Decision Making
Life Cycle Cost Tool in ADIF
Track Maintenance or Track Renewal/Replacement?

Roberto Muela Gutiérrez
Background

- What is asset management?
  - Asset Management is about achieving an appropriate balance of asset cost, risk and performance to meet organisational objectives and deliver value from the assets to an organisation and to its stakeholders

- ISO 55.000 series of documents
  - represent a global consensus on what Asset Management is and what it can do to increase the value generated by all organisations

- Different start points in Asset Management in each IM, why?
  - Historic reasons
  - Best technical knowledge
  - Major concentration of resources
Background: ISO 55.000 principles

- **Fundamentals or Basics**, as:
  - Value, Alignment, Leadership and Assurance
- **The Treatment of Risk**
  - For railway infrastructure organisations, decisions and plans should be robust against uncertainties in assumptions and hazards or other events that may occur.
  - Risk management should provide an effective mechanism for identifying threats to Asset Management objectives, for assessing their impact and for identifying appropriate mitigation measures
- **Definition Scope Asset Management System**, is a critically important early step to alignment with ISO 55001 and successful Asset Management as a whole.
Background: ISO 55.000 principles

- **The ISO Artefacts**, the existence of the following key artefacts within an organisation is a specific and definitive requirement of ISO 55001:
  - Asset Management Policy
  - Strategic Asset Management Plan or The Strategic Asset Management Plan (SAMP)
  - Asset Management Plan(s)

- **Decision Making Criteria** is a recurring theme in ISO 55001. It should consider the business context, stakeholder requirements and the organizational and Asset Management objectives to assure decisions on Asset Management plans and asset interventions.

The strength of Adif in Asset Management is in Decision Making Criteria
Background: Asset Management Framework

Asset Management Framework

Stakeholders & Context

Organisational Objectives

Asset Management Objectives

Network Objectives

Route Objectives

Asset Management Policy

Leadership & Commitment

Strategic Asset Management Plan

Asset Management Plans

Implementation of Asset Management Plans

Asset Management System

Asset Management Enablers

Asset Portfolio

Execution of Work

Route Delivery Plans

Route Asset Plans

Asset Strategy

Operation

Operational Strategy

Route Operational Plans

Timetable & Access Planning

Network Operation

Performance Evaluation

Improvement
What are we doing in Adif?

First steps

- Characterization of Railway Network Elements with Key Indicators allowing to set the proper time when we have to decide between Renewal/Replacement or Maintenance

- Where exactly do we invest the money when we focus on Asset Renewal Policy?
What are we doing in Adif?

Spanish Railway Network

- High Speed Network (In blue, 1435 mm gauge)
  - ≈3200 km (in double track)
- Conventional Network (in red, 1668 mm gauge)
  - ≈15000 km (track, not line)
- Narrow Gauge Network (in green, 1000 mm gauge)
  - ≈1300 km (track, not line)
What are we doing in Adif?
Developing a Tool for helping decision making
What are we looking for?
Basics Life Cycle Cost Tool

- **Economic Efficiency in Assets Management during the whole Life Cycle Cost**
  - We have characterized the whole network with KPIs measuring the proper time to stop maintenance activities and therefore to start renewal activities

- **Relationship between Service Level and Economic Efficiency**
  - The investment priority results are from a combination of Service Level (SL) willing to render an economic efficiency during the whole Life Cycle Cost

- **Global View of Network Status**
  - We have all the KPI aggregated so that we can predict future scenarios of Net state based on different hypothesis of investments during these years
What are we looking for?
Basics Life Cycle Cost Tool

- **Homogenization Criteria for selecting Renewal activities**
  - We have homogenous criteria applied to any part of the network, wherever area related to the decision. Until nowadays, this issue was not possible

- **Renewal and Maintenance Policy & Common Strategy Setting**
  - It allows Direction to fix them up and to maintain them as fixed information in the definition of Renewal Plans, so that we can make sure that every Renewal fulfills the fixed requirements for the Direction Team
Which ones are the Network critical assets? Track

- We have began by developing the new Asset Management Tool for the Conventional Line (1,668 mm)
  - Higher needs of renewal than High Speed Lines
  - High Speed Net, young enough to have renewal needs
  - Greater complex due to Network heterogeneity
    - Physical: due to different Network elements
    - Asset degradation status

Route Section of 200 meters

Track km. in Conventional Network

75,000 sections of 200 meters

15,000
How do we prioritize Maintenance in Track?

Track key indicator: Risk Level

- Prioritization in maintenance activities face how to eliminate detected failures previously found in Track Condition Analysis: We use a key Indicator denominated Risk Level (RL), to quantify:
  - The Risk of reducing Service Level (implementing Temporary Speed Restrictions) when detected failures have been not eliminated.
  - The greater or lesser impact of reducing such a service level by section

- The KPI Risk Level (RL) is calculated, for every basic section of 200 m. as follows:

  The greater the RISK LEVEL value is: the higher priority in maintenance activities (defined on every basic section)
How do we prioritize Investment in Track?

Track Key indicator: Residual Useful Life (RUL)

- The Residual Useful Life measures:
  - The level of Track maintainability (Related to the efficiency in maintenance operations)
  - The likelihood to implement a Temporary Speed Restriction (TSR) if we do not work in a given section

- The Replacement Policy is determined by the setting of thresholds in the following KPI: RL & RUL (values can be modified by the user)

- The set-up of a Replacement Policy is equal to the setting of the following target, every basic section of 200 meters should have:
  - A Level of Risk LOWER (RL) than the Level of Risk threshold
  - A Remaining Useful Life (RUL) BIGGER than the RSL threshold

<table>
<thead>
<tr>
<th>REPLACEMENT POLICY</th>
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<tbody>
<tr>
<td>&amp; RL &amp;</td>
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<td>5.00 &amp;</td>
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<tr>
<td>RL * &amp;</td>
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Track Maintenance or Replacement?

Decision making Matrix

Decision making for maintenance activities & renewal policy is determined by Risk Level (RL), and Residual Useful Life (RUL), that is calculated for every basic section.

<table>
<thead>
<tr>
<th>Residual Useful Life (RUL)</th>
<th>Risk Level (RL)</th>
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<tbody>
<tr>
<td></td>
<td>HIGH &gt;5</td>
<td>LOW&lt;5</td>
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<tr>
<td>HIGH &gt;3</td>
<td>Short-term</td>
<td>Short-term Maintenance activities: Level 1</td>
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<td></td>
<td>Maintenance activities: 1-2-3</td>
<td>Medium-term Maintenance activities: Level 2-3</td>
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<tr>
<td>LOW &lt;3</td>
<td>Short-term</td>
<td>Short-term Maintenance activities: Level 1</td>
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<td></td>
<td>Renewal</td>
<td>Medium-term Maintenance activities: 2-3</td>
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<td></td>
<td></td>
<td>Long-term: Renewal</td>
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Short- term: <1 year
Medium-term: 1-3 year
Long-term: >3 year
What kind of results do we get?

A. Global view & Prioritized Renewal Plans

![Graph showing Residual useful life (RUL) years and Risk Level (RL) 0-10 for all network situation.](image-url)
What kind of results do we get?

B. Whole Finances Needed to replacement of assets

- Recast Directive (DIRECTIVE 2012/34/EU establishing a single European railway area)
  - IMs shall develop and maintain a register of their assets and the assets they are responsible for managing which would be used to assess the financing needed to repair or replace them.
  - Member States shall ensure that a contractual agreement with IMs includes user-oriented performance targets:
    - (a) train performance, such as in terms of line speed and reliability, and customer satisfaction,
    - (b) network capacity,
    - (c) asset management,
    - (d) activity volumes,
    - (e) safety levels, and environmental protection
Conclusion

Adopting an asset management system in the railway means improving the maintenance and replacement decision making of the assets in order to achieve:

- Transparency
- Operational, Economic and Social Efficiency
- Homogeneity
Thanks

Roberto Muela Gutiérrez
Asset Management Deputy Director
Adif
rmuela@adif.es