
47	Establish a procedure to instruct signal maintenance personnel on providing consistent and complete detailed information on the cause of signal failures and the repair action taken in the WO reports. While awaiting a new log-in system with a consistent and nested drop down of primary causes of signal failures on incident reports, redesign work order forms along these lines, with a consistent section and checklist for identifying root cause.	F1 F2 F3 F15	Signals	MGL, MRL				

Rec. #	Recommendation Description	Related Finding #	Delay Category	Line	Assigned Staff in Charge	Agree or Disagree	Proposed Action	Est. Date of Completion
48	Identify the funding and timeline for the new M3 system and move the project forward expeditiously.	F4	Signals	MGL, MRL				
49	Perform more investigations and analysis to determine the root causes for high frequency signal failures even if they do not result in service delays.	F15 F16	Signals	MGL, MRL				
50	Establish a procedure for operating personnel to reflect the impact of any signal failure on normal operation even if it does not result in a service delay.	F1-F3 F5 F6 F13	Signals	MGL, MRL				
51	Conduct periodic condition surveys on signal installations in advance of, and complementary to, the asset inventory that will be undertaken soon and refreshed every three years.	F4 F16	Signals	MGL, MRL				
52	Establish a process and a criterion for replacement of existing signal installations that includes useful life of installation, failure rate, obsolescence, service needs, and available funding. While the Metro asset inventory will provide an important resource to this end when it is finished, this system of prioritization should be formalized and implemented in current signal procedures.	F17 F18	Signals	MGL, MRL				
53	Perform more investigations and analysis to determine the root causes for traction power failures, including a review of the catenary design, installation standards, and operating condition of TPSS equipment.	G7	Traction Power	MBL				
54	Establish a procedure to instruct traction power maintenance personnel on providing complete detailed information related to traction power failures in the WO reports. While awaiting a new log-in system with a consistent and nested drop down of primary causes of traction power failures on incident reports, redesign work order forms along these lines, with a consistent section and checklist for identifying root cause.	G7	Traction Power	MBL				
55	Investigate the high level of failures that occurred at San Pedro Traction Power Substation.	G5	Traction Power	MBL				
56	Conduct periodic condition surveys on traction power equipment in advance of, and complementary to, the asset inventory that will be undertaken soon and refreshed every three years.	G8	Traction Power	MBL				
57	Establish a process and a criterion for replacement of existing traction power equipment that includes useful life of installation, failure rate, obsolescence, service needs, and available funding. While the Metro asset inventory will provide an important resource when it is finished, this system of prioritization should be formalized and implemented in current signal procedures.	G7-G9	Traction Power	MBL				

Appendix C

List of Interview Participants

Metro Participants in Interview Groups	The Wathen Group Interviewers	Date	Time
1. Control Center		6/8/17	3:00 - 4:00 PM (PDT)
Bernard Jackson, Sr. EO, Rail Ops Robert Castanon, Service Ops Superintendent	Nabil Ghaly Linda Kleinbaum Deborah Wathen Finn Werner Uttinger		6:00 - 7:00 PM (EDT)
2. Rail Vehicles		6/9/17	11:30 AM - 12:30 PM (PDT)
Bob Spadafora, Senior, EO, Rail Fleet Services Michael Ornelas, Sr. Director Rail Vehicle Maintenance Richard Lozano, Senior Director, Rail Vehicles Acquisition & Maintenance	Werner Uttinger Linda Kleinbaum Nabil Ghaly		2:30 - 3:30 PM (EDT)
3. Rail Operations/Yards		6/9/17	2:30 - 3:30 PM (PDT)
Bernard Jackson, Sr. EO, Rail Ops John Sanchez, Director of Transportation Operations Patty Alexander, Services Operations	Jim Brown Linda Kleinbaum Nabil Ghaly		5:30 - 6:30 PM (EDT)
4. Signals/Traction Power		6/21/17	2:00 - 3:00 PM (PDT)
Erroll Taylor, Senior EO, Maintenance & Engineering Marshall Epler, DEO, Systems Engineering Remi Omotayo, DEO, Wayside Systems Engineering & Maintenance Leonid Bukhin, DEO, Corporate Safety	Nabil Ghaly Linda Kleinbaum		5:00 - 6:00 PM (EDT)
5. Capital Programs/Asset Management Plan/SOGR		6/12/17	10:00 - 11:00 AM (PDT)
Greg Kildare, Chief Risk, Safety & Asset Management Officer Denise Longley	Linda Kleinbaum Werner Uttinger		1:00 - 2:00 PM (EDT)
6. OMB Finance Department		6/16/17	9:30 AM (PDT)
Quintin Sumabat, DEO, Finance Chris Gallanes, DEO, Finance	Deborah Wathen Finn Nabil Ghaly Werner Uttinger James Brown Linda Kleinbaum		12:30 PM (EDT)
7. M3 Logging Module		6/19/17	3:00 PM (PDT)
Patrick Astredo, DEO, Enterprise Information Management (out sick) Regina Lim, Supvg Engineer Cathy Fong	Deborah Wathen Finn Nabil Ghaly Werner Uttinger James Brown Linda Kleinbaum		6:00 PM (EDT)
8. Vehicle Engineering and Acquisition		6/22/17	1:30 PM (PDT)
Jesus Montes, Director, Rail Vehicle Acquisition & Maintenance Stephanie Kaping, Sr. Administrative Analyst	Linda Kleinbaum Werner Uttinger		4:30 PM (EDT)
9. Chief Operating Officer's Department		6/23/17	4:00 PM (PDT)
Diane Coral-Lopez, Executive Officer - Central Oversight & Analysis	Linda Kleinbaum		7:00 PM (EDT)

Appendix D

List of Tables

Appendix E

List of Figures

Metro Interoffice Memo

Date	October 19, 2017
To	Karen Gorman Inspector General
From	James T. Gallagher JTG. Chief Operations Officer
CC	Greg Kildare Chief Risk, Safety & Asset Management Officer
Subject	Management Response to the Draft Rail Service Disruption Review Report

Operations Management has received and reviewed the Rail Service Disruption Review Report issued by the Office of Inspector General. The report includes a total of 57 recommendations relative to Metro assets, State of Good Repair (SGR) efforts and projects, Enterprise Asset Management Plan initiatives, rail vehicles, rail operations, yard control, signals, traction power, and the mitigation, identification, tracking, and investigation processes of incidents that result in service delays.

The Operations and Risk, Safety & Asset Management Departments will begin the process to implement change recommendations over the next year; joining efforts with the Safety Culture Initiative that was launched in May 2017. Staff will provide regular updates to the OIG as recommendations are addressed and/or closed out.

Cc: Phillip Washington, Metro Chief Executive Officer
Metro Board of Directors
Andrew Lin, Audit Manager
Bernard Jackson, Sr. EO, Rail Operations
Errol Taylor, Sr. EO, Rail Maintenance & Engineering
Bob Spadafora, Sr. EO, Rail Fleet Services
Diane Corral-Lopez, EO, Operations Administration
Vijay Khawani, EO, Corporate Safety
Nancy Alberto-Saravia, Sr. Manager, Transportation Planning

Appendix B: Schedule of Recommendations and Metro's Proposed Actions to Implement LA Metro Service Disruption Review – Report

Rec. #	Recommendation Description	Related Finding #	Delay Category	Line	Assigned Staff in Charge	Action / Agree or Disagree	Proposed Action	Est. Date Completion
1	Instruct operators to report all alert indications shown on the console. This is especially important given the amount of information that is available on the console of the new trains. In addition, operators should assess whether passenger behavior caused an indication as opposed to a problem with the equipment.	A1, A2, A3, A4	Root Cause	System-wide		Operations		
2	Establish a dedicated, 24/7 "supertech" maintenance team full time in the ROC to provide expert support to the ROC for equipment, systems and infrastructure faults.	A5	Root Cause	System-wide	B. Spadafora - SEO	RFS	To be submitted in RFS' FY-19 Budget Submittal.	2 months after FY-19 Budget Approval
3	Ensure the Rail Vehicle Department records root cause for rail vehicle delay incidents, which are the highest number of incidents across all five rail lines. Instruct the ROC to record "Rail Vehicle Event" for subsequent update by the Rail Vehicle Department.	A6, A7, A8	Root Cause	System-wide	B. Spadafora - SEO & A. Huntley - Manager Training	OPS/RFS Action	Re-instruction	6-months
4	Maximize the redesign of the M3 software program logging module. All departments should work with the design expert to create a dropdown listing that would capture the most meaningful root cause categories for their area of responsibility. Ideally, the ITS department should also bring all fault reports into one environment, so that internal department reports of failures can be tracked along with those recorded through the ROC. This redesign of the M3 module should allow for automated tracking of delays and their root causes, reporting delay trends, identifying mitigations and tracking their impact.	A9	Root Cause	System-wide		ITS		
5	Include Train Operator Display (TOD) information, such as time of the incident, in the reporting of incidents.	A4	Root Cause	System-wide		Operations		
6	Review approach to Police/Health delay incidents (while not part of this analysis, these delay incidents warrant review based on their frequency and duration).	B1	Police/Health	System-wide		Opa/ tions Security		
7	Partner with law enforcement agencies to review process used for police/health incidents.	B1	Police/Health	System-wide		Security		

Rec. #	Recommendation Description	Related Finding #	Delay Category	Line	Assigned Staff in Charge	Action / Agree or Disagree	Proposed Action	Est. Date Completion
8	Identify root cause for the top three categories of delay for each line to allow Metro to develop mitigations that have the potential to significantly reduce total delay incidents.	B2-B10	Top 3 causes by line overall	System-wide		RVE		
9	Set priorities based on Metro's asset assessment as soon as it is completed to reduce delay incidents.	B2-B10	Top 3 causes by line overall	System-wide	B. Spadafora - SEO M. Ornelas -Sr.Dir	RFS	Plan already implemented in M3	To start in January 2018
10	Given the large number of incidents where no root cause was identifiable, establish a procedure to instruct vehicle maintenance personnel on providing consistent and complete detailed information related to vehicle failures in the WO reports. While awaiting a new log-in system with a consistent and nested drop down of primary causes of vehicle failure on incident reports, redesign work order forms along these lines, with a consistent section and checklist for identifying root cause.	C2	Rail Vehicle	System-wide	B. Spadafora - SEO M. Ornelas - Sr. Dir N. Madanat - Sr. Dir.	RFS/RVE	To develop sustainable follow-up and tracking measures in M3	6 months
11	Identify the funding and timeline for the new M3 system and move the project forward expeditiously.	C1-C5	Rail Vehicle	System-wide		ITS		
12	Establish a procedure for collecting the root cause of every vehicle failure even if it does not result in a service delay so that robust trends can be generated, tracked and mitigated.	C1	Rail Vehicle	System-wide		RVE		
13	Conduct periodic condition surveys on vehicles and components in advance of and complementary to the asset inventory that will be undertaken soon and refreshed every three years.	C1-C5	Rail Vehicle	System-wide	ALL RFS nDivision Directors and Managers	RFS	Already in M3 - Part of the State of Good Repair Inspections	On-going
14	Establish a process and a criterion for replacement of existing vehicles and vehicle components that include useful life, failure rate, obsolescence, service needs, and available funding. While the Metro asset inventory will provide an important resource to this end when it is finished, this system of prioritization should be formalized and implemented in current vehicle procedures.	C1-C5	Rail Vehicle	System-wide	R. Lorzano - Sr. Dir	RFS	Already in-process, decommissiong plan establish and is in full swing	Completed
15	Continue funding for daily maintenance and up-keep of the P865/2020 fleets although no major capital investment is recommended at this time.	C15-C18	Light Rail Vehicle	MBL, Expo Line	R. Lorzano - Sr. Dir	RFS	Just for the P2020 cars. The P865 are being decommission	Aug-18

Rec. #	Recommendation Description	Related Finding #	Delay Category	Line	Assigned Staff in Charge	Action / Agree or Disagree	Proposed Action	Est. Date Completion
16	Identify the P865 cars in the worst condition for decommissioning and use them as spare part suppliers to support more reliable cars.	C12-C14	Light Rail Vehicle	MBL, Expo Line	R. Lorzano - Sr. Dir	RFS	Criteria already established	Completed
17	Keep enough P865 cars as floats to improve the availability of P2000 vehicles, which have a higher incident rate, for refurbishment.	C5	Light Rail Vehicle	MBL, Expo Line	B. Spadafora - SEO	Disagree	The P865 cars can no longer be support and have to be replaced with the new P3010	Completed
18	Review the decommissioning process of the P865 fleet given the lower incident rate for the P865 fleet. P865 cars with low to no incidents should be kept in service during the P2000 overhaul to expedite the overhaul, replacing some P2000 services with P865 cars to increase the vehicle availability during the overhaul.	C5, C14	Light Rail Vehicle	MBL, Expo Line	R. Lorzano - Sr. Dir	RFS	P3010 cars will be used to supplement P2000 OH cars See Rec#17 above	Completed
19	Maintain the remaining P865 cars only out of the MBL maintenance shop, which has the best expertise, logistics and parts inventory to maintain the P865 fleet.	C6, C17	Light Rail Vehicle	MBL, Expo Line	B. Spadafora - SEO	Disagree	The P865 cars can no longer be support and have to be replaced with the new P3010 cars	Completed
20	Continue with the P865 component upgrades to keep a reduced fleet with increased reliability in service until replaced by the P3010. Areas of upgrades still useful are contactors, relay panel and ECU power supply.	C7-C11, C15, C16, C18	Light Rail Vehicle	MBL, Expo Line	B. Spadafora - SEO	Disagree	The P865 cars can no longer be support and have to be replaced with the new P3010 cars	Completed
21	Evaluate overhaul needs of select main components. Depending on how long Metro intends to keep cars of the P865/2020 fleet, some of the main components, such as gears and traction motors, of selected well-performing cars might have to be overhauled.	C7-C11, C15, C16, C18	Light Rail Vehicle	MBL, Expo Line	B. Spadafora - SEO	RFS	RFS has already established the usefull life of P865 = decommission; P2020 component overhaul continue 5 years	On-going
22	Continue the refurbishment program to reduce fuse failures, such as upgrades to the chopper control unity, contactor and relay replacements, in place as needed for some of the P865 cars.	C16, C18	Light Rail Vehicle	MBL, Expo Line	B. Spadafora - SEO	Disagree	The P865 cars can no longer be support and have to be replaced with the new P3010 cars	Completed
23	Plan the midlife overhaul to first upgrade the worst vehicles, such as cars #220, 205, 208. 212, 229, 242 & 247.	C23-C28	Light Rail Vehicle	MGL, MBL, Expo Line	R. Lorzano - Sr. Dir	RFS	Already done.	Completed

Rec. #	Recommendation Description	Related Finding #	Delay Category	Line	Assigned Staff in Charge	Action / Agree or Disagree	Proposed Action	Est. Date Completion
24	Analyze the float vehicle needs for the P2000 vehicle midlife overhaul and ensure that the overhaul contractor has enough cars to expedite the overhaul. On the MBL, P865 vehicles being decommissioned could be reduced temporarily to provide enough vehicles to the overhaul contractor.	C5, C14, C28	Light Rail Vehicle	MGL, MBL, Expo Line	R. Lorzano - Sr. Dir	RFS	Already done.	Completed
25	Consider converting some P2000 cars running on the MBL/Expo lines back to the MGL operation if the ATO/ATP packages removed earlier are still available. The critical float will be the P2000 MGL cars with their line specific ATO/ATP equipment.	C5, C14, C28	Light Rail Vehicle	MGL, MBL, Expo Line		RVA		
26	Improve the diagnostic capabilities of the propulsion system.	C19	Light Rail Vehicle	MGL, MBL, Expo Line		RVA		
27	Use information from TODs on the P2550 vehicles for improved incident reporting. The P2550 cars are the first Metro vehicles that have a sophisticated TOD and diagnostics.	C35	Light Rail Vehicle	MGDL		Operations		
28	Modify the incident reports for P2550 vehicles to include the information provided by the TOD at the time of the incident, in addition to the Operator reports.	C35-C36	Light Rail Vehicle	MGDL		Operations		
29	Accurately report the time of the incidents as shown on the TOD, not by the system time at the ROC.	C35-C36	Light Rail Vehicle	MGDL		Operations		
30	Use the time of the incident displayed on the TOD in evaluating the delay incident to improve accuracy and turnaround time of the affected vehicle.	C35-C36	Light Rail Vehicle	MGDL		Operations		
31	Keep the Base Buy subway cars running by planning enough funding for Rail Fleet Services to maintain this fleet.	C46-C47	Subway Vehicle	Subway	Division Director and Manager	RFS	Will maintain until new cars arrive - already discussed	Completed
32	Ensure that the knowledge of the chopper controls is not lost before the new cars arrive.	C38, C46	Subway Vehicle	Subway	Rail Instruction	RFS	Already known	Completed
33	As the new HR4000 vehicles arrive, take the Base Buy cars out of service as early as possible to reduce maintenance costs. The cars in the worst condition should be replaced first.	C42-C45, C47	Subway Vehicle	Subway	Division Director and Manager	RFS	Already known	Completed
34	Perform the midlife overhaul on GE subway vehicles as planned.	C53-C55	Subway Vehicle	Subway		RVA		
35	Assess current mitigation measures to address operator absenteeism and late reports, and initiate management enhancements as appropriate.	D3, D7, D8	Rail Ops					

Rec. #	Recommendation Description	Related Finding #	Delay Category	Line	Assigned Staff in Charge	Action / Agree or Disagree	Proposed Action	Est. Date Completion
36	Re-assess the level, allocation, and scheduling of Rail Operations Extraboard Operators as an opportunity to mitigate the impact of all service incident related delays resulting from service recovery, operator late or no show, station terminal and yard operator related delays, “gap trains” staffing (extra trains added to the schedule to supplement service capacity as needed), etc.	D7, D8	Rail Ops					
37	Reinforce desired practices to mitigate future “Operator Error” service impact events including additional focus on operator vehicle troubleshooting tactics. Given that vehicle defects represent the most significant factor impacting Metro Rail service delays, assess operator awareness of common vehicle troubleshooting methods to expedite the safe movement of the vehicle and reduce service delays resulting from vehicle defects.	D9	Rail Ops					
38	Consider the development of an Operations pocket size vehicle defect troubleshooting guide that reinforces what operators are trained to perform and summarizes the desired tactics to follow when confronted with vehicle related defects. Common vehicle troubleshooting methods and other lessons learned from operator errors that resulted in service delays should continue to be reinforced in current operator training programs.	D9	Rail Ops					
39	Continue to hone service recovery contingency plans, which are key to minimizing the impact of all Rail Operations incidents.	D7, D8	Rail Ops					
40	Assess the designation of Rail Operations incidents and allocate accordingly to reflect only those accountable to that Division.	D10, D11	Rail Ops					
41	Continue to assess service contingency plans and related staff training to implement the service restoration contingency provisions. Document current effective service restoration practices and reinforce staff awareness through training.	D12	Rail Ops					
42	Assess running time schedule needs by Line to confirm the adequacy of layover time at station terminals.	D13	Rail Ops					

Rec. #	Recommendation Description	Related Finding #	Delay Category	Line	Assigned Staff in Charge	Action / Agree or Disagree	Proposed Action	Est. Date Completion
43	Utilize the recommendations (numbers 1-4 and 7) relative to determining root cause for vehicle caused operations delays to better instruct operators in troubleshooting and to identify the cause of the vehicle related incident. Allocate cause accordingly.	D14, D15	Rail Ops					
44	Utilize the recommendations (numbers 1-4 and 7) relative to determining root cause to better identify the cause of the incident. Allocate accordingly so that incidents not caused by the operator are appropriately characterized and mitigated.	D16	Rail Ops					
45	Limit the designation of Yard Control incidents to those actually attributed to yard issues.	E1, E2	Yard Control	Yards				
46	Review Yard vehicle availability constraints and evaluate options designed to further support the consistent achievement of 100% equipment schedule availability.	E1	Yard Control	Yards				
47	Establish a procedure to instruct signal maintenance personnel on providing consistent and complete detailed information on the cause of signal failures and the repair action taken in the WO reports. While awaiting a new log-in system with a consistent and nested drop down of primary causes of signal failures on incident reports, redesign work order forms along these lines, with a consistent section and checklist for identifying root cause.	F1, F2, F3, F15	Signals	MGL, MRL				
48	Identify the funding and timeline for the new M3 system and move the project forward expeditiously.	F4	Signals	MGL, MRL				
49	Perform more investigations and analysis to determine the root causes for high frequency signal failures even if they do not result in service delays.	F15, F16	Signals	MGL, MRL				
50	Establish a procedure for operating personnel to reflect the impact of any signal failure on normal operation even if it does not result in a service delay.	F1-F3, F5, F6, F13	Signals	MGL, MRL				
51	Conduct periodic condition surveys on signal installations in advance of, and complementary to, the asset inventory that will be undertaken soon and refreshed every three years.	F4, F16	Signals	MGL, MRL				

Rec. #	Recommendation Description	Related Finding #	Delay Category	Line	Assigned Staff in Charge	Action / Agree or Disagree	Proposed Action	Est. Date Completion
52	Establish a process and a criterion for replacement of existing signal installations that includes useful life of installation, failure rate, obsolescence, service needs, and available funding. While the Metro asset inventory will provide an important resource to this end when it is finished, this system of prioritization should be formalized and implemented in current signal procedures.	F17, F18	Signals	MGL, MRL				
53	Perform more investigations and analysis to determine the root causes for traction power failures, including a review of the catenary design, installation standards, and operating condition of TPSS equipment.	G7	Traction Power	MBL				
54	Establish a procedure to instruct traction power maintenance personnel on providing complete detailed information related to traction power failures in the WO reports. While awaiting a new log-in system with a consistent and nested drop down of primary causes of traction power failures on incident reports, redesign work order forms along these lines, with a consistent section and checklist for identifying root cause.	G7	Traction Power	MBL				
55	Investigate the high level of failures that occurred at San Pedro Traction Power Substation.	G5	Traction Power	MBL				
56	Conduct periodic condition surveys on traction power equipment in advance of, and complementary to, the asset inventory that will be undertaken soon and refreshed every three years.	G8	Traction Power	MBL				
57	Establish a process and a criterion for replacement of existing traction power equipment that includes useful life of installation, failure rate, obsolescence, service needs, and available funding. While the Metro asset inventory will provide an important resource when it is finished, this system of prioritization should be formalized and implemented in current signal procedures.	G7-G9	Traction Power	MBL				

Agenda Item 31

Briefing on the Metro Rail Service Disruption Review

November 16, 2017

THE WATHEN GROUP

Metro

Our Time Together Today

- Welcome and Team Introduction
- Project Scope
- Rail Delay Incidents in 2016
- Key Takeaways
- Recommendations and Next Steps

"We're waging a transportation revolution. We have the opportunity to be bold and tackle not only the infrastructure challenges of today, but the challenges of tomorrow."

Phil Washington, LA Metro
CEO

Project Scope

Scope

- Identify and evaluate the top three incident delay categories for each rail line.
- Determine if the issues causing delays are being addressed and appropriate state of good repair (SGR) investments are being made to reduce their reoccurrence.

Our Team

Deborah Wathen Finn
Project Executive
The Wathen Group

Linda Kleinbaum
Project Manager
The Wathen Group

Dr. Nabil Ghaly
Technology, Security, and Systems Power

James Brown
Safety, Operations, and Emergency Preparation

Werner Uttinger
LTK Engineering Services
Technical Lead

Jeraldine Herrera
Data Analysis and Statistician

Rail Delay Incidents in 2016

Incident Type	Expo	MBL	MGDL	MGL	Subtotal Light Rail	MR&PL	Subtotal Subway	Grand Total
Rail Vehicles	237	456	323	272	**1,288**	134	**134**	**1,422**
Rail Operations	76	97	74	57	**304**	26	**26**	**330**
Traction Power	19	30	19	15	**83**	9	**9**	**92**
Yard Control	25	17	25	13	**80**	1	**1**	**81**
Signals	13	18	14	17	**62**	10	**10**	**72**
Rail Accident	13	33	18	4	**68**	4	**4**	**72**
Extra Service/Missed Car Cut		25			**25**		**0**	**25**
Fire/Emergency		9	4		**13**	4	**4**	**17**
Track	2	2	10		**14**		**0**	**14**
TSE SCADA	1	1		2	**4**	6	**6**	**10**
Communication		1		2	**3**		**0**	**3**
Passenger Conduct			2	1	**3**		**0**	**3**
Fire Equipment					**0**	2	**2**	**2**
FM Contract Svc				1	**1**		**0**	**1**
Grand Total	386	689	489	384	**1,948**	196	**196**	**2,144**

*Grand Total excludes 441 Police / Health incidents (17% of delays)

Top Causes of Delay Incidents in 2016

Top 3 Causes for Each Line

Rail Vehicle Delays on all Lines

Rail Operations Delays on all Lines

Signal Delays on Metro Green and Red Lines

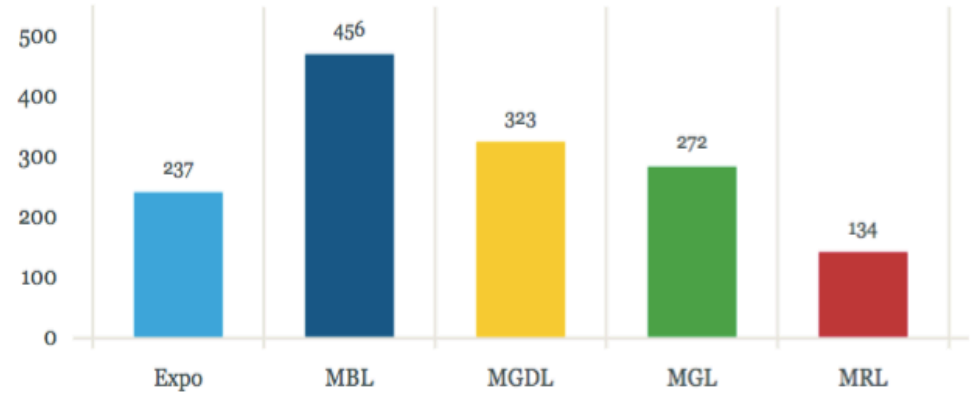
Yard Control Delays on Metro Expo and Gold Lines

Traction Power Delays on Metro Blue Line

82% of total delays were rail vehicle and rail operations; however, operations accounts for only 16%.

66% of total delays were rail vehicle – when you break that down by subway and light rail it is still the #1 cause.

Rail Vehicle Incidents by Line



Rail Vehicle Fleet Composition

LRV Fleet	# of Cars	% of Total LRV	Age	Overhaul?
P865 / 2020	69	40%	23 - 27 years	N
P2000	52	31%	15 years average	Underway
*P2550	50	29%	10 years**	Planned

Subway	# of Cars	% of Total Subway	Age	Overhaul?
Base Buy (BB)	30	29%	24 years	N
General Electric (GE)	74	71%	18 years	Underway

On-going component upgrade programs to maintain fleet for P865 cars until decommissioned.

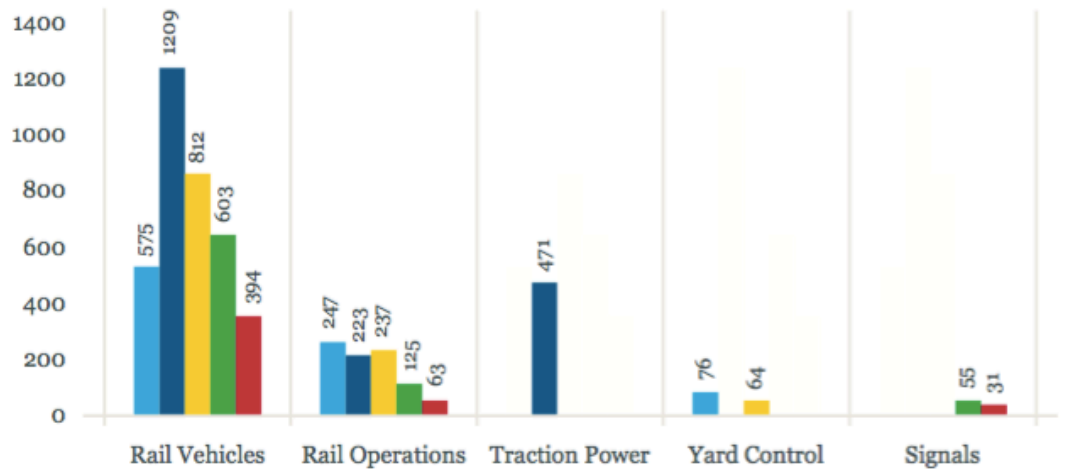
*Has train operator display / diagnostic system.

**Most reliable LRV car in the fleet.

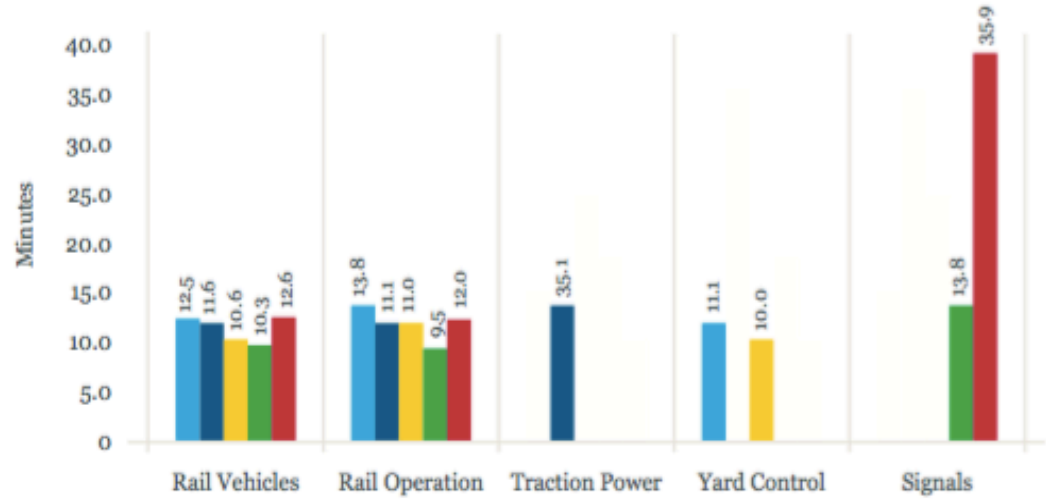
***Procurement underway or in progress for P3010 (Replace P865); HR4000 (Replace BB).

Impact to the Customer

Total Cancelled and Late Trains by Top 3 Incident Types



Average 'Maximum Delay' Minutes for Top 3 Incidents Per Line



Expo MBL MGDL MGL Subway (MRL)

*High average 'maximum delay' is from 10 signal incidents on the MRL

Mitigating Delay Incidents through State of Good Repair Investment

State of Good Repair Investments

$4.8 billion over ten years ($480 million annually).

FY 2018 Capital Program: $2.09 billion, which includes $1.7 billion for expansions and $394 million for Operating Capital.

$224 million for Rail State of Good Repair.

$145 million (65%) for Rail Vehicle investments that reflect priorities based on TWG analysis.

FY 2018 Rail SGR budget includes about $80 million for all remaining rail SGR needs system-wide.

Rail Operations and Yard Related

No infrastructure/capital investments for mitigation.

Signal Related

Low number of incidents does not allow for an assessment of optimum investment decisions; need to include infrastructure failures for comprehensive analysis.

Traction Power Related

Lack of periodic condition surveys not possible to assess investment decisions.

Key Takeaways

Capital Investments

Importance of ongoing midlife vehicle overhauls and new car procurements.

Priority investment in redesign of M3 system.

Importance of robust SGR program based upon ongoing, systematic and comprehensive asset condition surveys.

Emphasis on creating effective balance between SGR versus system expansion.

Operations and Maintenance Measures

Reinforce root cause determination and reinstruct as appropriate.

Enhance collection and monitoring of all failures to identify preventative maintenance and capital investments.

Review allocation, level of Extraboard for rail operators.

Establish a mechanical desk, 24/7 of ”super techs” in ROC.

Continue to hone service recovery planning.

57 Recommendations to Identify, Track and Reduce Incidents

Next Steps

Q&A