MONONGAHELA INCLINE PHASE II QUALITY ASSURANCE ANALYSIS

MAINTENANCE PROCEDURE ASSESSEMENT

FOR

PITTSBURGH REGIONAL TRANSIT

REPORT DATE: October 2, 2024

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EXECUTIVE SUMMARY

Port Authority of Allegheny County d/b/a Pittsburgh Regional Transit (PRT) retained the professional services of Talson Solutions, LLC (Talson), an independent capital advisory firm, to assess existing maintenance procedures and activities specific to electrical upgrades for the Monongahela Incline (Incline). Westmoreland Electric Services, LLC (WES) serves as the electrical contractor through agreement with PRT, and Mott MacDonald (Mott) provides design services under an on-call contract with PRT. SAI Consulting Engineers (SAI), Inc., and Advanced Integration Group (AIG) provided full time inspection and construction management and administration services for the project on behalf of PRT. The system integrator, ELCON Technologies (ELCON), is a subconsultant to WES.

Unlike Talson's Phase I assessment work, which focused on a quality assurance analysis of the Incline rehabilitation contract and made recommendations for improvement, this assessment focused on the cadence of regular preventive maintenance, repairs, quality assurance and quality control, inspection and testing, reporting, and training for the Incline in the period before and after the most recent rehabilitation activities. Talson also assessed previous and new Standard Operating Procedures (SOPs) specific to the Incline. The objective of Talson's work was to provide insight and recommendations to enhance PRT's day-to-day maintenance and operation of the Incline, as part of PRT's ongoing efforts to ensure safe and reliable Incline services for its riders, various business owners, and other community stakeholders in Mt. Washington.

Three primary areas of Incline maintenance were assessed as indicated below:

1. Regular maintenance, including the issuance and performance of preventive maintenance;
2. Preparation of preventive maintenance work details, development of SOPs and tracking of problem codes; and
3. Incline training for maintenance and operations personnel.

Talson identified nine improvement opportunities that would enhance maintenance activities, increase training, and augment the monitoring and reporting of trending and/or problematic maintenance items that are reoccurring and routinely identified by the maintenance team. Problem tracking is currently not being performed to its fullest potential and may be done electronically through the existing PRT data base reporting system. There may also be a future opportunity to utilize reporting from the Incline's revised Rockwell SCADA control system software. Both options would allow for research into single failure points or flaws within Incline operations.

Talson noted that, as of early June 2024, nine draft preventive maintenance procedures were prepared and submitted by WES for SAI and PRT review and ultimately approved. Further analysis of potential supplemental procedures may be warranted with direct input from PRT's Incline maintenance team. As of September 2024, collation of the preventive maintenance procedures into a final Incline Operations & Maintenance Training Manual had been completed by WES.

Talson is aware that limited training by WES for PRT Incline operations and maintenance personnel has occurred; however, more structured and detailed training is planned and required by contract and has not been completed as of mid-September 2024 . This additional training will allow for the basic operations and maintenance of the Incline, but further baseline training assessments (e.g., SCADA reporting, PLC usage, and other new Incline maintenance procedures) should be conducted by PRT to determine if there are "training gaps" that need to be addressed. PRT may also consider integrated training with existing or future planned Incline operators and maintenance personnel to identify inefficiencies and leverage institutional knowledge in managing the Incline's day-to-day maintenance and operation.

PROJECT BACKGROUND

The Incline is the oldest continuous operating funicular in the United States. Built in 1870, the 154-year old community asset provides a direct connection from Mt. Washington to Station Square and downtown Pittsburgh. Over the lifetime of the Incline, there has been regular maintenance, repairs and general upkeep to ensure the longevity of the Incline.

On December 27, 2021, PRT entered into a $2.6 million agreement with WES for the Incline Phase II Rehabilitation electrical work. On January 27, 2022, the Notice to Proceed was issued, with substantial completion anticipated to occur 365 days from the notice date. However, the completion of the work was challenged with significant delays and closures cause by material and equipment issues. The work was to convert the overall mechanical controlled system into an automated software-based operating system.

The Incline's operations have been affected by various significant and concerning issues. Additional stoppages to the Incline's operations in 2024 were caused by software deficiencies related to track slowdown devices, brake resistor failures and other deficiencies resulting from the newly installed mechanical equipment and software operating systems. PRT and SAI have formally notified WES of delinquent completion on multiple occasions, serious incidents impacting the prove-in period completion, and delayed issuance of the Final Acceptance Certificate from April 23, 2023 through January 9, 2024.

On April 27, 2024, after subsequent additional design review was conducted based on the resistor redesign, the Incline entered into revenue operations and another 60-day proving period commenced (ending on June 18), which was required as condition of acceptance of the newly installed equipment warranties and software system ownership by the PRT. Upon full acceptance by PRT, WES will contractually deliver software codes, databases, licenses, and withdraw all obligations to further manage the system. After the warranty period has lapsed, future software support and remediations may be performed by PRT, ELCON and/ or another third-party integrator (through an ancillary contractor). As a result of the ongoing attempt to remedy the deficiencies, formal training for PRT personnel by WES has been delayed.

Section 017900 of the WES's contract specifications require demonstration and training for both Operations and Maintenance personnel. Training includes, but is not limited to, start-up and inspection procedures, development of demonstration and training videos, and submission of training manuals for each module covered. The instructor must be qualified and experienced in conducting a training program to the expectations of the contract.

Notification of potential liquidated damages due to schedule extensions and preservation of rights for future liquidated damages have also been communicated to WES. As of September 2024, 14 of the 17 previously unresolved punch list items have been adequately addressed. Talson was made aware that additional items were identified by PRT that required corrective actions and that WES was addressing those items. In total, there were 12 open punch list items as of October 1, 2024.

WORK PERFORMED

To better understand the current delays, it was necessary to reflect on past years of operations and maintenance of the Incline. Talson reviewed various project documents at its Philadelphia office, followed by on-site work activity at PRT's offices from May 13-14, 2024. Fieldwork consisted of interviews conducted in WES offices, a site visit to the Incline Upper Station, review of additional documentation, and subsequent discussions with personnel involved in the project. The complete list of documents reviewed and personnel interviewed are attached as ***Appendices A*** and ***B*** respectively. ***Appendix C*** is a template matrix for PRT Senior Management's use in assigning appropriate PRT Department leads for development of corrective action implementation plans.

Specific assessment activities included, but were not limited to:

1. **Inspection:** Assessed the prior rehabilitations and system upgrades, inspections, and testing that PRT has issued and produced before and after the electrical and operating system enhancements to validate and measure the actions taken to maintain operations.

2. **Documentation Review**: Reviewed and evaluated documents received from PRT that focused on maintenance schedule, preventive maintenance procedures, SOPs, and other relevant inspection and testing documents.

3. **Project Administration:** Evaluated practices by PRT specific to maintenance, repairs, quality assurance testing and schedule of repairs to assess the processes taken before and after the electrical and operating system enhancements. In addition, meetings were facilitated with key PRT project management, engineering, and maintenance personnel (including individuals represented by PRT's primary labor union, ATU Local 85). Talson witnessed the presence of data fields within the "Fiix Program," which is a key component in the administration of PRT's preventive maintenance program

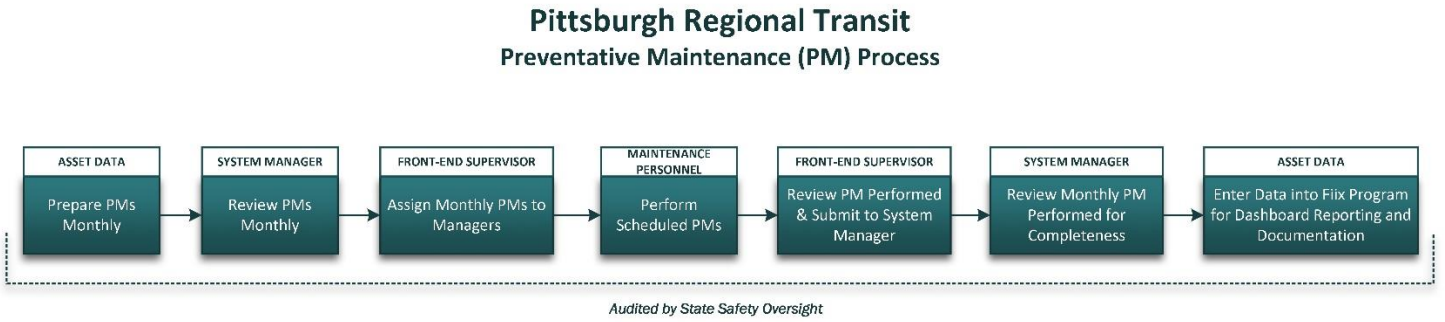
Talson conducted the assessment by utilizing applicable guidance and reporting standards outlined by the International Professional Practices Framework issued by the Institute of Internal Auditors. These standards require quality assurance over adequate planning and performing the assessment to obtain sufficient and appropriate evidence to provide a reasonable basis for observations and conclusions within a detailed assessment plan based on risk-assessed objectives. Talson believes that the evidence obtained provides a reasonable basis for our observations and conclusions based on our assessment's objectives.

The scope of work included the general assessment of maintenance activities, systematic repairs, cadence of regular maintenance, testing, ongoing maintenance, and ongoing repairs. Focus included understanding prior rehabilitations, system upgrades, inspections and testing, and daily, weekly, monthly and as needed preventive maintenance activities. Talson assessed the project team's management's (e.g., PRT) alignment with industry best practices throughout the engagement, facilitated knowledge sharing discussions, and collaborated with the project team to ensure transparency of the assessment but also maintained independence.

I. PREVENTIVE MAINTENANCE PERFORMANCE

Regular maintenance of the Incline is performed through the issuance of Preventive Maintenance work orders, generated through the Facilities Asset Data department. These work orders contain daily, weekly, monthly, quarterly, semi-annually, and annual maintenance activities. There are approximately 55 current Preventive Maintenance work orders for the Incline (18 of which are for door operation maintenance alone). It is expected that some of the existing procedures will be retired as new ones are created by WES, ELCON and PRT to support the recent enhancements to the Incline.

The "Fiix Program" is used by PRT to generate the Preventive Maintenance work orders on a monthly basis through a manual process. The Fiix Program has the ability to produce dashboard reporting, note systemic or reoccurring issues, and map trending maintenance items. Currently, Preventive Maintenance work orders for the Incline are printed and filled out by hand. Preventive Maintenance works orders for other PRT owned and operated facilities and equipment are completed digitally. The current flow of the Preventive Maintenance process is diagramed below. The process is subject to audit by the Pennsylvania Department of Transportation State Safety Oversight Agency and also subject to audit by PRT's System Safety Department.



Enhancement Opportunities:

I.1. Facilities Asset Data, in collaboration with Agency Innovation Services (i.e., Information Technology), should evaluate the Fiix Program's capability to produce digital Preventive Maintenance work orders, to allow for greater communication and tracking of single point failures to identify problem codes more efficiently. Problem codes may be identified as anomalies or systemic trending maintenance issues. Identification of the problem codes will also lead to realization of problem causes and allow for the development of further detailed Preventive Maintenance work orders to proactively address and mitigate future issues. This would further allow for enhanced predictive maintenance. Producing the Preventive Maintenance work orders digitally would also align the Incline maintenance program with other PRT maintenance reporting and data entry processes.

I.2. The potential exists to link the recently updated Rockwell Automation, which is the same platform as the Incline SCADA Application, via an Interface to pull information from the Incline SCADA Application over to the Fiix Application for automated work order generation. Talson understands this is outside the scope of the current WES contract and would require PRT to secure additional funding and have development resources available to make this integration possible as part of a separate, future PRT capital project.

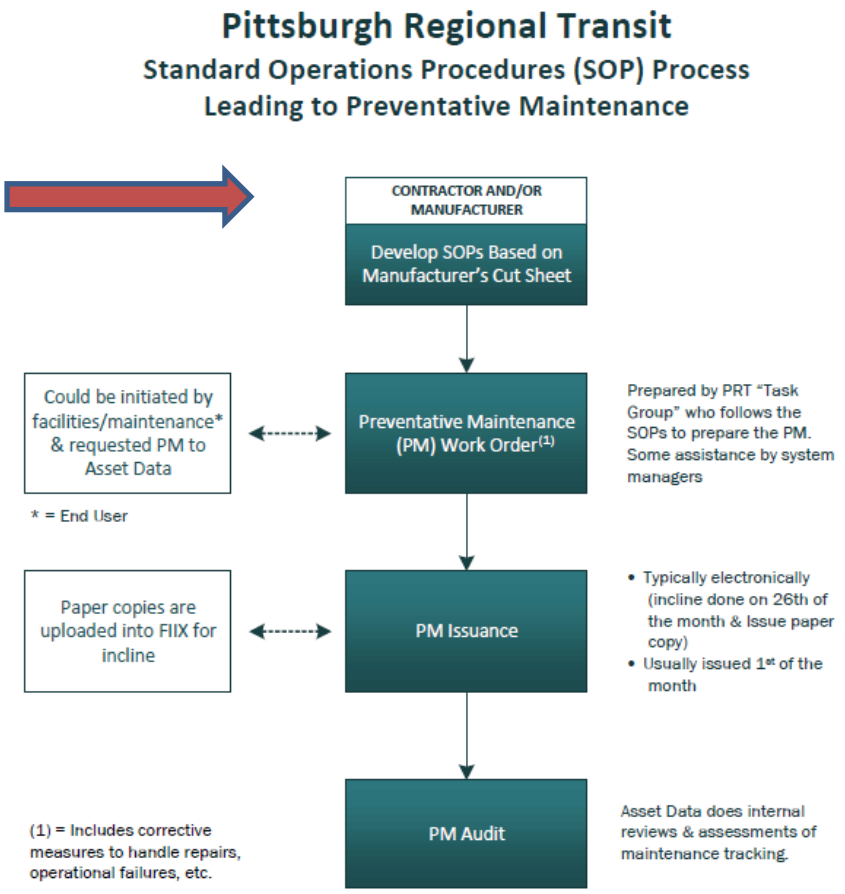
II. PREVENTIVE MAINTENANCE & SOP PREPARATION

Preparation of Preventive Maintenance work orders and SOPs are initiated through the Facilities Asset Data department. The process flow chart to the right maps out the SOP development process.

The "Fiix Program" generates current hard copy Preventive Maintenance work orders. The Rockwell System is a data base-driven system which has capacity to collect and report problem codes.

New SOPs related to the Incline are being prepared based on manufacturer cutsheets and guidance from WES and ELCON. The development of special operating instructions and procedures is a WES contractual obligation, along with any associated training.

PRT's Engineering and Safety Departments are typically (and should be) included in the review of newly developed SOPs and Preventive Maintenance sheets for the Incline.



Enhancement Opportunities:

II.3. PRT should consider implementing a software configuration management process which includes regression testing of software that drives the newly implemented operating systems upon any modification to the system. This will ensure that there are no impacts to facility operations, maintenance, established Preventive Maintenance work orders, or SOPs. The software configuration management process should be inclusive of the Rockwell SCADA System software to ensure new modifications do not affect past modifications. Any changes should be easily reversable in the event that they impact operations of the facility.

II.4. All existing applicable Preventive Maintenance sheets and SOPs as well as any newly created maintenance procedures and/or processes should be clearly documented and combined into comprehensive binders (hard copy and electronically in shared Departmental folders or databases). This should include references to any manufacturers' guidelines, PRT specifications and other industry best practices specific to the installed equipment at the Incline.

III. MAINTENANCE AND OPERATIONS TRAINING

WES has contractual obligations for detailed training and submission of training documents. These obligations are clearly defined within Section 017900 of WES's contract specifications. Talson noted, that although PRT will supplement operator and maintenance training for the Incline facility, WES is expected to lead the initial training. PRT is to review the materials for acceptance and its adequacy to meet contractual obligations prior to commencement of the sessions.

Enhancement Opportunities:

III.5. PRT should work with WES in accordance with the contract to conduct detailed training and provide materials specific to and on how to operate and maintain the Incline facility to all relevant Incline operations and maintenance personnel.

III.6. An ongoing training curriculum should be created and implemented for operations and maintenance of the Incline. The curriculum could be used to train individuals on how to maintain and operate the Incline along with providing continuous education about modifications to SOPs, Preventive Maintenance activities, problem codes and system failures that can be corrected with predictive maintenance. Specific curriculum could include focus on SCADA, Programable Logic Controller operation, Electric Drive Door Operators, Emergency Release System, Station PID Unit, Vehicle Antenna, Station Antenna, Drive Motors, Generator Systems, Lighting Systems, etc.).

III.7. A training "Gap Assessment" should be considered for all existing and potential future Incline facility maintenance personnel to determine specific baseline training needs. This may include expertise in areas of computing efficiency, use of tablets, awareness of existing PRT systems (such as the Fiix Program and its monitoring and reporting capabilities) and other core competencies needed to consistently operate and maintain the newly enhanced Incline facility.

III.8. Subject to its collective bargaining agreements and related work rules for represented personnel, along with available budgetary resources, PRT may choose to include and/or train other operators and maintenance personnel in the training of the Incline to ensure there is adequate coverage should there be a disruption or absence of trained staff to operate and/or maintain the facility. Currently, there is a limited number of operators and maintenance personnel for the Monongahela Incline. Assessment of existing PRT staffing and whether it fully meets PRT's day-to-day operating and maintenance needs for all days and hours that the Incline is in service and/or scheduled for off hours service could be of further value.

III.9. PRT should consider integrated training and operator responsibilities pertaining to limited maintenance in select scenarios or emergency situations. Institutional knowledge and operational experience of Incline is well known by the operators and their abilities could be beneficial to preventive and reactive maintenance in the event of an emergency. Talson understand union agreement and restrictions may limit the ability to allow for operator involvement in assisting with Preventive Maintenance procedures, but at a minimum, ensuring operators are trained to identify operating anomalies and properly report them, should be reviewed and implemented.

APPENDIX A: DOCUMENTS REVIEWED

From: Pittsburgh Regional Transit

- Construction Contract No. Mon 21 – 13 G, H, and E, dated September 17, 2021
- Contract No. Mon 21 13 E Agreement, December 27, 2021
- Construction Contract No. Mon 21 – 13 G, H, and E Addendum No. 1, dated October 19, 2021
- Construction Contract No. Mon 21 – 13 G, H, and E Addendum No. 3, dated October 21, 2021
- Construction Contract No. Mon 21 – 13 G, H, and E Addendum No. 3, dated October 28, 2021
- SAI Scope of Contracted Services, undated
- Mott MacDonald Scopes of Contracted Services, undated
- PRT Notice of WES Delinquent Completion, dated December 21, 2023
- PRT Notice of Software Nonconformance, dated January 8, 2024
- PRT Incident Report, dated January 9, 2024
- Mon Incline Rehab Structural 1982, dated April 5, 1982
- Mon Incline Rehab Architectural 1982, dated April 5, 1982
- Mon Incline Rehab Electrical 1982, dated April 5, 1982
- Mon Incline Rehab Mechanical 1982, dated April 5, 1982
- Mon Incline Improvements 1992, dated November 1993
- Construction Contract No. Mon 14 - 01, dated October 21, 2014
- Construction Contract No. Mon 14 – 01 Technical Provisions, dated October 21, 2014
- Construction Contract No. Mon 14 – 01 Terms & Conditions, dated October 21, 2014
- Mon Incline Flood Repairs, dated March 28, 2019

From: SAI Consulting Engineers, Inc.

- Submittal No. 61B Scada System O&M, dated September 29, 2023
- Submittal No. 77B Brake Cabinet Calculations REV3, dated June 4, 2024
- Submittal No. 79 Brake Cabinet Re-Design, dated April 30, 2024
- Submittal No. 81 On Track DCU Prox Sensors, dated May 29, 2024
- Submittal No. 82 Door Maintenance Procedure REV 1, dated May 29, 2024
- Submittal No. 83 Kistler-Morse Calibration Record 3/3/2023, dated May 29, 2024
- Submittal No. 84 FT User Security Walkthrough, dated June 4, 2024
- Submittal No. 85 IP Addresses Mon Incline, dated June 4, 2024
- Submittal No. 86 SQL Data Export, dated June 4, 2024
- Submittal No. 87 ABB Drive Key Pad Pass Code, dated June 4, 2024
- Submittal No. 88 Mon Incline Laser Maintenance, dated June 4, 2024
- Submittal No. 89 Encoder Adjustment Procedure, dated June 4, 2024
- Submittal No. 90 Power Cycle Procedure Rev 2, dated June 6, 2024
- Submittal No. 91 Mon Incline Door Troubleshooting Guide, dated June 6, 2024

APPENDIX B: INTERVIEWS CONDUCTED

Pittsburgh Regional Transit

- Mike Cetra – Chief Legal Officer *(discussion only)*
- Amy Silbermann – Chief Development Officer *(discussion only)*
- Eric Bilsky – Deputy Chief Engineer *(discussion only)*
- Andrew Lukaszewicz – Director of Rail Service Delivery
- Jacob Cherevka – Manager Facilities Systems
- Christopher Jones – Assistant Manager
- W. Trapper Kurpe – Manager of Facility and Rail Asset Data
- Michael Siegel – Assistant Director of Bus and Rail Training
- Sean Neizmik – Facilities Systems Supervisor*
- Richard Colwell – Incline Maintainer*
- Daniel O'Donnell – Incline Maintainer*
- Carman Servocky – Incline Maintainer*

**Recommended for interviews by ATU Local 85 leadership*

APPENDIX C: CORRECTIVE ACTION MATRIX TEMPLATE

(To be completed by PRT Senior Management)

PREVENTIVE MAINTENANCE PERFORMANCE			
Enhancement Opportunity		**PRT Department Lead(s) for Development of Implementation Plan**	**PRT Department Lead(s), Supporting Groups & Resources for Corrective Action Completion**
I.1	Facilities Asset Data, in collaboration with Agency Innovation Services (i.e., Information Technology), should evaluate the system capabilities to produce digital Preventive Maintenance work orders.		
I.2	Link the recently updated Rockwell Automation, which is the same platform as the Incline SCADA Application, via an Interface to pull information from the Incline SCADA Application to the Fiix Application for automated work order generation.		

PREVENTIVE MAINTENANCE & SOP PREPARATION			
Enhancement Opportunity		**PRT Department Lead (s) for Development of Implementation Plan**	**PRT Department Lead(s), Supporting Groups & Resources for Corrective Action Completion**
II.3	PRT Engineering with support from Agency Innovation Services should consider implementing a software configuration management process which includes regression testing of software that drives the newly implemented operating systems upon any modification to the system.		
II.4	Existing applicable Preventive Maintenance sheets and SOPs as well as any newly created maintenance procedures and/or processes should be clearly documented and combined into comprehensive binders (hard copy and electronically in shared Departmental folders or databases).		

MAINTENANCE AND OPERATIONS TRAINING			
Enhancement Opportunity		**PRT Department Lead(s) for Development of Implementation Plan**	**PRT Department Lead(s), Supporting Groups & Resources for Corrective Action Completion**
III.5	PRT should work with WES in accordance with the contract to conduct detailed training and provide materials specific on how to operate and maintain the Incline facility to all relevant Incline operations and maintenance personnel.		
III.6	An ongoing training curriculum should be created for operations and maintenance of the Monongahela Incline. The curriculum could be used to train individuals on how to maintain and operate the Incline along with providing continuous education about modifications to SOPs, Preventive Maintenance activities, problem codes and system failures.		
III.7	A training "Gap Assessment" should be considered for all existing and potential Incline facility maintenance personnel to determine specific baseline training needs. This may include expertise in areas of computing efficiency, use of tablets, awareness of existing PRT systems.		
III.8	PRT to include and/or train other operators and maintenance personnel in the training of the Incline to ensure there is adequate coverage should there be a disruption or absence of trained staff to operate and/or maintain the facility *(Subject to its collective bargaining agreements and related work rules for represented personnel, along with available budgetary resources).*		
III.9	PRT should consider integrated training and operator responsibilities pertaining to limited maintenance in select scenarios or emergency situations.		