



SRT Incident Review and Subway Track Modernization

Board Meeting - April 11, 2024

Overview

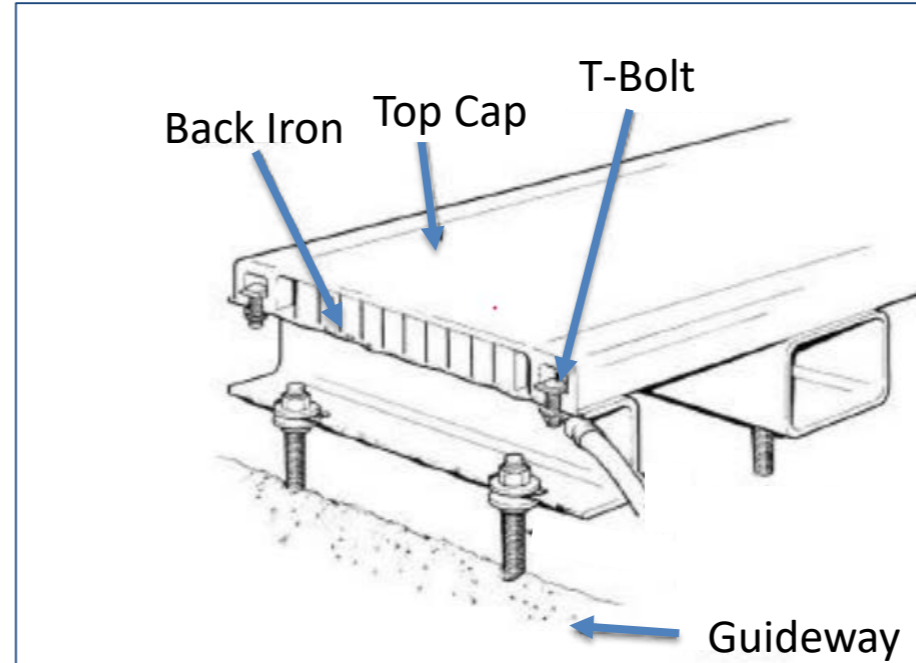
1. SRT Derailment Recap
2. Why Did Reaction Rail Defects Drop Drastically?
3. Modernization and Continuous Improvements



SRT Incident Review

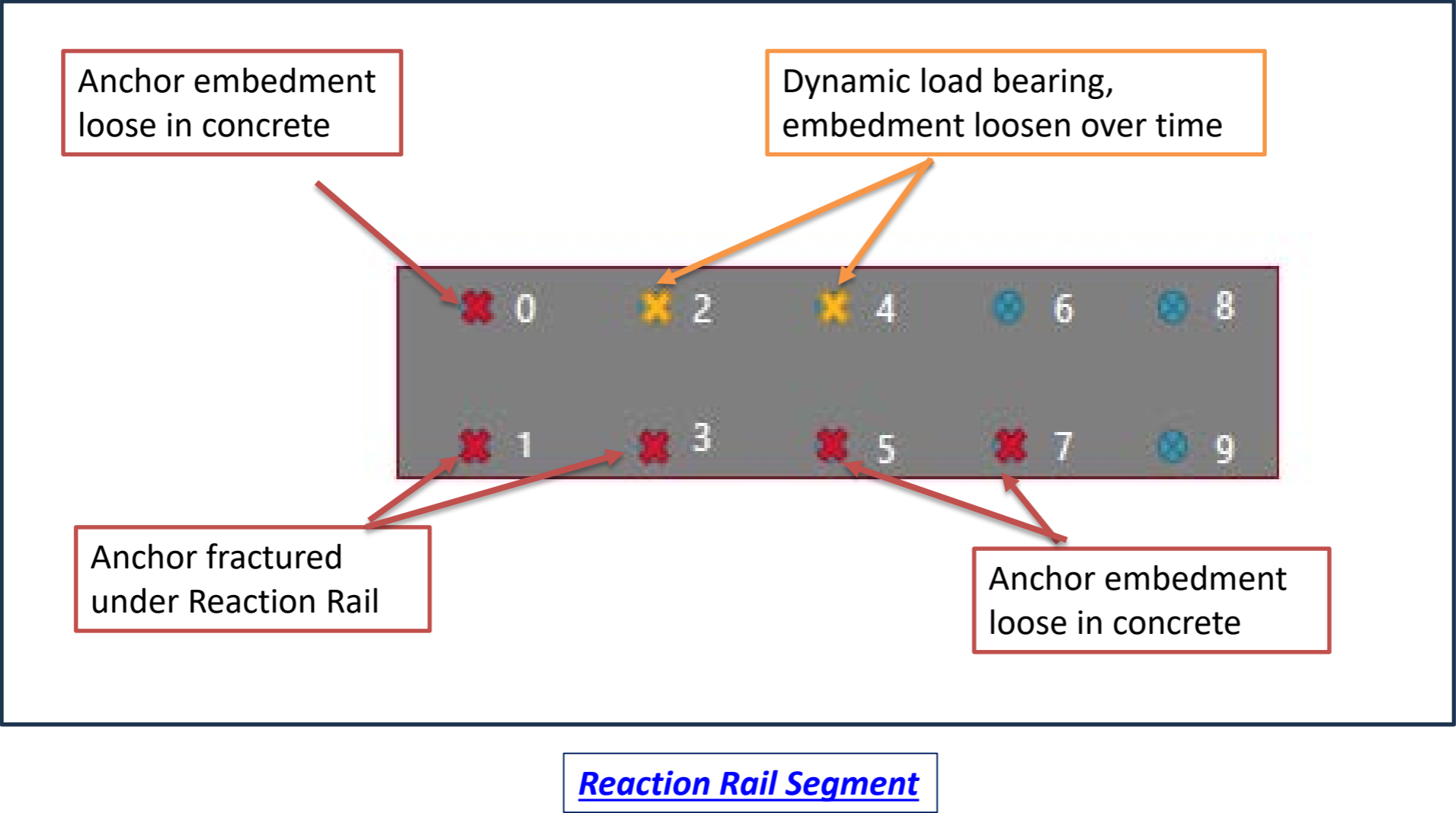
Investigation Findings

- Running rails – not a contributing factor
- Vehicle – not a contributing factor
- Reaction rail – anchor bolts failed



Reaction Rail Components

SRT Incident Review



Final Recommendations

Areas of Improvement

1. Asset management practices – Enterprise Asset Management Program
2. Standards and procedures
3. Defect Prioritization and management
4. Track Patroller training
5. Engineering review process



Notable Effectiveness

Network Rail Consulting

- ✓ "...Track Patrollers do act on what they believe are unsafe defects around the reaction rail, as speed zones have been implemented for reaction rail defects"

Systra Canada Inc.

- ✓ "the general quality of the track condition and other installed equipment can be considered as fairly good throughout the inspected area"
- ✓ "best practices were observed and accomplished throughout all witnessed track work"
- ✓ "in all inspections and facilities visited, we can confirm the compliance of track maintenance works with TTC safety rules and standards"
- ✓ "throughout all inspections and interviews, SYSTRA has observed that the TTC staff are fully aware of their roles, tasks and commitments to the company within their respective department and units"

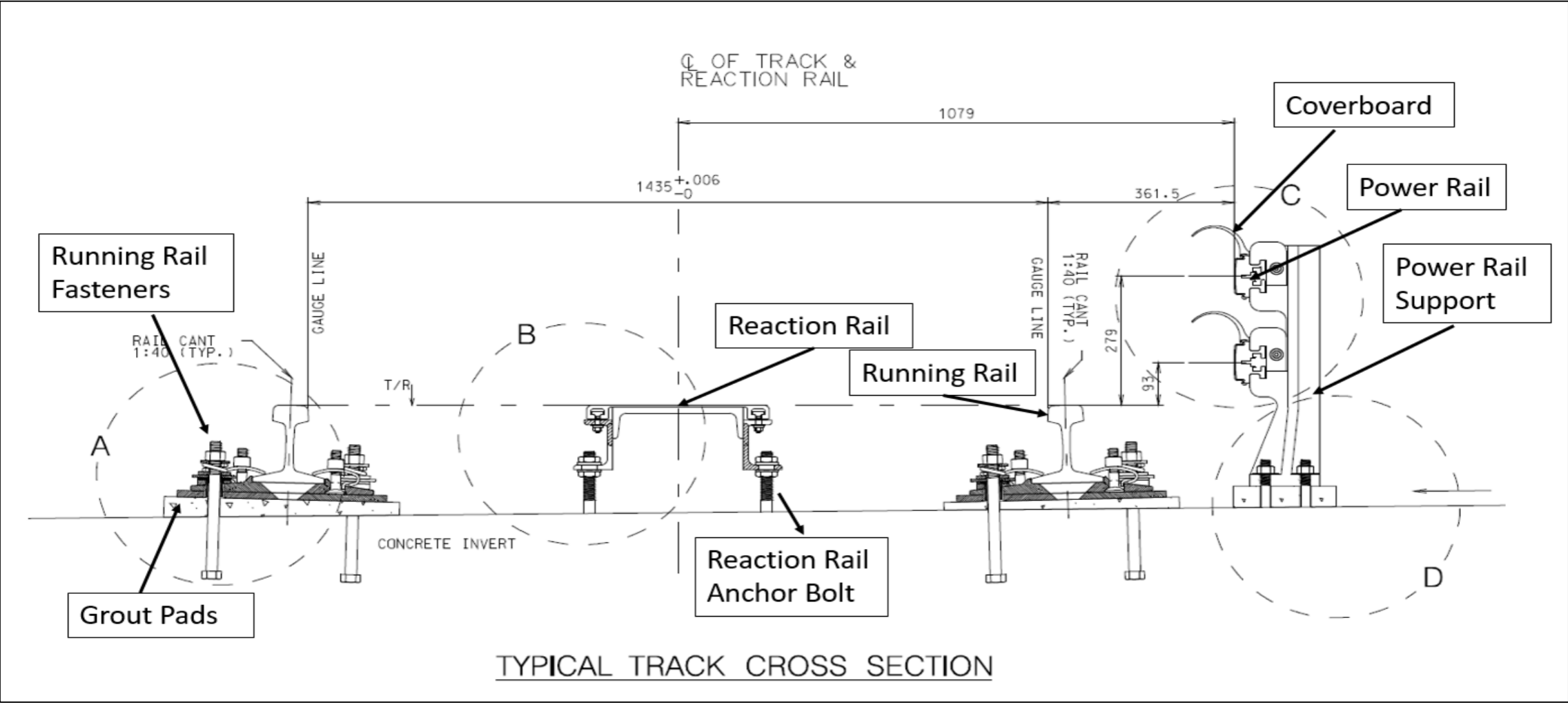
| Why Did The Reaction Rail Defects Drop Drastically?

- Improved track asset reliability and availability, due to the successful execution of the SRT Life Extension project and consistent time-based maintenance.



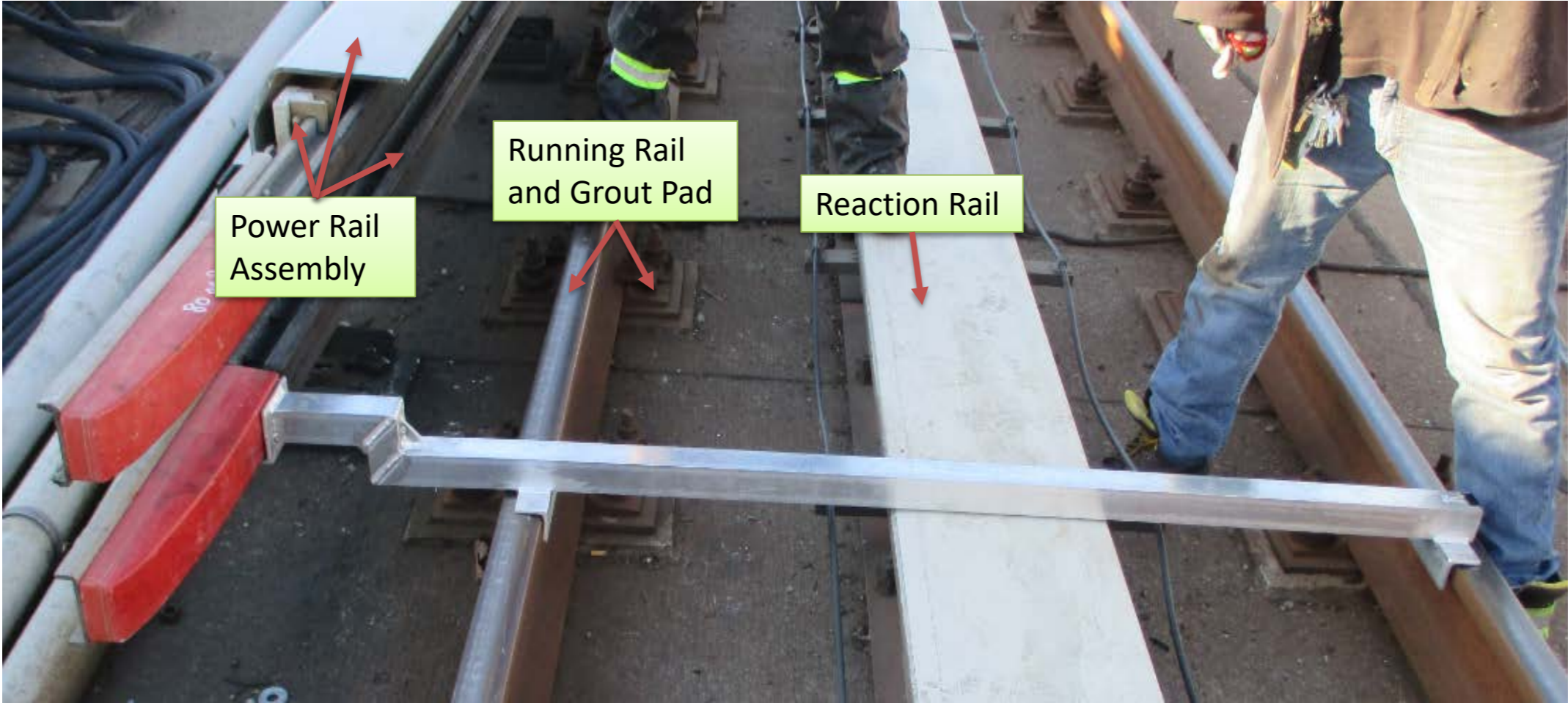
SRT Maintenance Projects - Life Extension Program

Condition and Predictive-Based Maintenance



SRT Maintenance Projects - Life Extension Program

Condition and Predictive-Based Maintenance



SRT Components



SRT Maintenance Projects - Life Extension Program

Condition and Predictive-Based Maintenance



Power Rail Assembly



Running Rail Grout Pad



Reaction Rail

SRT Maintenance Activities

Calendar-Based Preventative Maintenance

APTA Standard	TTC Standard	SRT 2021-2023
Track Inspection: Visual, every three to 11 days	<ol style="list-style-type: none"> 1. Visual Inspection every three days 2. Reaction rail laser survey semi-annually 3. Roadmaster yearly specialized inspection 	No reduction and consistent with other lines
Ultrasonic Running Rail Inspection: Yearly	Yearly	No reduction and consistent with other lines
Detailed Switch Inspection: Monthly (and yearly Track and Signal joint inspection)	Monthly and yearly joint inspection	No reduction and consistent with other lines

* Seven reaction rail laser surveys were run in 2021 as part of the renewal program. Returned to semi-annual in 2022.

**Monthly switch inspection compliance increased by 30% from 2021 to 2023, 97.1% compliance rate in 2023. Joint switch inspection no change from 2021 to 2023.



Subway Track Modernization

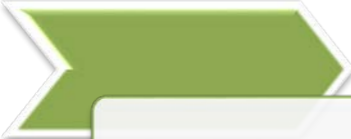
2018

- NRC track condition survey on Line 1
- First Appointment of Chief Infrastructure and Engineering Officer
- Vibration Monitoring Stations to address customer complaints
- The first North American Transit Agency to use Rail Milling



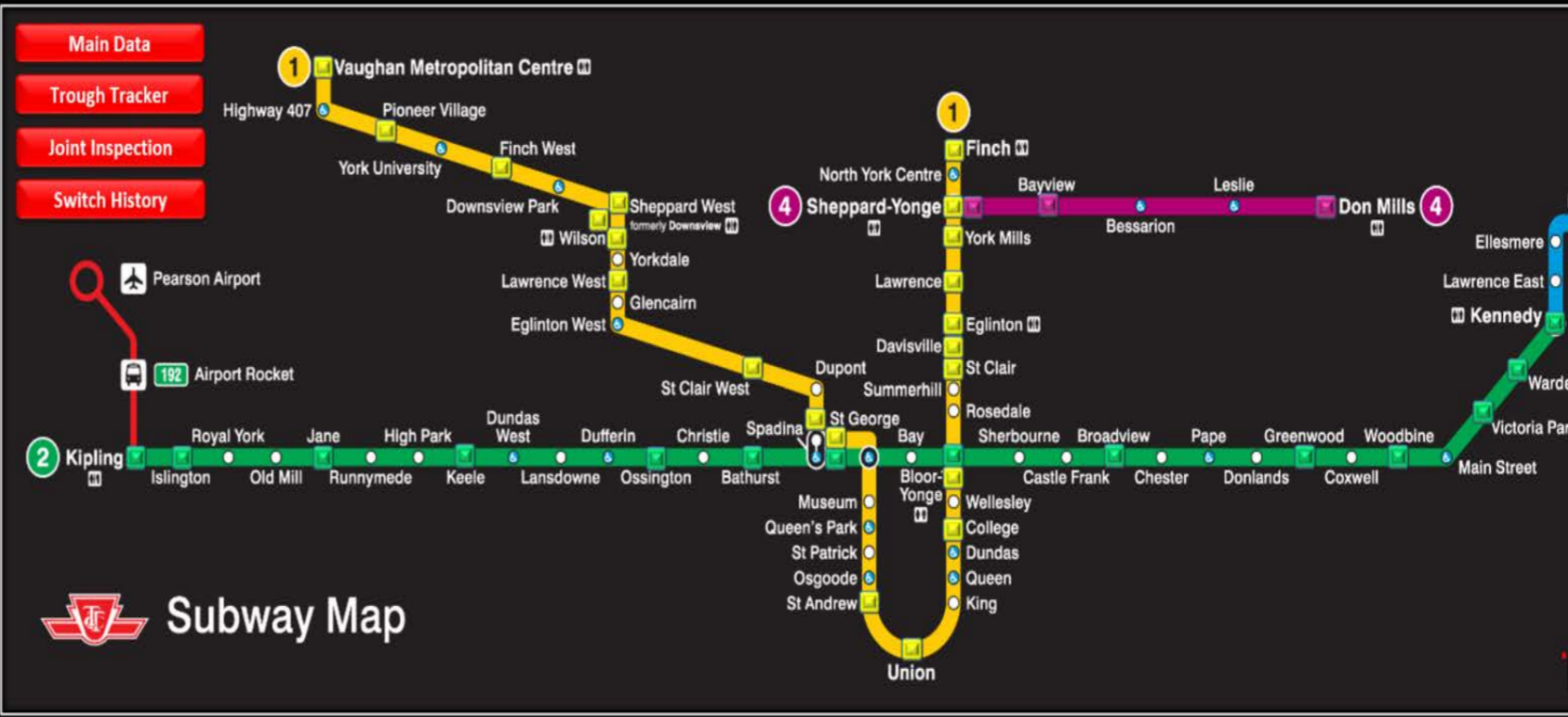
Rail Milling Vehicle

Subway Track Modernization



2019

- Improved the track inspection process, including switch inspection
- Began developing the Track Inspection Vehicle (TIV)
- Staff competency assessment
- Commenced Wilson Hands-on Training Center design



Improved Switch Inspection Dashboard



Subway Track Modernization

2020

- Asset Management software (Maximo) trial
- Re-organization of Capital Project Office and created a new Procedure Section
- Advanced noise and vibration management technologies to monitor noise and vibration
- Track Safety Inspection Officers



Noise and Vibration Real Time Monitoring

Subway Track Modernization

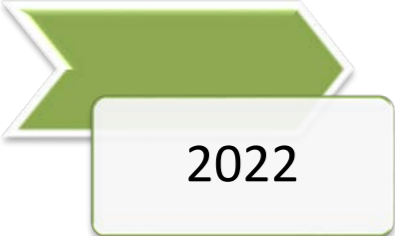
2021

- Track condition survey for entire system
- Reviewed and updated NDT standard
- Continue to advance track asset and trial maintenance technologies for more reliable asset



Traditional Wood Ties vs New Composite Ties

Subway Track Modernization



2022

- Implement Maximo Linear Asset Management software to track maintenance
- Wilson Hands-On Training Center opened
- Enhanced switch inspection process

The screenshot displays the Maximo Asset Management interface for Work Order 4574521. The top navigation bar includes tabs for List View, Work Order, Plans, Related Records, Actuals, Log, Failure Reporting, and Specifications. The main content area is divided into two sections: 'Children of Work Order 4574521' and 'Tasks for Work Order 4574521'. The 'Children' section shows a table with columns for WO #, Classification, Summary, Status, Inherit Status Changes?, Asset, Defect #, Track, Dir., From, To, Target Start, Priority, Position, and Failure Class. Two rows are visible, both with a status of 'COMP'. The 'Tasks' section shows a table with columns for Sequence, Task, Summary, Estimated Duration, Status, Inherit Status Changes?, Owner Group, Work group, and Crew workgroup (Admin Group). Three tasks are listed, all with a status of 'COMP'. Below the tasks section, there are tabs for Labor, Materials, and Tools. The 'Labor' section shows a table with columns for Task, Crew Type, Craft, Description, Skill Level, Vendor, Quantity, Labor, Crew, Regular Hours, and Total. A message indicates 'There are no rows to display.'

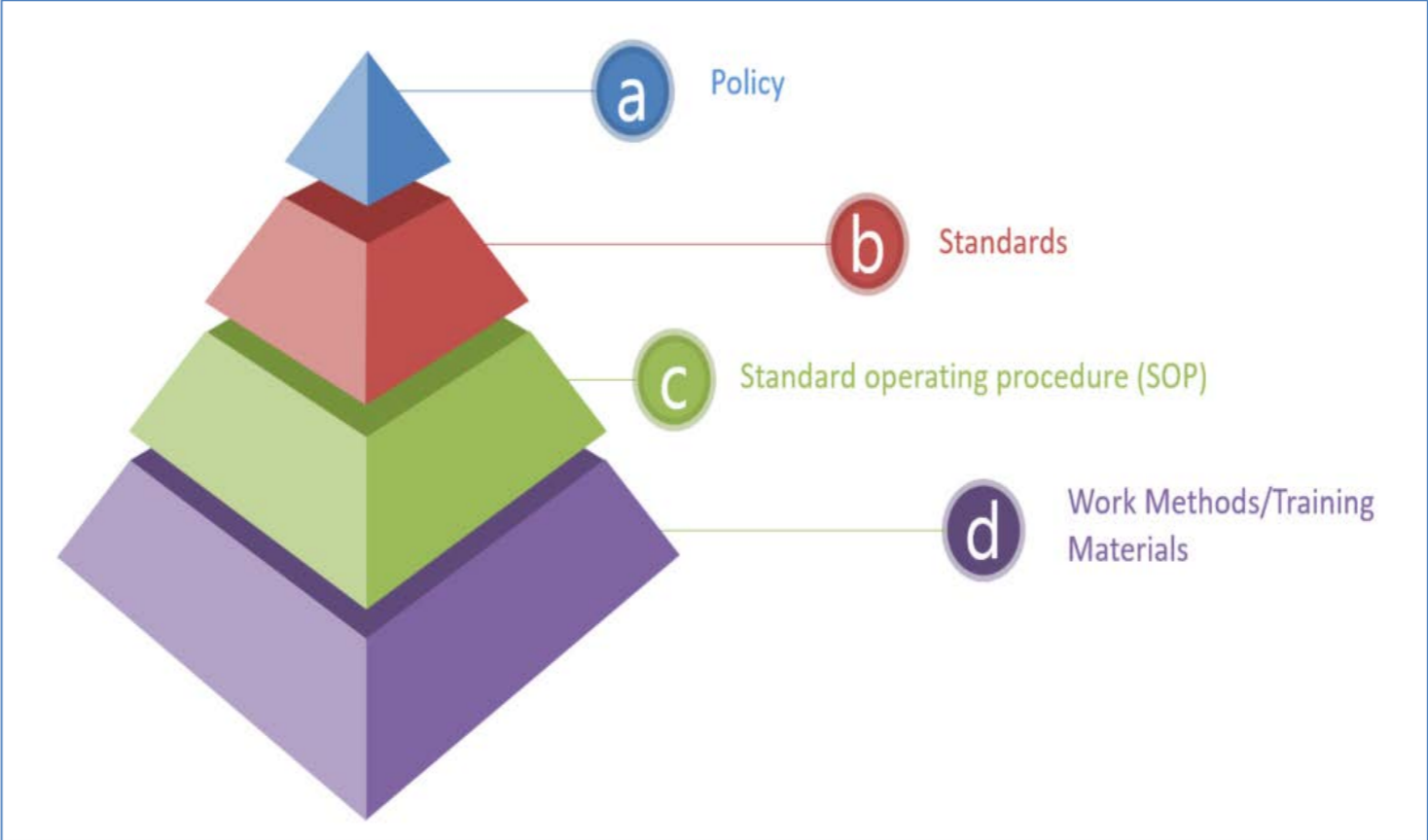
Maximo Asset Management Dashboard



Subway Track Modernization

2023

- NRC track condition survey entire system
- Systra maintenance process review and benchmarking
- NRC full maintenance document review and recommendation on improvement for standards, SOPs and work methods



Proposed Document Hierarchy



Continuous Improvements - Onwards

Training

Already Underway

- Continue to review and enhance training programs
- Expand leadership training for supervisory staff employees

Future Initiatives

- Expand mentorship and ongoing assessment processes
- Intergrade new standards and procedures into training material



Wilson Hands-on Training Center- Opened 2022

Continuous Improvements - Onwards

Documentation

Already Underway

- Systematically improve document control, creating new structure for document organization
- Review and update of all 399 documents, including standards, SOPs and work methods
- Enhance record keeping process



Record Keeping at Track Patrol



Continuous Improvements - Onwards

Organizational Change

Already Underway

- Analyze current maintenance organization and silos, re-organize for better collaboration
- Utilize Asset Planner to improve Maximo defect management

Future Initiative

- Review QA process for maintenance activities, including roles and responsibilities to manage maintenance output



Toughbook Tablet for Enhanced Maximo Access

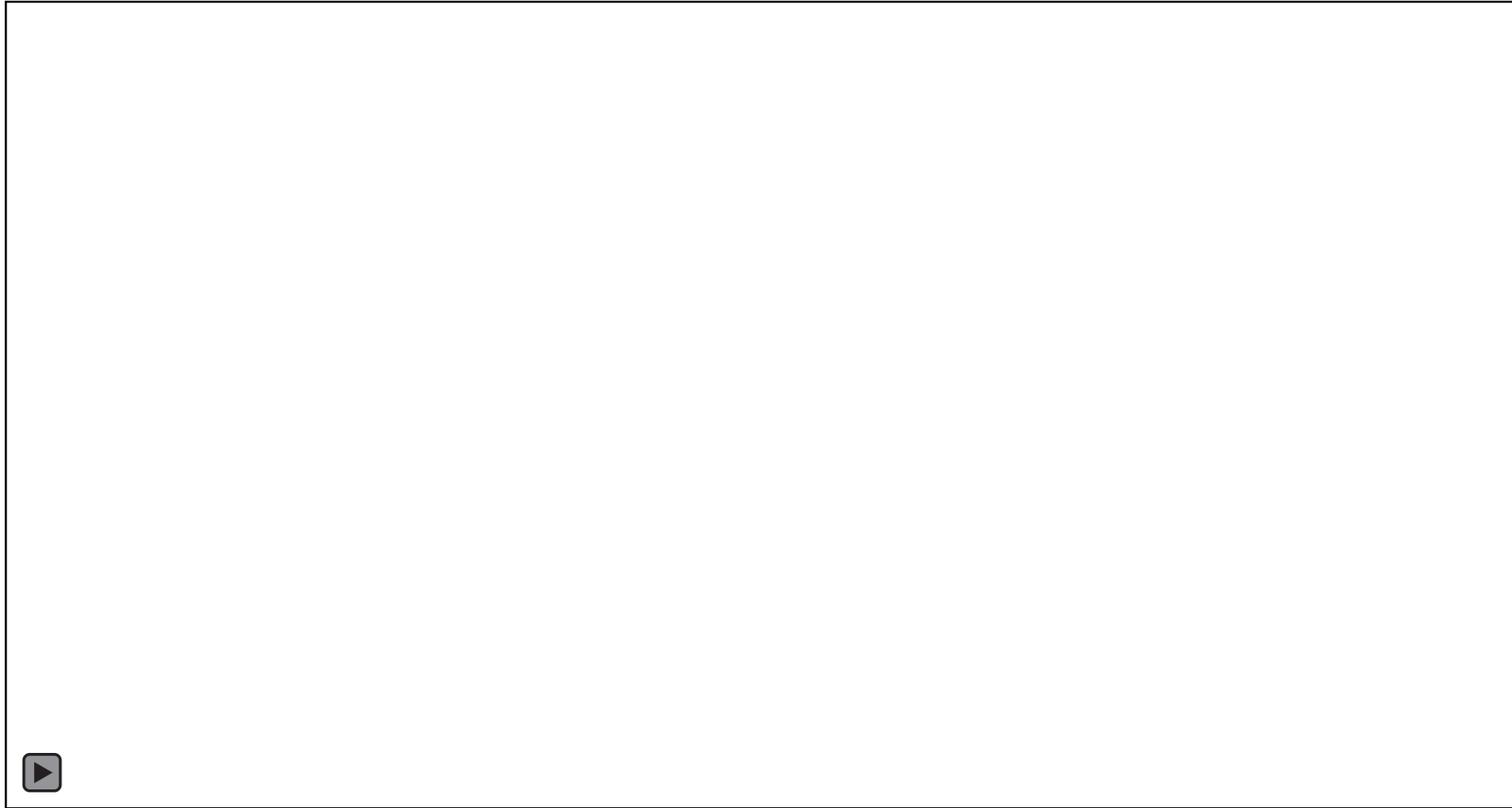


| Appendix

1. SRT Dynamic Simulation
2. Rail Milling
3. Hands-on Training Center (HOTC)
4. Subway Track Modernization – Five Year Journey and Continued Improvements
5. Track Inspection Vehicle (TIV)



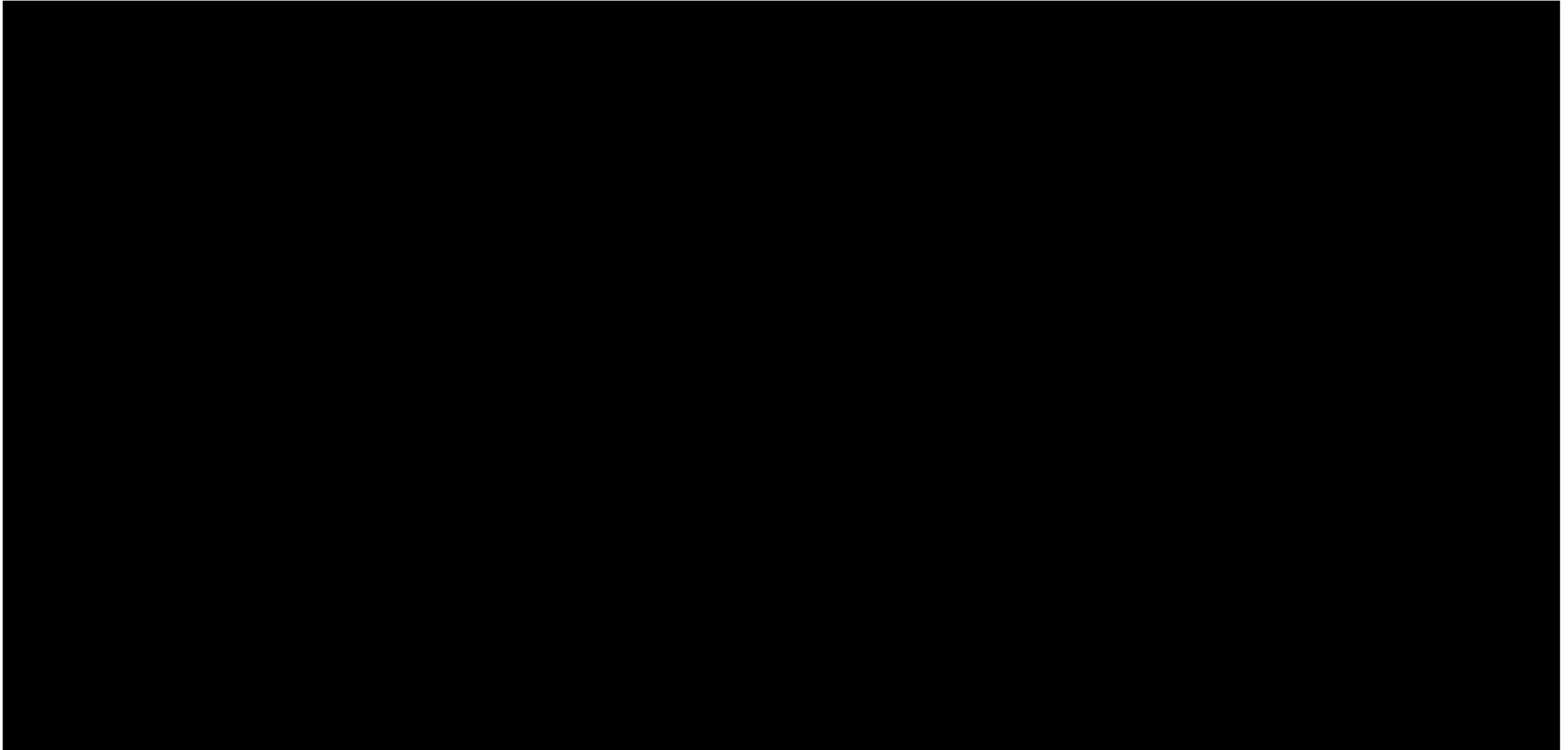
SRT Dynamic Simulation



Reaction Rail Anchor 0, 1, 2 and 3 Loose



Rail Milling



Hands-on Training Center (HOTC)

**Operations
and
Infrastructure**
HANDS-ON TRAINING CENTER



Subway Track Modernization – Five Year Journey

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Continuous Improvements - Onwards

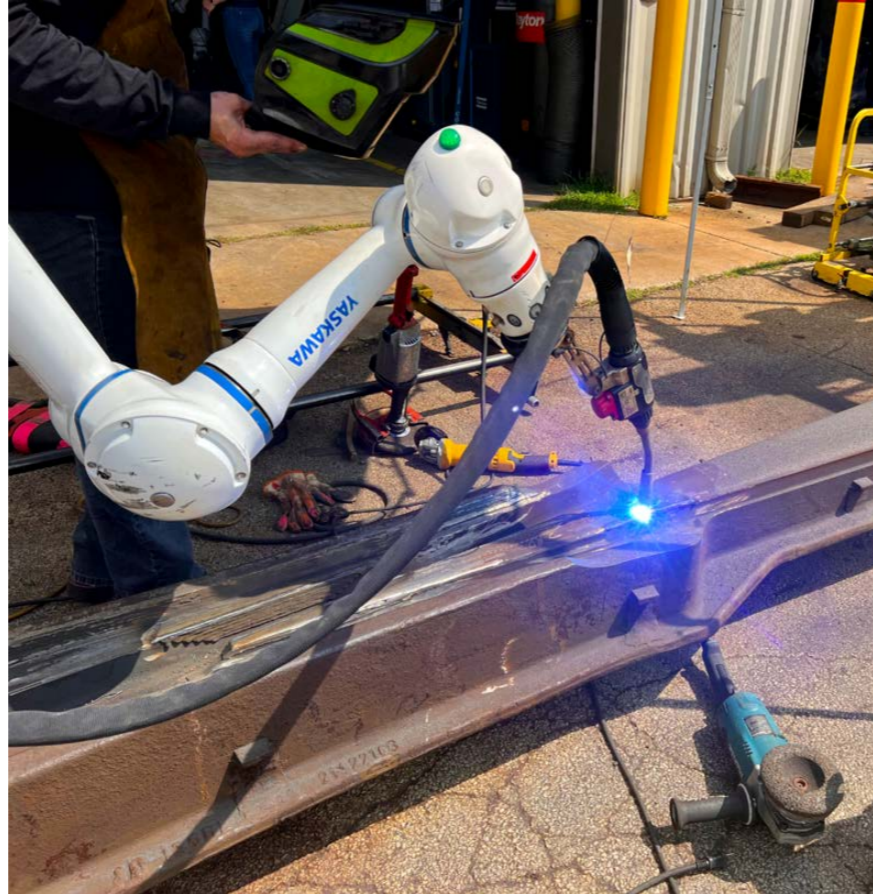
Maintenance

Already Underway

- Review of track inspection process and frequency
- Develop tamping plan
- Continue to enhance welding process

Future Initiative

- Succession and development plan for key staff members



Trial of Welding Technologies

Continuous Improvements - Onwards

Engineering

Already Underway

- Enhance engineering change management process
- Continue to develop the Track Inspection Vehicle (TIV)
- Continue to trial new technology that supports proactive maintenance strategies

Future Initiative

- Develop comprehensive preventative maintenance program



[Track Inspection Vehicle \(TIV\)](#)

Track Inspection Vehicle (TIV)

**TRACK INSPECTION
VEHICLE**

TIV

