Preventative Maintenance & Inspection Improvements

Fiscal and Management Control Board
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The vision of modernizing to **Full Cycle Asset Management** of the MBTA transit system infrastructure is over five years old with a transition of Asset Management Group from Engineering & Maintenance (E&M) to the Office of Chief Engineer.

Modernizing maintenance management within the E&M divisions began with asset data collection.

E&M divisions went live with a new **enterprise asset management system (EAMS)** in January 2019, and work management is now digitally tracked at the individual asset.

Since fall 2019, E&M managers, with the assistance of an industry-leading consultant, have developed **preventative maintenance & inspection (PM&I) schedules for critical assets**.

These maintenance intervals are being input into the asset management system to allow for scheduling and tracking.
Safety Review Panel recommendation:
“The establishment of PMI safety performance targets and safety performance indicators must ensure that these activities:

• Are aligned with industry best practice.
• Are occurring at the required frequency.
• Are monitored to ensure required mid-life or other critical system overhauls are conducted
• Have sufficient human capital to be carried out
• Are properly funded

Key initiatives:
• Introduced structured PM&I implementation
• Developing data-driven compliance checks and informed business decision making
• Continuous improvement towards best-in-class asset management
Modernized Maintenance – A Confluence of Efforts

This fall, the oldest subway in America will be maintained by a modern maintenance management system.

- MBTA field technicians armed with tablet computers will be logging **scheduled critical inspections** in real time on geo-located assets.
- Efficient digital **work management** streams such as defect tracking and repair works will revolutionize maintenance effectiveness.
- Data of **critical asset conditions** will feed dashboards and key performance indicators where all management levels will monitor compliance.

**Historical Milestones:**
- EAMS go-live **JAN 2019**
- PM&I improvement program established **DEC 2019**
- **Critical Asset Digital PM&I Tracking** **FALL 2020**
Safety PMIs

Four Departments of E&M Critical Assets

Maintenance of Way (MOW)
- 162 miles of active track
- Over 600 switches

Transit Facilities Maintenance (TFM)
- 180 Stations & 90 Facilities
- 135 Bridges & 39 Miles of Tunnels

Power Systems Maintenance (PSM)
- 200 Miles of AC cable
- 1,000 Miles of DC cable
- 46 Traction Substations & 96 Unit Subs
- 125 Miles of Overhead Catenary

Signals & Communications Maintenance (SCM)
- 985 AC Track Circuits
- Over 400 Power Switches
Categories of PM&I Priorities

- 31 discrete schedules or tests are classified as **Safety Critical**: “uncontrolled risk of a safety incident or safety event if not undertaken as per requirement”
  - Visual track inspections and switch certifications
  - Ultrasonic rail & track geometry testing
  - Signal, switching, and train stop testing
  - Fire & life safety systems compliance
  - Emergency generator, egress, & exhaust fan certifications
  - Power generation PM
  - Structural Inspections

- 72 additional **System Critical & Routine PM&I** schedules are identified as “activity that form part of the routine E&M schedules to maintain the performance and reliability of the asset.”

- 32 **Future Improvement or Best Practice** protocols are being considered, and assessments to continually improve the discrete list of actions
Example: Safety Critical Test of a Critical Asset

- Inspections by the Signals Department are governed by SM1, laying out 20+ tests to be conducted on the Signal Systems at various intervals: monthly, quarterly, annually, or every two, four, or ten years.

- Test 13 “Test of Switch Obstructions” is completed monthly on over 400 switches across all lines.

- Test ensures that when switch points are fully closed, they are prevented from opening more than 1/4" by lock rods.

- On average, **155,000 switch throws** occur across the MBTA system per month.

- This test is classified as “Safety Critical.”
Keys to Program Implementation:
1) Asset Data Collection & Digitization
2) PM&I Digitization & Tracking
3) Mobile Software Development
4) Improving Inspection Methods
PM&I Improvement – Asset Data Collection and Digitization

Asset Data Collection and Digitization

In order to become best in class, the MBTA will collect and digitize data on thousands of assets and corresponding inspection programs.

- The MBTA maintains over 50k assets including but not limited to track, signaling, communications, power, facilities, and civil assets across the greater Boston area.

- Project Milestones:
  - Collect and validate critical asset data
  - Create asset hierarchies and corresponding defect and repair codes
  - Digitize asset data and load into EAM
PM&I Improvement – PM&I Digitization & Tracking

PM&I Digitization & Tracking

- In order to maintain its assets, the MBTA needs to perform over 130 distinct preventative maintenance and inspection tasks at the appropriate frequencies. Many of these PM&I’s were previously managed and tracked via paper processes.

- Project Milestones:
  - Digitize PM&I programs/records and loaded into EAM.
  - Develop dashboards and KPIs to track compliance against PM&I requirements for critical assets.
PM&I Improvement - Mobile Software Development

Mobile Software Development

- The MBTA will be working to convert its paper work management processes to digital processes that can be managed with tablets operated by technicians in the field, enabling real time asset status and work tracking.

- Project Milestones:
  - EAM mobile workflows designed and implemented in mobile software solution
  - Field testing for Mobile workflow and tablet.
  - Training provided to E&M front line staff and managers.
Safety PMIs

PM&I Improvement – Improving Inspection Methods

Implementing International “Best in Class” Inspection Methods

Example I: Use of Drones for Thermal Imaging

- **Manual visual inspection** of rail yards can be very time consuming due to the size of the yard.
- **Thermal imaging** via drone can be used to pinpoint defects in rail yard such as defective bonds or heating elements. Some of these defects cannot be observed visually.
  - Reduced inspection time
  - Early detection of defects
PM&I Improvement – Improving Inspection Methods

*Implementing International “Best-in-Class” Inspection Methods*

**Example II: Introduce thermal image capture to manual switch box inspections**

Current Inspection Protocol  
Future Inspection Protocol
PM&I Improvement - Next Steps

Deployment of Critical Asset tracking:

- Mobile software and tablet field testing          ONGOING
- Employee training (PM&I and mobile)              JUNE 2020
- Critical asset digital PM&I tracking             FALL 2020
Conclusion

• In developing full cycle asset management for the MBTA transit infrastructure, employee technicians are given the tools to be efficient and build competence in all aspects of systems maintenance.

• Data-driven decisions are now accessible though real-time tools, such as trending to highlight early indicators, work management, and clear management view of compliance.

• Engineering & Maintenance is better positioned to succeed at infrastructure maintenance, supporting a best-in-class transit system that is reliable and safe.