Moving your network from reactive to proactive Asset Performance Management for Rail

Steve Hagner, Industry Solution Executive

ABB Enterprise Software

Power and productivity
for a better world™

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ABB inRail

ABB HOME → OFFERINGS → RAILWAY

GLOBAL SITE

Systems

Products

Service

For rolling stock

Traction transformers

Traction converters

Auxiliary Converters and Battery Chargers

Traction motors and generators

Turbochargers

Semiconductors

Surge arresters

Low Voltage products

Cable protections (PMA)

Transformers and reactors (Trasfor)

Asset Optimization and Management

For rail infrastructure

Static Frequency Converters

Power quality - FACTS

DC wayside power solutions - ENVILINE™

Power and Distribution transformers

Transformers and reactors from Trasfor

High Voltage products

Medium Voltage products

Low Voltage products

Cable protections (PMA)

Uninterruptible power supplies (UPS)

Communication for transportation

Power Consulting

Asset Optimization and Management

Protection and control for railway applications

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Connected Asset Lifecycle Management (CALM)
Asset Performance Management
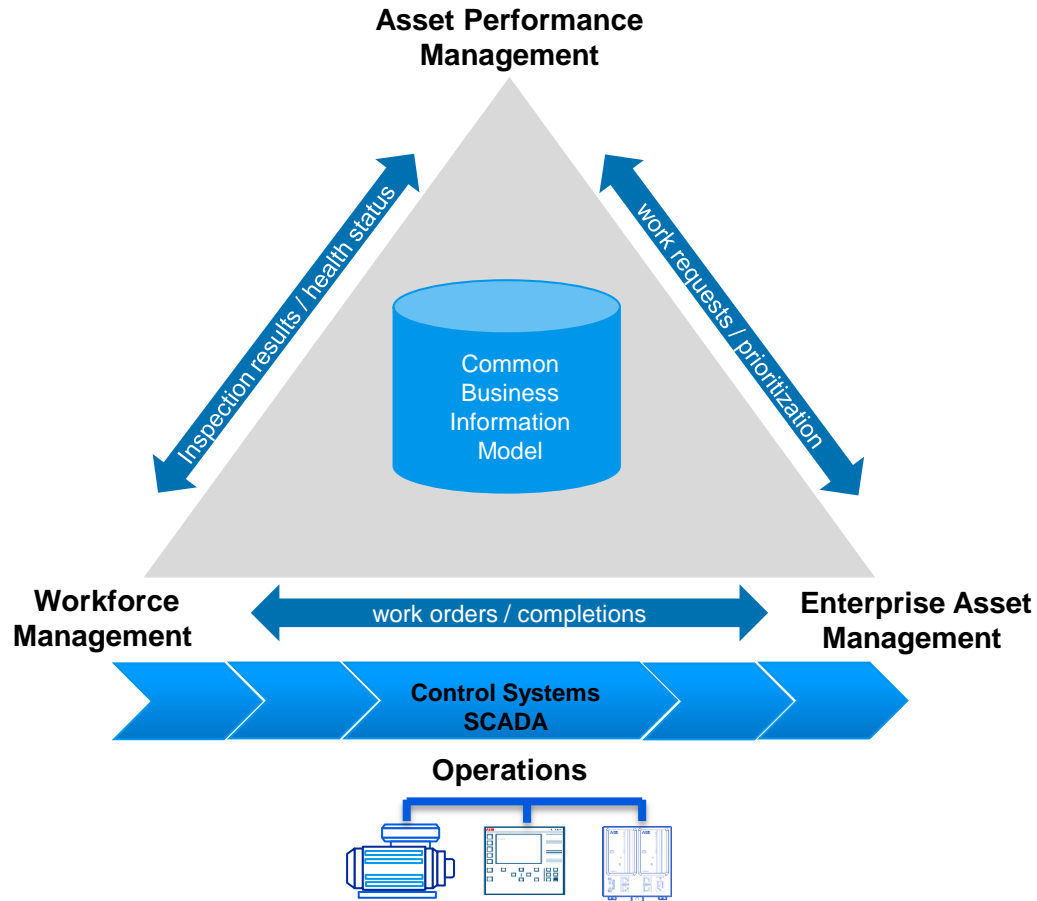
Why do Asset Performance Management?
Decisions

Safety

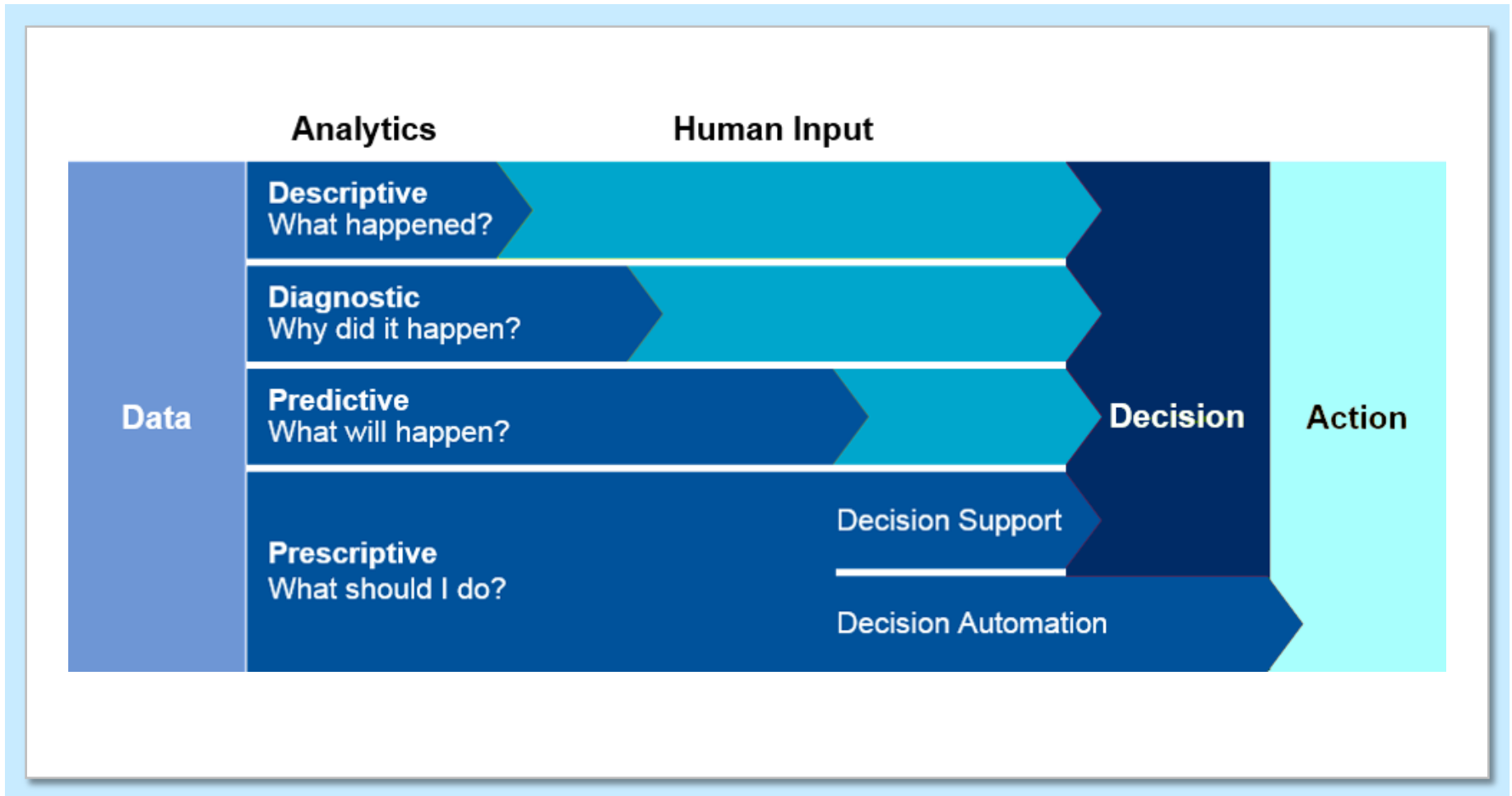Pressure for higher reliability

New & Old Infrastructure

Information challenges

ISO 55000/PAS55

Flat O&M budgets

Changing workforce

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Leveraging the Evolution of Analytics

Source: Gartner (February 2015)

ABB Asset Health Center
Prescriptive analytics for asset performance

1 **Collect**   Unified view of all asset data in proven analytics platform

2 **Prescribe**   Algorithms codify experience to predict and prioritize risk and prescribe actions
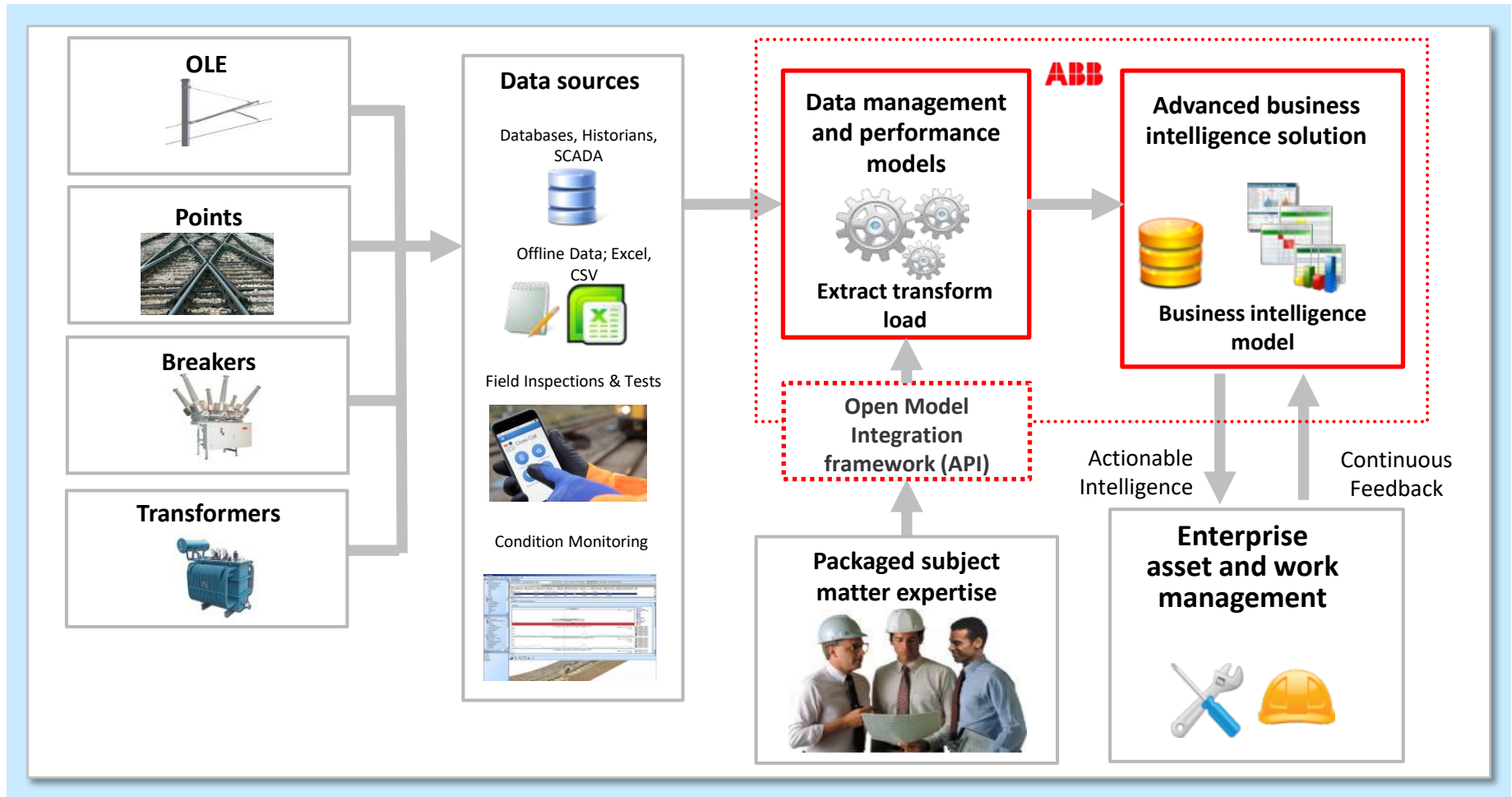
3 **Review**   Industry standard approaches help confirm analysis

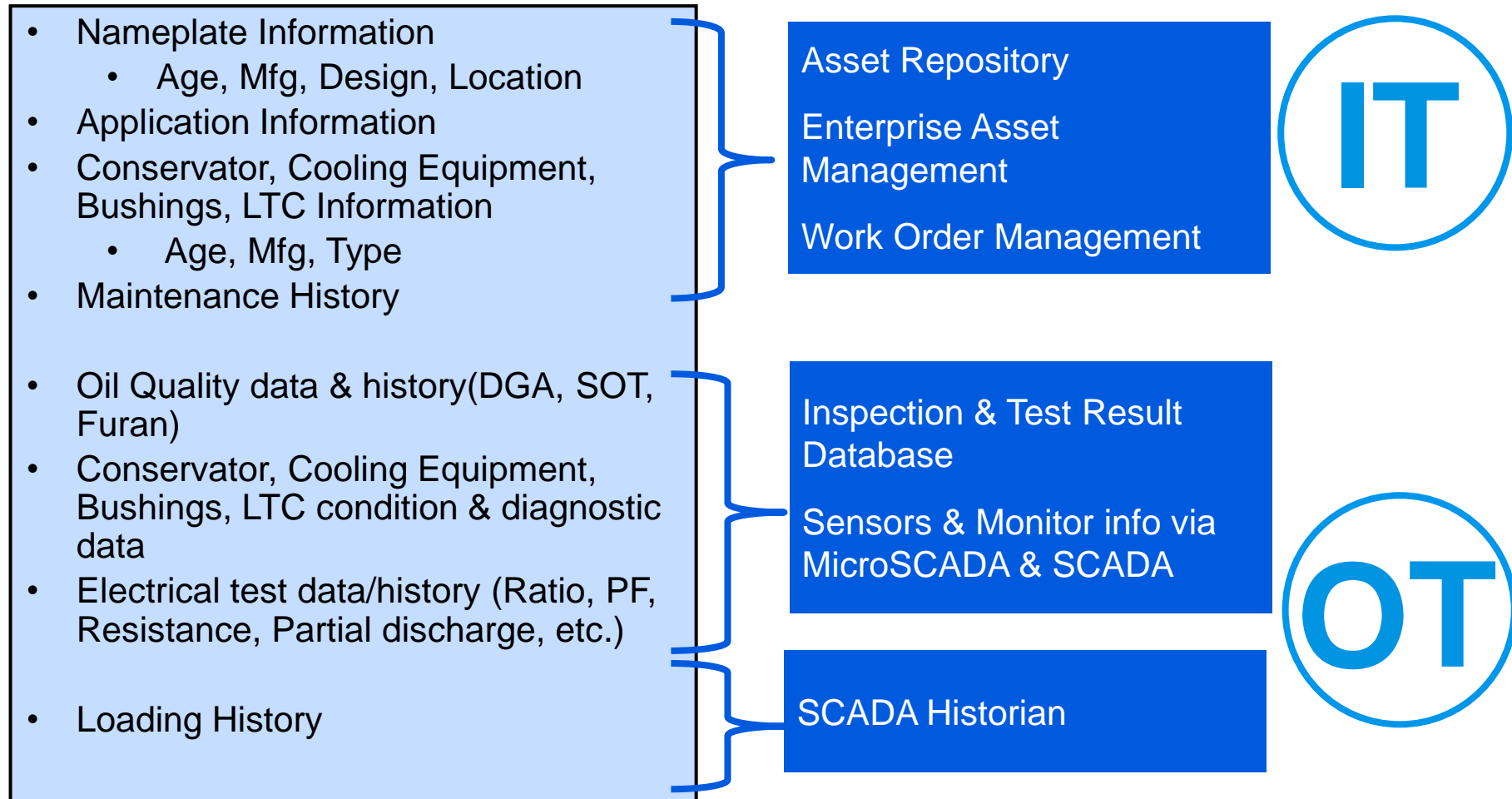**4** **Act**   Holistic asset performance management

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ABB Asset Health Center
Prescriptive Analytics for Rail

OLE

Points

Breakers

Transformers

Data sources

Databases, Historians, SCADA

Offline Data; Excel, CSV

Field Inspections & Tests

Condition Monitoring

Data management and performance models

Extract transform load

Advanced business intelligence solution

Business intelligence model

Open Model Integration framework (API)

Packaged subject matter expertise

Actionable Intelligence

Continuous Feedback

Enterprise asset and work management

Sample Data Sources
Models need both IT & OT Data

Transformers

- Nameplate Information
  - Age, Mfg, Design, Location
- Application Information
- Conservator, Cooling Equipment, Bushings, LTC Information
  - Age, Mfg, Type
- Maintenance History

- Oil Quality data & history(DGA, SOT, Furan)
- Conservator, Cooling Equipment, Bushings, LTC condition & diagnostic data
- Electrical test data/history (Ratio, PF, Resistance, Partial discharge, etc.)

- Loading History

Asset Repository

Enterprise Asset Management

Work Order Management

IT

Inspection & Test Result Database

Sensors & Monitor info via MicroSCADA & SCADA

OT

SCADA Historian

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Models from ABB, Partners & Customers
Leverage Subject-Matter Experts

Asset Performance Models for Rail Infrastructure

- Transformers
- Circuit Breakers & Switchgear
- Backup Batteries (substations, crossings)

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- Capacitor Banks
- Conductors
- Cables

KINECTRICS

- Switches (Points)
- Overhead Line Equipment
- Crossings

ABB & Customer

- Overhead Line Equipment (Lines & Structures)
- Third Rail

MERMEC

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Basis for an Overhead Line Equipment (OLE) Model
Weightings and Data will vary

Factors Predicting OLE Issues

- Measurement Train Score (contact force, wire geometry, wire wear)

- Wire Inspection Score (insulator issues, termination issues, broken droppers)

- Structure Inspection Score (rust, pulley lubrication, foundation issues)

- Late Maintenance (missed or delayed scheduled maintenance)

- Failure History (Likelihood of failure higher if recent failures)

| Failure History |
| Dewirement Score |
| Fault Score |
| Trip Score |
| Late Maintenance Score |
| Measurement Train Score |
| Data Gaps Score |
| Worst Span Score |
| Worst Structure Score |
| Structure Inspection Score |
| Wire Inspection Score |
| Caternary Score |
| Contact Score |
| Droppers Score |
| Insulators Score |
| Jumpers Score |
| Terminations |

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Basis for a Rail Switch Model
Weightings and Data will vary depending on Customer

Factors Predicting Switch Failure

- Sensor Data (abnormally slow movement, motor drawing too much current, unusual waveform)

- Issues identified in Inspections (lubrication, cable issues, tests, rust…)

- Maintenance History (missed or delayed scheduled maintenance)

- Failure History (Likelihood of failure higher if recent failures)

- Other (Usage & Age)

Failure History
Months since last failure
Inspection Assessment
Inspection: Cables
Inspection: Facing Point Lock
Inspection: Lubrication
Inspection: Missing Pieces
Inspection: Rust
Maintenance History
Months FPL Overdue
Months Inspection Overdue
Months Switch Insulation Overdue
Other
Age Score
Number of Operations
Sensor Data
LR Slow Switches
Over Avg Amps Counter
RL Slow Switches

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ABB Asset Health Center
Performance Models

Data sources	Data management and performance models	Algorithms Determine:

Data sources

Databases, Historians, SCADA

Offline Data; Excel, CSV

Field Inspections & Tests

Condition Monitoring

Data management and performance models

Extract transform load

Open Model Integration framework (API)

Packaged subject matter expertise

Algorithms Determine:

1. Health Score
2. Asset Importance
3. Recommended Actions
4. Messages, Errors, Warnings
5. Action Prioritisation
6. Replacement Prioritisation

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Rail Asset Health
Identify at-risk Switches via Analytics
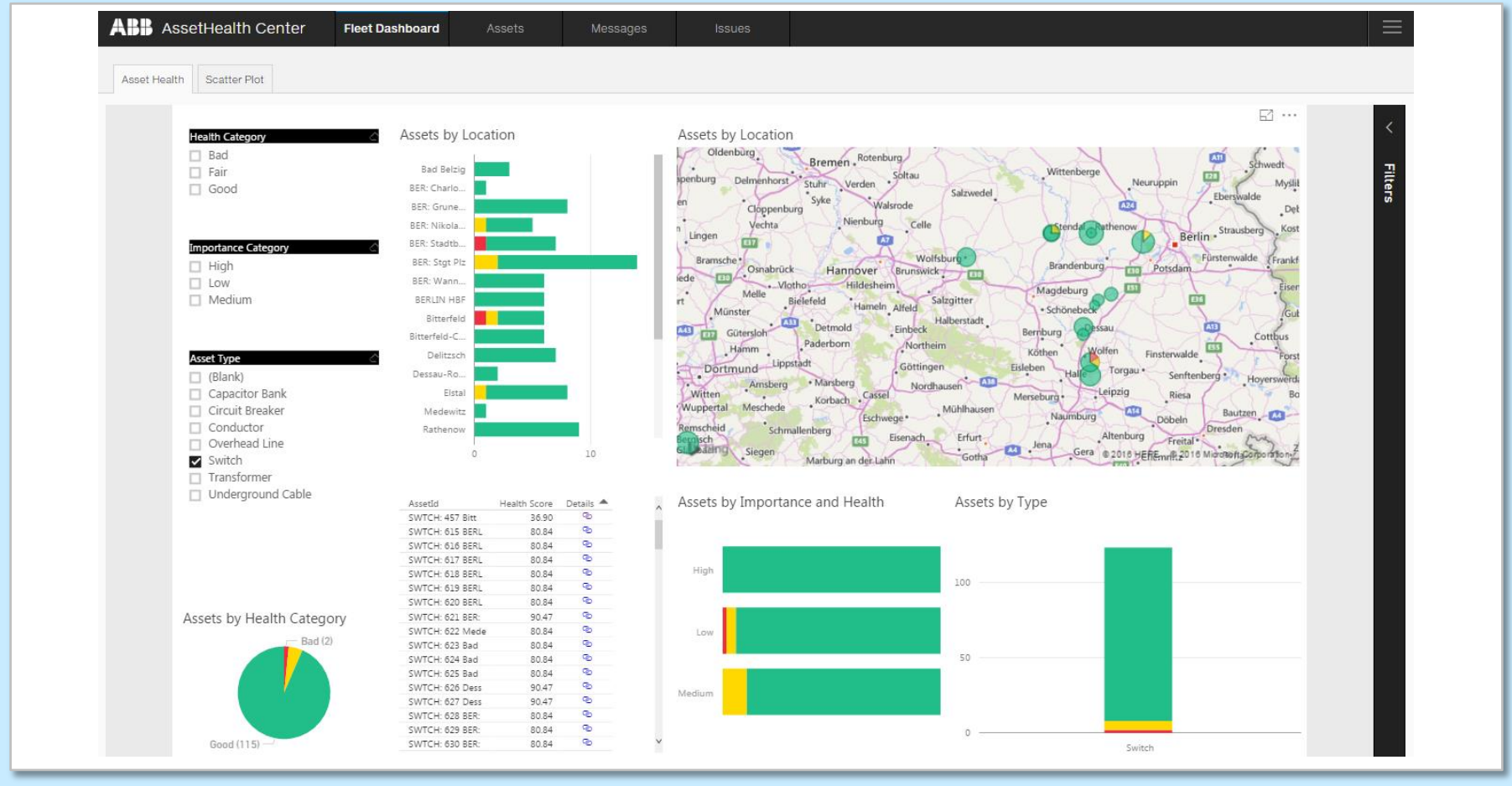
Detail View of one Rail Switch

Now a Work Request has been Created in Ellipse
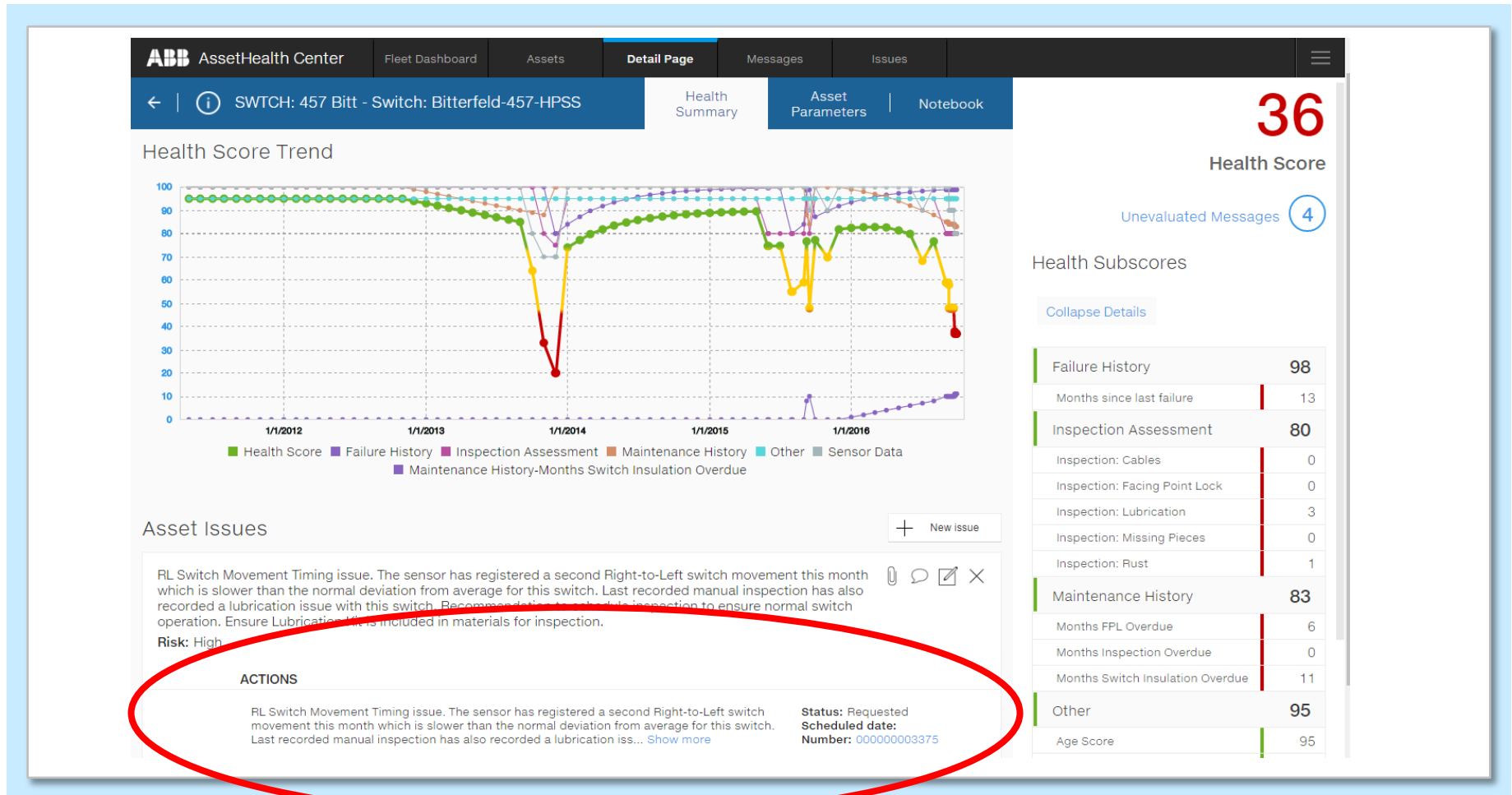
Work Request Appears in the Enterprise Asset Management System

Adoption of Predictive Maintenance
Time for Phases Vary

Implement

Build Trust

Optimize

Maintenance Activities

Time

- Savings
- Predictive
- Reactive
- Time Based

Maintenance Activities

Time

- Extra
- Savings
- Predictive
- Reactive
- Time Based
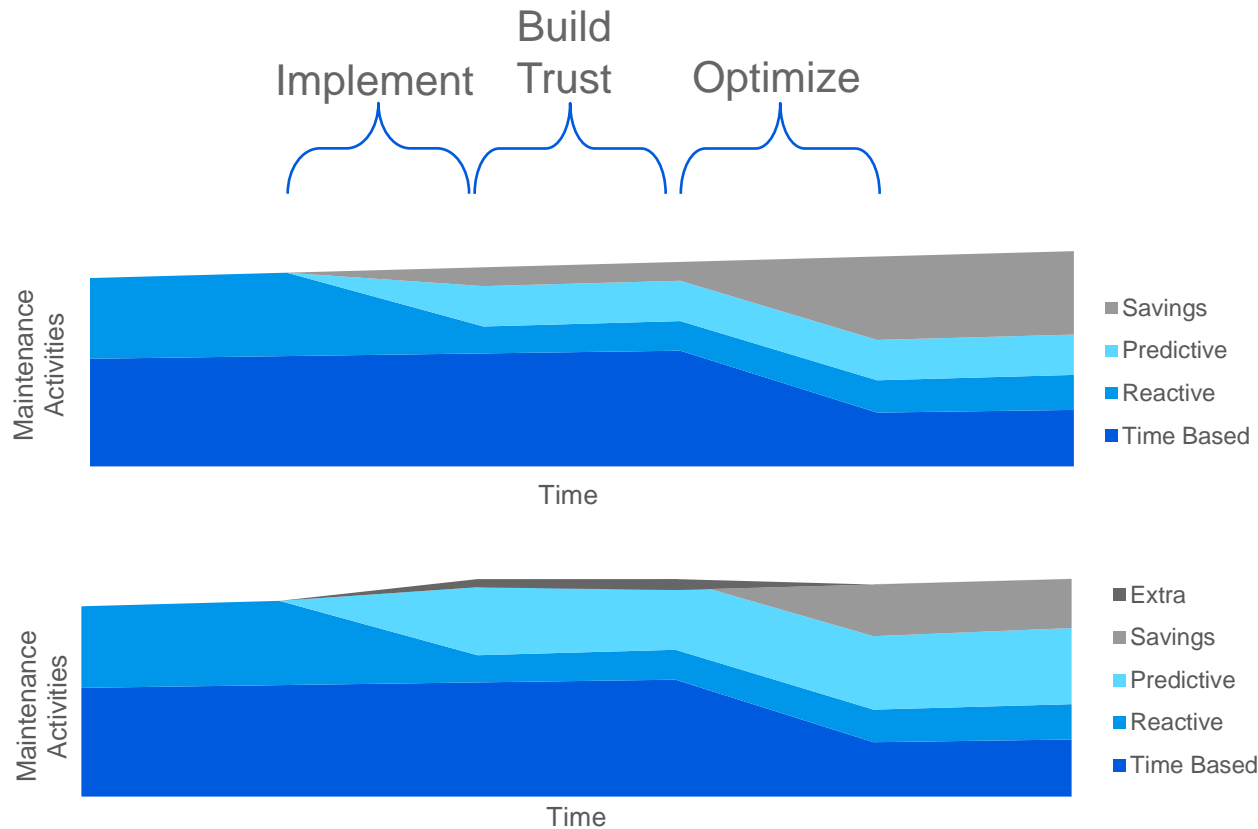
Keys to Adoption

- Executive Champion

- Start with a Business Case

- Data specialist helpful

- In-house skills or Easy-to-Use Solutions

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A Harte Hanks Company

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What We've Learned

1. Start with a Business case….but start!

2. Combine "Intelligent Rail" with Inspections and Maintenance History (IT/OT)

3. Consolidate Asset Types in one system

4. Act on the Results: Document Issues, Generate Work Orders, Prioritize Maintenance & Replacement

   • Linkage to Work Management

   • Linkage to Investment Planning

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Rail & Transport : References across the globe…

AC Transit	Australian Railtrack Corporation	Network Rail	Niagara Frontier Transportation Authority
BNSF Railway	Brisbane City Council	NSW Department of Commerce	Orange County Transportation Authority
Central Ohio Transit Authority	City North Infrastructure	Public Transport Authority of Western Australia	QR National
Corrective Services NSW	County Fire Authority Victoria		
Department of Justice Victoria	Victoria Department of Sustainability & Environment	RailCorp	San Diego MTS
Fort Worth Transportation Authority	GILLIG	State Transit Authority	Sydney Ferries
Great North Eastern Railway	Indianapolis Public Transit	Transit Authority of River City	Valley Metro
London Underground	Long Beach Transit	VIA Metropolitan Transit	VicRoads
		West Central Road & Rail	Yarra Trams

ABB is the #1 EAM provider for Rail in Australia, the world's 5th largest rail system in the world with 40,000 km of tracks