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# Railway Predictive Maintenance Course: Sensor Data, Alert Rules and Maintenance Planning

27 June – 1 July 2027  
Muscat





## Railway Predictive Maintenance Course: Sensor Data, Alert Rules and Maintenance Planning

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### Programme Summary

Railway predictive maintenance is the subject of this one-week training course for rail infrastructure asset managers, maintenance heads and data leaders, ending in a predictive maintenance business case for one track or signalling asset group. Rail assets are inspected on fixed cycles, so faults found late close lines while healthy assets are visited too often. The programme moves from principles, through diagnosis of sensor and inspection data, to design of alert rules and maintenance plans, then to application on one asset group. Mars Training Centre UK delivers this railway predictive maintenance programme for infrastructure owners and operators.

### The Business Case

Predictive models only pay back where a warning arrives early enough to change a maintenance decision. Leaders who know which assets fail, what data precedes the failure and how much lead time the workforce needs can place sensors and models where they matter, and stop funding alerts nobody acts on.

- Unplanned Track and Signalling Failures: Fall as alerts give maintenance planners time to act before service is affected.
- Inspection Visits per Asset: Become better targeted as condition data replaces fixed cycles.
- Possession Utilisation: Improves as predicted work is bundled into fewer track access windows.

### Principles and Evidence Base

- ISO 55000: The asset management standard frames the link between asset condition, value and maintenance decisions in Sessions 1 and 4.
- RAMS reliability, availability, maintainability and safety: The discipline sets the failure and availability measures used to judge any model in Sessions 2 and 3.
- Remaining useful life estimation: The method used in surveys of railway infrastructure shows how condition data becomes a forecast of failure, and it shapes the alert rules built in Session 3.

### Intended Participants

- Asset managers who decide maintenance strategy for track, points and signalling equipment.
- Maintenance heads who plan inspection, repair and track access.
- Data and digital leaders who own sensor feeds and analytics for infrastructure.
- Reliability engineers who must judge whether a model is dependable enough to act on.

The programme serves railway infrastructure managers, metro operators, freight networks and rail engineering contractors.



## Learning Outcomes

1. Participants will be able to evaluate which track and signalling assets justify predictive maintenance.
2. Participants will be able to diagnose weaknesses in sensor, inspection and failure data.
3. Participants will be able to construct alert rules with a stated lead time and false alarm tolerance.
4. Participants will be able to prioritise predicted work against available possessions and crews.
5. Participants will be able to justify a rollout decision to a steering group using evidence.
6. Participants will be able to design a predictive maintenance business case for one asset group.

## Programme Structure

### Day 1: Railway Predictive Maintenance Principles and Asset Failure

Which rail assets fail in ways that data can warn of?

- Asset Failure Mode Inventory
- ISO 55000 Asset Value Framework
- Condition-Based Maintenance Concepts
- Failure Lead Time Concept
- Sensor and Inspection Data Source Map

### Day 2: Diagnosing Sensor Data, Failure Records and Model Limits

How good is the data, and what can a model learn from it?

- Track Geometry Data Review
- Signalling Fault Log Analysis
- Labelled Failure Data Gap Check
- RAMS Availability Measure Review
- Anomaly Detection Output Reading

### Day 3: Designing Alert Rules and Remaining Life Forecasts

When does a warning justify a work order?

- Alert Threshold and Lead Time Grid
- Remaining Useful Life Forecast Reading
- False Alarm and Missed Failure Trade-Off
- Model Validation Scorecard
- Alert-to-Work-Order Flow

### Day 4: Designing Maintenance Plans and Rollout Decisions

How are predictions turned into planned work and funded investment?



- Possession and Crew Loading Plan
- Spares and Lead Time Review
- Sensor Placement Cost Comparison
- Rollout Stage Gate Criteria
- Data Ownership and Model Review Roles

## Day 5: Applying Railway Predictive Maintenance to One Asset Group

Is the business case ready to put before the steering group?

- Applying the Session 1 Failure Inventory to the Chosen Group
- Testing the Session 2 Data Findings against Real Records
- Checking the Session 3 Alert Grid for Gaps
- Rehearsing the Session 4 Rollout Briefing
- Completing the Predictive Maintenance Business Case

## Methodology

The programme uses a data workshop method built on anonymised inspection records, sensor extracts and fault logs. Participants work in small groups on a realistic asset group, test alert rules against past failures and receive feedback from peers and the facilitator on each work product.

- Suggested activity: Reading a fault log to find the failures that earlier data would have flagged.
- Suggested activity: Setting an alert threshold and counting the false alarms it would have produced.
- Suggested activity: Loading a month of predicted work into a limited set of track possessions.

## Capstone Output

Each participant completes a predictive maintenance business case for one track or signalling asset group. It holds a failure mode summary, a data readiness review, an alert rule set, a maintenance loading plan and a rollout briefing outline. It is used at work to decide where to place sensors and models and to brief the steering group.

## Frequently Asked Questions

### Is railway predictive maintenance suitable for asset managers who are not data specialists?

Yes. Railway predictive maintenance starts from asset failure and assumes responsibility for maintenance decisions, not skill in building models.



## **Which references does railway predictive maintenance rest on?**

Railway predictive maintenance rests on ISO 55000, the RAMS discipline and remaining useful life estimation.

## **How is the business case from railway predictive maintenance used at work?**

You use the predictive maintenance business case to choose assets for monitoring, set alert rules and brief the steering group.

## **How does railway predictive maintenance differ from a programme on general data analytics?**

Railway predictive maintenance centres on track and signalling failure, alert timing and possession planning, while general data analytics centres on methods applied across any business data.