

# SoGR @ BART

Achieving and Sustaining a State of  
Good Repair

# System Maturity → Rehabilitation

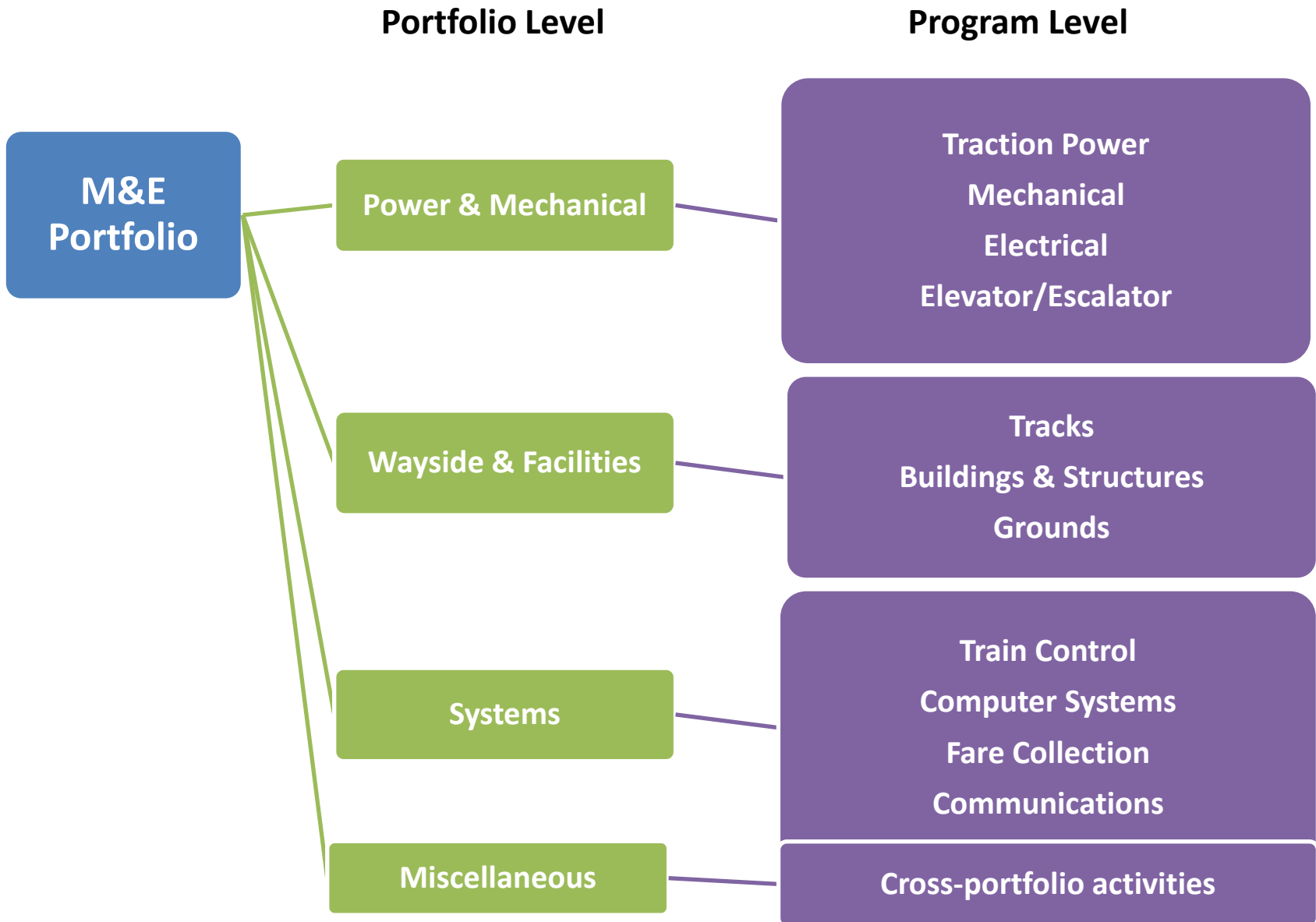
- BART has been operating for 39+ years:
  - Our assets are reaching the end of useful life
  - Many are significantly beyond their design life
- Symptoms:
  - Frequent failures (increasing rate)
  - Assets are beyond useful/design life
  - Little to no spares (anywhere!)
  - Reduced PM cycle has shortened asset life
  - Some assets operate but lack functionality
  - Inconsistent technologies (O&M cost driver)

# System Maturity → Rehabilitation

- Impacts of poor SoGR:
  - Safety
  - Operational Reliability
  - Operational Efficiency
  - Financial Costs
  - Legal/Compliance

# Enterprise Asset Management

- In progress
- Developing a full inventory of assets
- Assessing asset condition
- Developing a completing listing of capital reinvestment projects
- Rehabilitation projects classified into 'portfolios' and 'programs'



# Power & Mechanical Traction Power

- Major Assets:

- 12 Switching and Bulk Supply Substations
- 210 miles of 34.5kV AC Cable Distribution System
- 62 Traction Power Substations
- 44 Gap Breaker Stations
- 300 miles of 3rd Rail and Coverboard

- Projects In-Progress

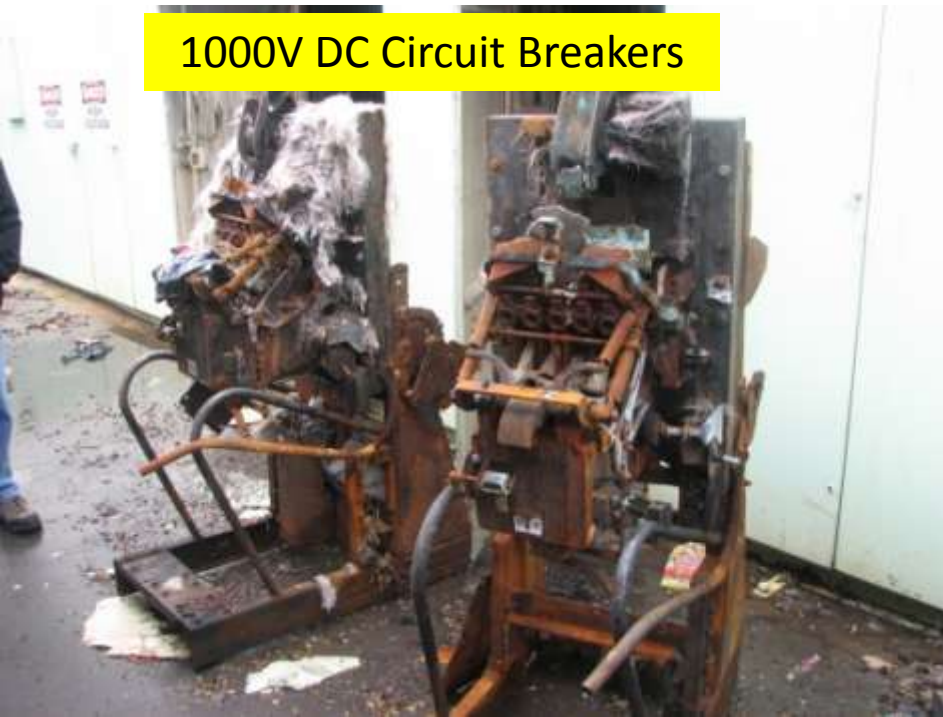
- 14 Substation Replacement Procurement
- 16 Miles of 34.5kV AC Cable Replacement
- TP Protection Scheme Enhancements

# Power & Mechanical

## Traction Power

- Impacts and Liabilities
  - Direct ability to run trains
  - System Reliability
  - Reduced capacity forces slow operation
  - Reduced capacity impacts ability to perform maintenance and repair
  - Breaker design was 1000 cycles, far exceeded design life
  - Personnel safety
  - Coverboards are a significant reliability issue
  - Significant repair time post failure

1000V DC Circuit Breakers



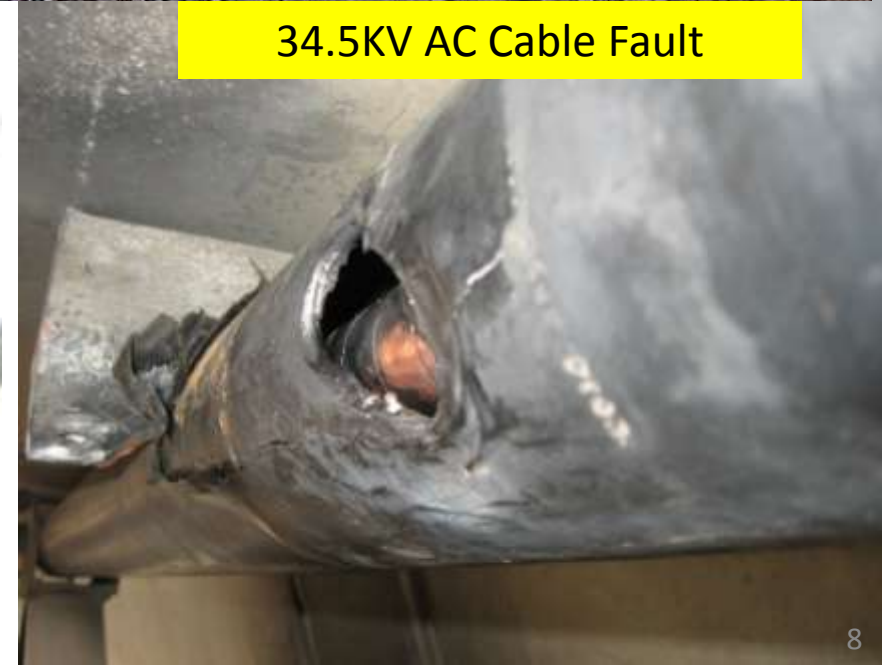
34.5KV AC Cable Repair



Rectifier Transformer Failure



34.5KV AC Cable Fault



# Power & Mechanical Mechanical

- **Major Assets:**
  - Line Ventilation Fans
  - Sump and Waste Pumps
  - Fire Extinguishing Systems
  - Car Washers/Turn Tables
  - RS&S Shop Equipment
  - Station Entrance Grilles
  - Heating, Ventilation and Air Conditioning (HVAC) Systems
- **Projects In-Progress**
  - 48 Line Ventilation Fan Rehabilitation
  - Station Grille Replacement at 6 Stations
  - HVAC at 4 Train Control rooms

# Power & Mechanical

## Mechanical

- Impacts and Liabilities
  - Emergency response (fans, sump pumps, and fire suppression equipment)
  - Service delivery – RS&S equipment, turntables, car wash
  - Broad equipment reliability impact
  - Patron access and station control

Line Vent Fan & Damper



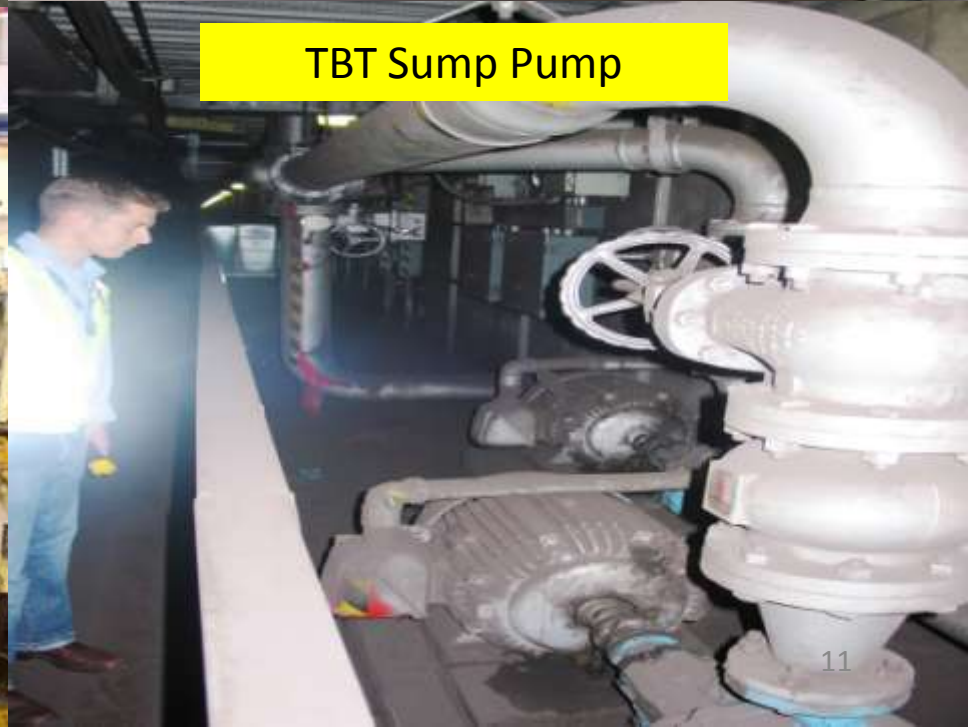
Station Entrance Grills



Shop Equipment – Wheel Press



TBT Sump Pump



# Power & Mechanical Electrical

- Major Assets
  - 480 Volt Distribution Equipment
  - Lighting
  - Fire Alarm Systems
  - Cathodic Protection
  - Battery /UPS Systems
  - Emergency Generators
- Projects In-Progress
  - Station 480 Switch gear Replacement
  - Oakland Vent Emergency Generator
  - Cathodic Protection Rehabilitation
  - Fire Alarm Upgrades at 6 stations
  - Emergency Lighting at 3 stations
  - UPS Replacements at 3 locations
  - Battery Replacements at 6 locations

# Power & Mechanical Electrical

- Impacts and Liabilities
  - Safety
  - Reliability
  - Patron Experience
  - Power outage tolerance

Station 480V Switchgear



TCR Battery System



Emergency Generator



Station Fire Alarm Control Panel



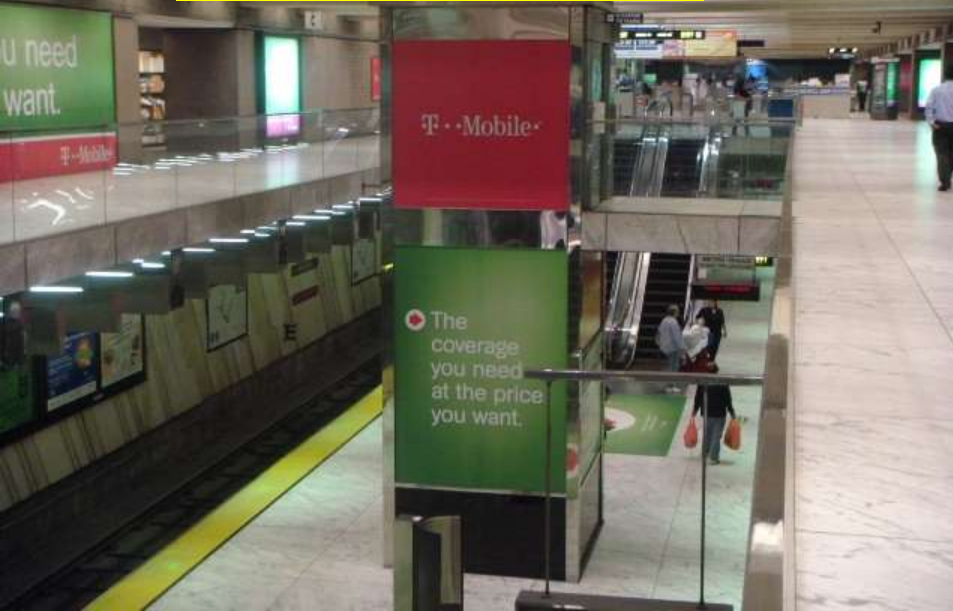
# Power & Mechanical Elevators and Escalators

- Major Assets:
  - 176 Station Escalators
  - 81 Station Elevators
  - 46 Parking Structure Elevators
  - 3 Stair Lifts
  - 14 Ancillary Elevators
- Projects In-Progress
  - S.F. Street Escalators Rehabilitation (19 units)
  - Escalator Remote Monitoring System Installation

# Power & Mechanical Elevators & Escalators

- Impacts and Liabilities
  - ADA
  - Regulatory compliance
  - Patron experience
  - Personal injury

Station Elevator



Station Escalator



Hands-Free Phone & Hall Call



Elevator Floor Replacement



# Wayside & Facilities Track

- Major Assets
  - 104 Route miles, 224 lineal miles
  - 448 miles and 47,000 tons of rail mainline
  - 96 miles of curved track
  - 308 Mainline Turnouts
  - 199 Yard Turnouts
  - 221,000 ties
  - 420,000 direct fixation fasteners
- Projects In-Progress
  - Rail, tie and fastener renewal
  - Geometry car replacement
  - Rail grinding program

# Wayside & Facilities Track

- Impacts and Liabilities
  - Safety
  - Reliability
  - Slow operation due to de-classified rail
  - High curve wear rate due to cylindrical wheels
  - Patron and Neighbor experience

Curve Worn Rail



Corroded Rail



Rail Pad Replacement



Corrugated Rail



# Wayside & Facilities Building and Structures

- Major Assets
  - 44 Passenger Stations – 1.37M square feet
  - 96 Platforms – 12.7 miles
  - 28 miles Aerial Structure
  - 28 miles Subway and Tunnel
  - 4 Yards and Oakland Shops
  - Portals and Transition Structures
  - Parking Garages and Lots
- Projects In-Progress
  - Fall Protection
  - Street Grate Replacement
  - Lake Merritt Tunnel
  - Invert Concrete Pours for Trackway in tunnels

# Wayside & Facilities Building and Structures

- Impacts and Liabilities
  - Integrity of Structures
  - Passenger Safety
  - Trip and Fall/Slip and Fall
  - ADA accessibility
  - Service Delivery
  - Service Life

Lake Merritt Tunnel



Bridge Bearings



Street Grates



Systemwide steel lined subways have serious corrosion problems in many areas due to water intrusion. Concrete walkways, 2<sup>nd</sup> stage concrete is falling apart. Drains are encrusted over, seal rings are failing.

# Systems

## Train Control

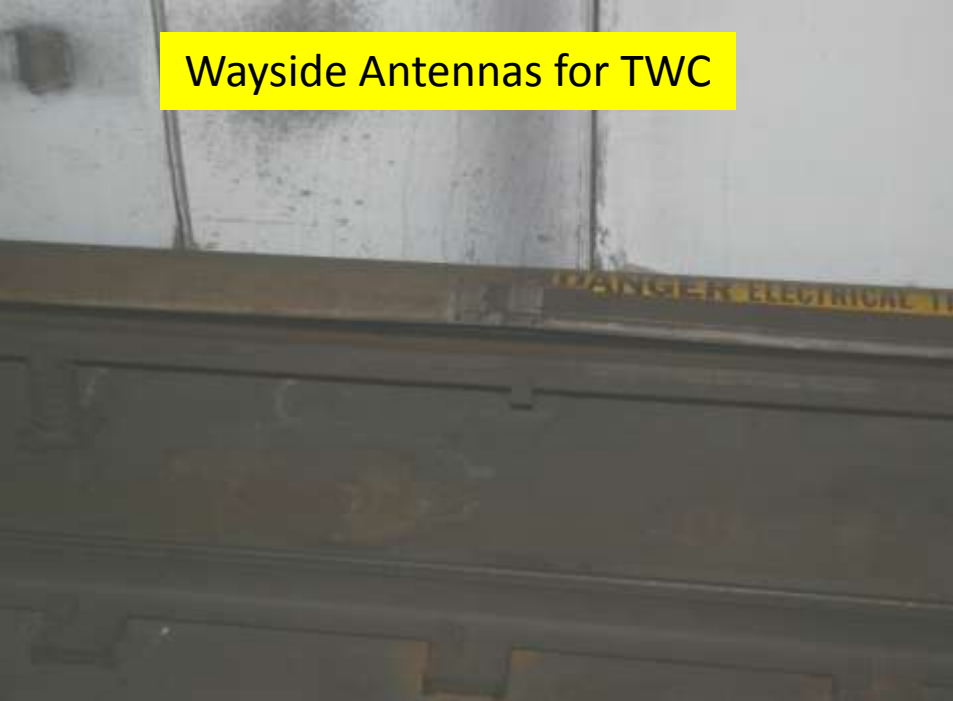
- Major Assets
  - 2255 Track Circuits
  - 507 Switch Machines
  - 49 Interlockings
  - 49 Fiber Based Communications links
  - 65 miles of Cable (much is buried)
  - 37 Sequential Occupancy Release Systems
- Projects In-Progress
  - Switch Machine Replacement
  - Station and Wayside MUX
  - Interlocking Microprocessor Project
  - Communications Based Train Control (CBTC)

# Systems

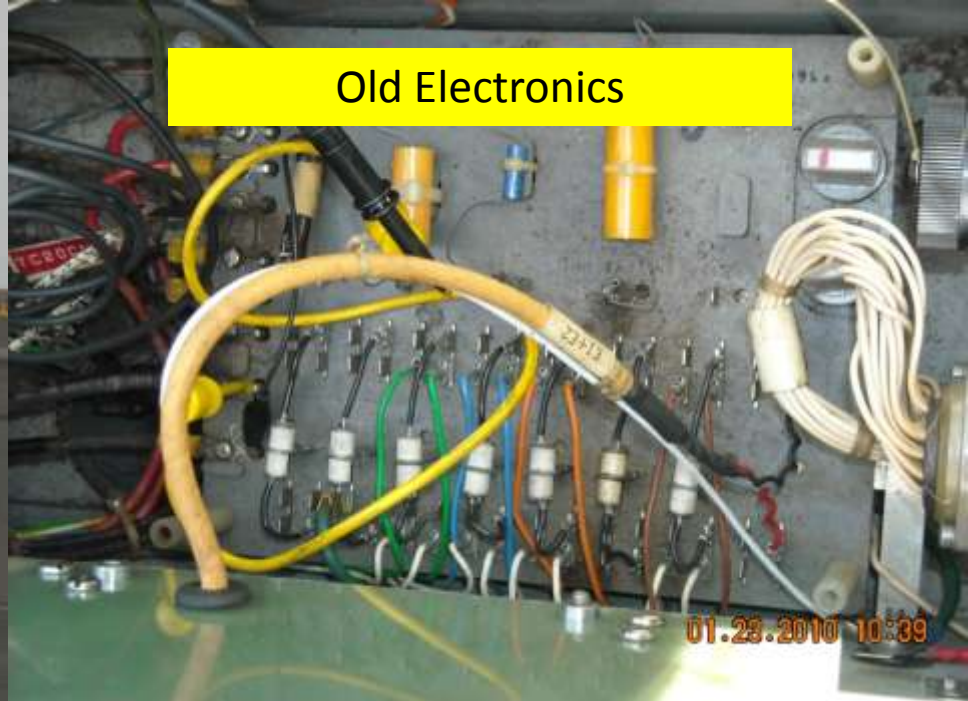
## Train Control

- Impacts and Liabilities
  - Major safety implications
  - Major reliability implications
  - End of life targeted 2020
  - Increased throughput requirement 2020
  - Platform operations – doors and positioning
  - Impacts ability to perform Maintenance
  - Unsupported technology

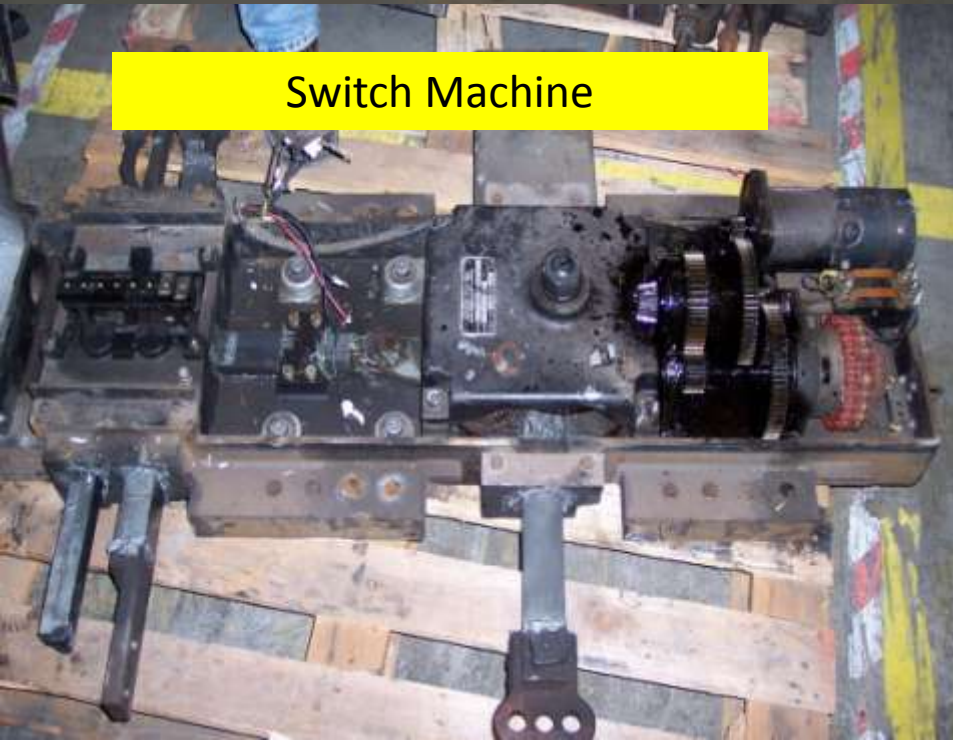
Wayside Antennas for TWC



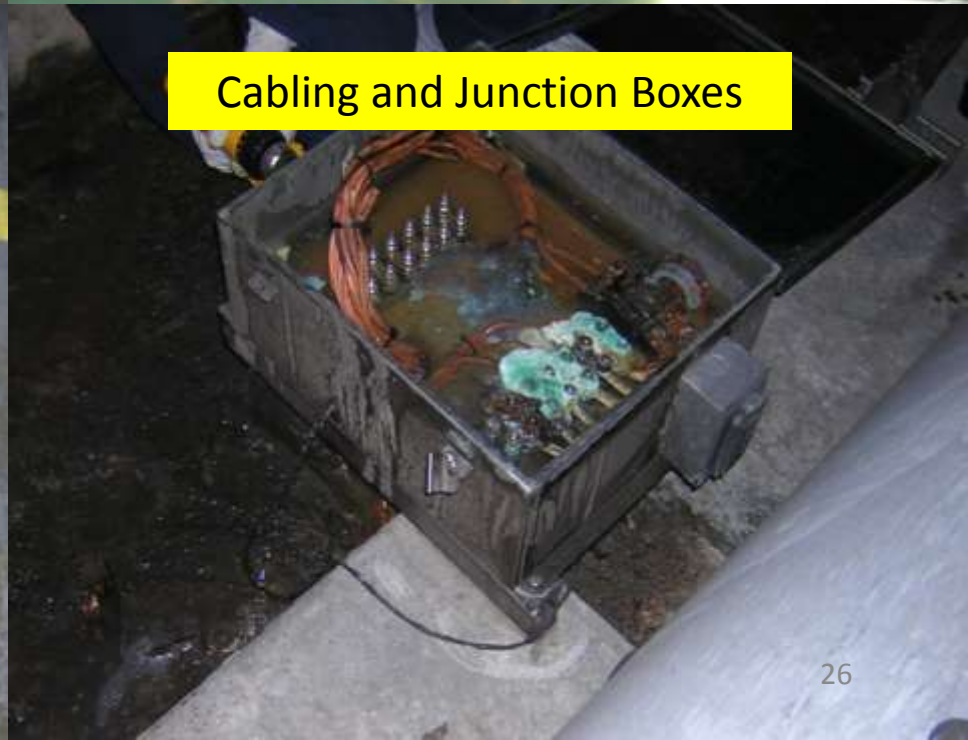
Old Electronics



Switch Machine



Cabling and Junction Boxes



# Systems

## Computer Systems

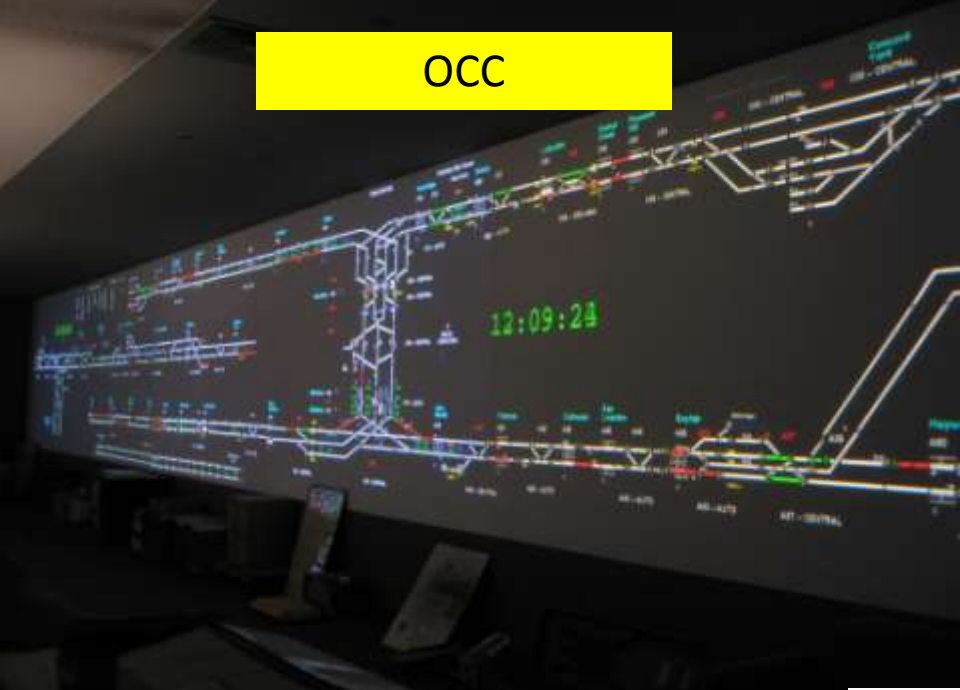
- Major Assets
  - ICS Central Computer
  - Destination Sign System
  - Yard Control Consoles
  - SCADA Systems – Supervisory and Command
  - Security Systems
- Projects In-Progress
  - Replace Yard Tower Consoles
  - Upgrade CAD and Surveillance Video Systems in Police Dispatch

# Systems

## Computer Systems

- Impacts and Liabilities
  - Major service delivery impacts
  - Emergency response
  - Impacts ability to perform Maintenance
  - Patron experience and information
  - ADA implications

OCC



ISRC



ICS Server Rack



SCADA



# Systems

## Fare Collection

- Major Assets 302 TVMs
  - 179 AFMs
  - 528 fare gates (including 66 accessible fare gates)
  - 70 BBCs (Bill to Bill Changers)
  - 59 PVMs (Smart Card Parking Validation Machines)
  - 54 Station Agent Terminal PCs + 54 Ticket Readers
  - Data Acquisition System - 36 Servers supporting revenue
- Projects In-Progress
  - Replace Obsolete Servers
    - DAS Servers (Credit Card and Entry/Exit count Transactions)
    - Treasury Servers (Credit Card)
    - Station Agent Booth “Terminal” and “Ticket Readers”
  - Upgrade Credit Card processing for PCI Compliance

# Systems

## Fare Collection

- Impacts and Liabilities
  - Revenue Collection loss
  - Realtime operations supporting data
  - Maintenance supporting data
  - Patron experience
  - Credit card processing liabilities
  - ADA implications for accessible fare gates

# Systems

## Communication Program

- Major Assets

- Trunked Radio
- Public Address
- BARTNet
- CCTV
- Cable and fiber plant
- Emergency Telephone
- Telephone outside plant
- T1 and SONET
- Elevator accessibility equipment

- Projects In-Progress

- Rehabilitate Legacy “BartNet”
  - Replace legacy infrastructure with Unified Optical Network
  - Upgrade BART internet firewall and Cyber intrusion detection
- Trunked Radio Re-banding (Frequency re-allocation)
- Trunked Radio “P25” capability in underground
- Replace obsolete surveillance video systems.
- Upgrade 48 VDC UPS system in Stations
- Replace 40+ year old DTS communication System

# Systems

## Communication Program

- Impacts and Liabilities
  - Communications backbone for Operations
  - Patron experience and information
  - Situational awareness
  - Security
  - Administrative
  - ADA

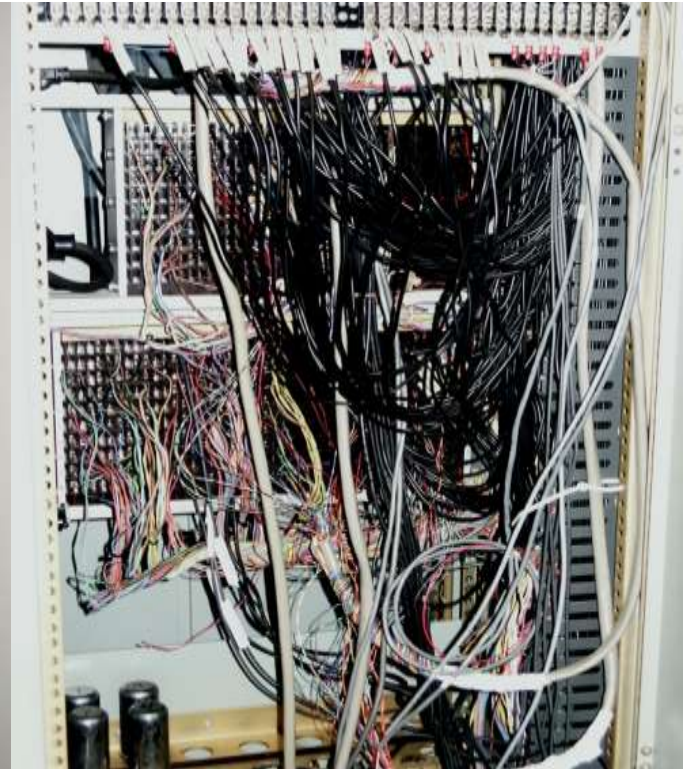
Station PA System



New Optical Network



Legacy Comm System



LASER Intrusion Detection

# Miscellaneous

- Non-Revenue Vehicles Program
- Maintenance Facilities
- Tool Replacement
- Uninterruptible Power Supply Battery Replacement
- Commercial Communications Program



# Summary

- A rehabilitation cycle is upon us
  - Important
  - Long-term
  - Expensive
  - Not doing it is not an option
- Our approach is based on sound, accepted principles/values
- We are developing methodology to manage it
- We have a plan, now we need the funding