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TRANSMITTAL DATE: **April 2, 2021**

MEETING DATE: **April 9, 2021**

TO: **Executive Committee**

FROM: **Stephanie Wiggins, Chief Executive Officer**

SUBJECT: **Metrolink's Locomotive Fleet Modernization Study Update**

Issue

The recommendations from the Metrolink Locomotive Fleet Modernization Study (Fleet Study) have been developed. The Fleet Study provides cost estimates, analysis and benefits to help Metrolink to plan for the modernization of the locomotive fleet. The Fleet Study explored a range of options for the overhaul and replacement of the MP36 fleet as well as zero emission transition concepts. Approval of the staff recommendations will ensure the advancement of the emissions reduction objectives set out in the newly approved Metrolink Climate Action Plan. The results of the study will be used to support Metrolink's efforts to apply for potential grant funding targeted at reducing diesel emissions and planning the transition to zero emissions.

Recommendation

It is recommended that the Committee recommend to the Board to provide approval to proceed with identifying and applying for grants to fund the staff recommendations for the MP36 replacement with new Tier 4 locomotives and pursuit of a zero-emissions pilot program on at least one locomotive.

Strategic Commitment

This report aligns with the Strategic Business Plan commitment of:

- **Advancing Key Regional Goals**: We will grow the role of regional rail in addressing climate change, air quality, and other pressing issues by advancing toward zero emissions, making rail a compelling alternative to single-occupant automobiles and advancing equity-focused opportunities for all communities throughout Southern

California. The investments explored through the Locomotive Fleet Modernization Study allows Metrolink to advance towards a zero emissions future while ensuring continued reliable service delivery on which our customers depend. The Fleet Study will identify strategies for the reduction in emissions and demonstrates Metrolink's commitment to environmental stewardship.

Background

Metrolink's active locomotive fleet consists of 39 recently procured F125 Tier 4 diesel locomotives and 15 MP36 Tier 2 diesel locomotives. Starting in 2017, Metrolink has seen a great improvement in its fleet's diesel emissions as the new Tier 4 locomotives were put in revenue service and Tier 0 fleet was decommissioned. Metrolink strives to continue reducing diesel emissions from its locomotive fleet and leading the path toward zero emissions.

Both the MP36 Tier 2 diesel locomotive fleet and F125 Tier 4 fleet are critical to Metrolink's core service and must be reliable, available and maintainable (RAMS). In conjunction with the Recovery Plan Framework, Metrolink is currently operating under reduced COVID-19 service levels of 108 weekday trains with 35 trainsets but is anticipated to return to a position of 160-170 weekday trains supported with 40 trainsets after FY21. Assuming pre-COVID-19 service levels and patterns, and factoring in locomotive RAMS, an active locomotive fleet consisting of 48 to 52 locomotives is required to operate 40 trainsets.

In 2019, staff identified an initial backlog of overhaul needs for the 15 older MP36 locomotives as well as the need to address the Tier 2 locomotive emissions. These locomotives are under increased scrutiny by the California Air Resources Board (CARB) and others concerned with diesel locomotive emissions and interested in transitioning to zero emissions.

Funding for the Fleet Study was placed on the FY20 annual rehabilitation project list as a high priority and funding was subsequently approved. With the approval of the funding, a task order request targeted at the MP36 locomotive RAMs and overhaul and zero emission transition strategies was submitted to the rolling stock consultant bench in November 2019. After a competitive process, a task order was awarded to Hatch LTK in March 2020. Staff updated the Board on the Fleet Study in February 2021. This report summarizes the results of the Fleet Study and includes recommendations. The Fleet Study deliverables include a series of technical memos, PowerPoint presentations and the alternative propulsion matrix, which are being incorporated and referenced in the Fleet Management Plan Update. In October, November, December 2020 and January, February and March 2021, presentations about the condition of the MP36 fleet and need for overhaul planning were made to the Member Agency Advisory Committee (MAAC). At the March 2021 Board meeting, the Metrolink Climate Action Plan was approved. The Climate Action Plan sets a "moon shot" of reaching zero emissions by 2028. Advancing the recommendations in this effort will be critical in moving closer to that objective.

Discussion

The focus of the Fleet Study is two-fold: first, determine an investment plan to keep the 15 MP36 locomotives operating reliably; and second, accelerating the transition to zero emissions to power Metrolink's locomotive fleet.

MP36 Locomotive Fleet Replacement and Investment Strategy

The Tier 2 MP36 fleet of 15 locomotives was deployed between 2008 and 2009. The fleet is now approaching its mid-life and the reliability and availability metrics are trending down due to age-related wear. Over time, the diminished reliability and availability could threaten Metrolink's ability to meet daily service needs. When acquired, the MP36PH-3C locomotives were not brand new locomotives but remanufactured locomotives. The remanufactured parts on the MP36 included the diesel engines, major electrical components, and rotating equipment. Remanufactured components in the MP36 made the initial costs and maintainability attractive but are a factor in overhaul investment considerations. Ultimately, without an investment plan for the MP36 locomotives, Metrolink can expect to see increased delays and terminations as well as increased materials expenditures to make unforeseen repairs.

Given the time required to identify and secure funding for the replacement or overhaul of the MP36 fleet, and the duration to complete procurement activities and then execute the selected option, there is an immediate need to gain approval on an investment plan addressing the deteriorating condition of the MP36 fleet. Based on meetings with vendors that overhaul or manufacturer diesel locomotives, the most technologically viable and available options include basic or in-kind overhaul at Tier 2 or Tier 2+, conversion to Tier 4 as well as replacement with a new Tier 4 locomotive. At this stage any options beyond Tier 4, that pair batteries with a Tier 4 engine are conceptual, costly and not yet proven. The next section of the report addresses possible zero emissions transition strategies.

As mentioned in February 2021, another consideration in determining a path forward for the MP36 is that staff are monitoring the CARB proposed concepts for in-use locomotive regulation which would require all California locomotive operators including Metrolink to set aside funding on an annual basis for operating equipment that is not zero emissions. The greatest spending account contributions would be for Tier 3 and under. If approved as currently proposed, this CARB regulation would result in a significant impact on Metrolink’s MP36 overhaul investment decision-making.

Staff Recommendation – MP36 Replacement with New Tier 4 Locomotives

Metrolink is focused on achieving continued diesel emissions reductions. The staff recommendation is to purchase between 10 and 15 new Tier 4 locomotives to replace part or all of the MP36 fleet. The number of locomotives purchased will be dependent on Metrolink's service plan demand for trainsets and funding availability. Staff is making this recommendation based on the analysis of the options from Hatch LTK as well as through discussions with overhaul vendors and other agencies. The Hatch LTK summary analysis is included in Attachment B. Since the MP36 locomotives were not new at purchase and due to the considerable engineering cost and risk of overhauling to Tier 4, purchasing new Tier 4 locomotives the best investment for Metrolink to continue to reduce locomotive diesel emissions. The emissions reductions from Tier 2 to Tier 4 are considerable with a more than a combined 65 percent reduction in nitrous oxide (NOx), particulate matter (PM) and hydrocarbon (HC). Funding for additional engineering support to develop the technical specification was included and approved in the rehabilitation FY21 budget. The specification development can occur in parallel with the pursuit of grant funding.

The Fleet Study explored a wide range of options including:

Lifecycle Maintenance Program (Tier 2)
Work would be performed locally with the local equipment maintenance contractor. Lifecycle maintenance program (LCM) uses data-based condition monitoring of individual and collective components, detailed understanding of component life cycles, and aggressive replacement of components before failure. The challenge with the approach includes criticality of scheduling and sequencing of component replacement, skillsets of the contractor performing LCM's, and shop space. Program duration may also conflict with CARB's In-Use Locomotive Regulation Tier 2 Phase out.

Estimated cost per locomotive is $724,748 including contingency, consultant support and staff time. LCM extends life of the locomotive five to eight years (depends on the degree and timing of component replacement). Total cost for LCM on a fleet of 15 locomotives is $10.9 million.

Basic life extension overhaul (Tier 2)
Work would be performed locally with the local equipment maintenance contractor. The life extension is intended to be a limited scope overhaul, to moderately extend the life of the engine. Work can be performed on between one-three locomotives at a time, depending on shop space and staffing. The challenges include resource and shop capacity limitations. Before performing work on-site, parts sourcing/procurement, shop space, Equipment Contractor resources need to be evaluated. Program duration may conflict with CARB's In-Use Locomotive Regulation Tier 2 Phase out.

Estimated cost is similar to the lifecycle maintenance approach. Estimated cost of $718,277 per locomotive includes contingency, consultant support and staff time. A basic lifecycle extension extends life of the locomotive eight or more years (depends on the degree of component replacement). The cost for a life extension overhaul program on the fleet of 15 locomotives is $10.8 million.

In-kind overhaul (Tier 2+)
Work would be performed offsite by a specialty overhaul contractor. An in-kind overhaul will provide higher reliability, availability, maintainability (RAMs) of the locomotive and upgrade components to a better product. The overhaul may include the overhaul of engines, removal of trucks, cooling systems, and other critical systems for refurbishment, as well as addressing body damage and exterior repainting. Caltrain owns six MP36 locomotives and has elected to perform an in-kind overhaul on their fleet. Caltrain is not upgrading their diesel emissions from Tier 1+. Metrolink's in-kind overhaul would slightly improve the emissions to Tier 2+. To be considered an in-kind overhaul and to avoid triggering federal EPA regulatory emissions upgrades, there are limitations on costs which should not be exceeded relative to new and used parts. Useful life may also conflict with CARB's In-Use Locomotive Regulation Tier 2 Phase out.

Estimated cost per locomotive is $3.8 million including contingency, consultant support and staff time. An in-kind overhaul is expected to extend the life of the locomotive between 10 and 15 years, depending on the work scope. The cost for an in-kind overhaul on the fleet of 15 locomotives is $57 million.

Overhaul and Tier 4 conversion
Work would be performed offsite with a specialty overhaul contractor. Offsite overhaul of the fleet and conversion of the main engine and all other components (HEP etc.) to Tier 4 emissions compliant. The overhaul may include the upgrade of the main and head-end power

(HEP) engines to a higher emissions tier (e.g., Tier 4), removal of trucks, cooling systems, and other critical systems for refurbishment, as well as addressing body damage and exterior repainting. MP36's have not been previously modified to accommodate a Tier 4 engine. For this reason, staff have identified considerable design and project delivery risks in converting the existing MP36 Locomotive to Tier 4. These factors also have an impact on cost.

Estimated cost per locomotive is $5.3 million including contingency, consultant support and staff time. An overhaul to Tier 4 is expected to extend the life of the locomotive by at least 15 years. The cost for an overhaul and Tier 4 conversion program on a fleet of 15 locomotives is $79.8 million.

Purchase of new commercially available Tier 4 locomotives (Staff Recommendation)
Procure commercially available Tier 4 emission compliant locomotives. Locomotives could be procured in logical groups (i.e., 5 at a time) with possible credit for trade-in of existing MP36 and other decommissioned locomotives included. It may be possible to exercise options currently available from other public agencies to procure these locomotives on an accelerated basis. Procurement package could include favorable long-term parts sourcing, extended warranties, trade-in prior of existing locomotives as well as options to make conversions to zero emissions as described below

Additionally, the possibility exists that the newly acquired Tier 4 locomotive, outfitted with AC traction motors and energy management software, may be converted to receive power from overhead catenary systems if sections of Metrolink's tracks were to be electrified in the future. Additionally, these Tier 4 locomotives could potentially be operated in conjunction with a battery electric locomotive to run in a hybrid consist.

Estimated cost per locomotive is $10.3 million including contingency, consultant support and staff time. The useful life of a new Tier 4 locomotive is between 25 and 30 years. Cost for a fleet of 15 new Tier 4 locomotives is $153.8 million.

MP36 Overhaul and Replacement Benefit Cost Analysis
A high-level benefit-cost analysis (BCA) was developed to provide insight into the MP36 overhaul investment options. The BCA factors analyzed include the capital costs, life-cycle maintenance costs, emissions/health benefits and grant funding scenarios. The BCA considered the following: capital costs including the equipment overhaul or purchase, lifecycle maintenance cost, fuel costs and costs of emissions (e.g. Social Cost of Carbon and Damage Cost for Pollutant Emissions, SCC from EPA Interagency Working Group (pre-2016) high end value, NOx and PM cost impacts from FTA BCA guidelines). The analysis made the following assumptions including a time horizon is 35 years, discount rates of 3 percent and 7 percent, varying depreciation rates, impact if proposed CARB regulations are approved with the highest spending account contribution and Tier 2 locomotives phased out after 2034, 2018-2020 SCRRA fleet data, all scenarios will have escalating maintenance requirements but at different rates (i.e. no reductions in current maintenance costs), diesel cost based on CA state average for 2020 and assumes no FTA repayment for the early retirement of MP36 locomotives.

The analysis summarized in Attachment A was developed by the Hatch LTK team and includes several scenarios of grant funding. The most cost-effective option would retain Tier 2 emissions under a lifecycle extension overhaul. This option would not be eligible for grant funding. If Metrolink does not receive any grant funding, the most cost-effective option that would improve the emissions to Tier 4 is converting the MP36 locomotives to Tier 4. But if

between 50 to 75 percent of the procurement were to be grant funded, the purchase of new Tier 4 locomotives is the most cost effective over the 35-year time horizon. (See Attachment A: Benefit-Cost Analysis of MP36 Overhaul and Replacement)

Transition to a Zero Emissions Locomotive Fleet

Staff have viewed presentations from several manufacturers offering battery electric and battery hybrid locomotive retrofit concepts. Hatch LTK has performed simulations of battery and hydrogen fuel cell locomotives for the Perris Valley Line, the Antelope Valley Line and the San Bernardino Line. A summary of the results are included in Attachment C. The initial results suggest that 100 percent zero emission production locomotive solutions such as battery electric and hydrogen fuel cell-battery will not currently meet Metrolink's daily train consist duty cycle in the five to ten-year time horizon for revenue operations with locomotive hauled 4 to 6 car trainsets. A presentation summarizing the results of the simulation is attached to the presentation.

Staff Recommendation – Pursue a Zero-Emissions Pilot Program on at least one locomotive.

Pilot versions of the zero-emissions locomotive hauled technology are anticipated to be feasible in the near term. Metrolink has been approached with concepts to demonstrate zero emissions and is also working with other agencies seeking to pilot this technology. Initial pilot technology will be both nascent and potentially costly, but it will be an important step in advancing zero emissions in passenger rail. Commercially available versions are expected to start to become available in the next 10 years. In an effort to determine what options may be available to demonstrate hybrid or zero emissions, staff are exploring using a request for information (RFI) to gain a better sense of the technology available and market interest. It should be noted that Metra in Chicago has grant funding and is working to procure kits for the battery conversion of its older diesel locomotives to battery electric. The opportunity exists to partner with Metra on their program.

Renewable Diesel Demonstration

Given the high cost and nascent technology maturity of zero emission locomotives, staff are also exploring options to reduce emissions in the near-term. Metrolink currently has a renewable diesel demonstration underway on a Metrolink MP36 Tier 2 locomotive. Renewable diesel (RD) is usable both blended with petroleum diesel and used as a stand-alone fuel. Owing to a higher cetane number, it is a much cleaner burning fuel and promises lower exhaust emissions of criteria pollutants as well as greenhouse gases. Emissions reduction impact according to California Air Resources Board (CARB) testing in heavy duty trucking is stated as 10 percent NOx, 10 percent CO, 5 percent HC and 30 percent PM. And up to 80 percent CO2 depending on the feedstock source. Metrolink is working with the CARB to conduct emissions monitoring for the MP36 demonstration. Metrolink is eager to verify the emissions reductions. The test plan, developed by Hatch LTK will help Metrolink to track fuel consumption, reliability and performance data to determine if there are any changes to fuel consumption and if there are any impacts on performance, the engine and other systems. Metrolink's Climate Action Plan sets a goal of achieving fossil fuel independence in 2022. Renewable diesel is the key to achieving that objective.

Funding Plan Overview

The funding strategy for both staff recommendations is heavily grant funding dependent. Staff expect federal and state funding opportunities that support the adoption of off-road heavy duty near zero and zero emissions technologies to be announced over the coming year. Staff are

closely monitoring funding opportunities at the state and federal levels that might be leveraged to fund the MP36 replacement with Tier 4 locomotives and a zero emissions locomotive demonstration. The Board adopted 2021 Legislative Program already considers both of these priorities.

The replacement of 10 to 15 MP36 locomotives with new Tier 4 locomotives will cost $10.3 million each (fully burdened including vehicle engineering consultant support, staff time, and contingency). Cost for 10 new Tier 4 locomotives is estimated at $102.5 million and the cost for 15 new Tier 4 locomotives is estimated at $153.8 million. If Metrolink only replaces 10 of the 15 MP36 locomotives, 5 of the MP36 locomotives will operate until they are replaced with more efficient, lower emissions locomotives. The staff objective is to secure up to 90 percent of funding to support this purchase through grant funding. As a first step, Metrolink plans to submit an application for Carl Moyer funding to support the MP36 fleet replacement. Carl Moyer applications are due June 1, 2021.

If Metrolink were to procure a prototype zero emissions locomotive, the cost is expected to be as high as $20 million to $30 million for the first locomotive, with subsequent locomotives costing significantly less. There may be opportunities to partner with other passenger rail agencies, such as Metra, on a battery electric procurement which may bring down the cost significantly. CalSTA is working with stakeholders on the Climate Action Plan for Transportation Infrastructure (CAPTI), which is developing plans for the investment of discretionary dollars to fund projects that will combat climate change, such as Metrolink's zero emissions locomotive demonstration. CAPTI is recommending the acceleration of TIRCP cycles to support transit recovery with deployment of ZEV transit/rail fleets and transit/rail network improvements. Staff will continue to track these discussions and will be ready to submit grant applications.

Staff will continue to periodically brief the MAAC and Board on the status of these efforts and will propose alternative approaches if funding requests are unsuccessful.

Coordination Between Fleet Study and Other Efforts

The recommendations and findings from this Fleet Study will be incorporated in the full Fleet Management Plan Update document. The Fleet Study deliverables include a series of technical memos, PowerPoint presentations and the alternative propulsion matrix, which will be referenced in the Fleet Management Plan Update.

Since the initiation of the Locomotive Fleet Modernization Study and the CMF Modernization Study, there has been periodic cross-study coordination. Updates about the Locomotive Fleet Modernization Study were presented to the CMF community in September 2020 and February 2021. The Fleet Study was coordinated with other internal efforts, including the Metrolink Climate Action Plan, Transit Asset Management Plan (TAM), and Metrolink Strategic Business Plan, as well as external efforts such as the Caltrans-led Rail-Fleet Consortium.

Budget Impact

Staff will work to identify and apply for grant funding for the staff recommendations. The projects will not advance to procurement until funding has been identified. Staff will plan to submit any matching fund requests through the budget process. If an out of cycle budget

commitment is needed, staff will request Board approval.

Next Steps

Timing of a decision on an MP36 investment direction is important. The staff recommendations are currently unfunded. Staff will identify and apply for grant opportunities to fund the MP36 replacement and the development of a zero-emissions pilot. Possible funding opportunities include the CalSTA administered, TIRCP program, Carl Moyer program as well as possible federal stimulus funding programs under development for which these critical fleet projects could be very competitive. Funding for additional engineering support to develop the technical specification was included and approved in the rehabilitation FY21 budget. The specification development can occur in parallel with the pursuit of grant funding. Staff will provide an update to the Board on the status of grant funding requests.

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Attachment(s)

Attachment A - Benefit-Cost Analysis of MP36 Overhaul & Replacement
Attachment C - Zero Emissions Simulation
Attachment B - Hatch LTK MP36 Analysis