Anticipate and prioritise maintenance & renewals
(business cases for track & bridges)
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Objective of maintenance & renewals policy

- Find the good balance between: Costs – Performances – Risks

- Industrial decision-makers issues:
  - How to switch from corrective maintenance & renewals policy to predictive maintenance & renewals policy?
  - How to measure the long term outcomes of my today’s maintenance & renewals decisions?
  - How to share my budget & resources (workforce, machinery) on my infrastructure segmentation?
Railway Infrastructure Asset Management

Strategic planning – 3 – 30 years

Tactical prioritising – 0 – 3 years

Operations: walkdowns, maintenance & renewals

Anticipate and prioritise M&R

Simulate M&R policy on the long term

Know the state of the infrastructure & act in consequence

Check the actions, inventory your assets
Business case 1: anticipate the M&R of track system

- An asset manager of a railway line wants to anticipate the evolution of his infrastructure following different maintenance & renewals scenarios.

- Budget constraints can be liable to cash issues but also to the industrial capacity (workforce, machinery, etc.).

- Line’s parameters are:
  - 55 km of single track
  - Full-track renewals set to 1.4 M€/km (CAPEX)
  - Maintenance laws planned (OPEX):
    - Rail renewal every 15 years
    - Tamping every 5 years
    - Grinding every 5 years then every 4 years

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Renewals – CAPEX</th>
<th>Walkdowns &amp; maintenance – OPEX</th>
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</thead>
<tbody>
<tr>
<td>Scenario 0</td>
<td>Without constraint</td>
<td>Without constraint</td>
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<tr>
<td>Scenario 1</td>
<td>Renewals need annually smoothed (in average 4.3 M€/year)</td>
<td>Without constraint</td>
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<tr>
<td>Scenario 2</td>
<td>Annual budget limited but allowing to maintain the current network consistency (in average 3.6 M€/year)</td>
<td>Without constraint</td>
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<tr>
<td>Scenario 3</td>
<td>Annual budget strongly restricted (in average 3.1 M€/year)</td>
<td>Without constraint</td>
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</tbody>
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Scenario 0: Without any budget constraint on maintenance & renewals
Scenario 1: Maintenance free & renewals need smoothed
Scenario 2: Renewals budget allowing to maintain the network at its current consistency
Scenario 2: Renewals budget allowing to maintain the network at its current consistency

Annual budget spent (CAPEX+OPEX) compared to missing cumulated budget
Scenario 3: Strong budget restriction on renewals
Unavailability risk measurement

Scenario 0: No annual budget constraint

Scenario 3: Strong budget restriction on renewals
Business case 2: prioritise the M&R of structures

- M&R prioritising method based on infrastructure risks assessment (risk-based maintenance)
- Prioritising founded by Failure Mode, Effects and Criticality Analysis (FMECA – ISO 31000)
- The prioritising should be connected to the human and technical resources availability (industrial capacity)
### Danger | Défaut | Cause
--- | --- | ---
Loss of pedestrian safety | Decreased layer thickness of steel | Steel corrosion, loss of efficiency of the rustproof painting layer

### Danger | Défaut | Cause
--- | --- | ---
Yielding by loss of mechanical properties | Cracks, spalls, rusted reinforcement rebars | Corrosion of the reinforcement rebars

### Danger | Défaut | Cause
--- | --- | ---
Loss of drainage capacity | Clogging | Sedimentation
Define an optimised action plan

Danger index ➔ M&R actions

Criticality index ➔ prioritising
- Evaluate the need in resources (workforce and machinery) of the optimised maintenance and renewals plan founded on FMECA
- Take into account constraints on resources (location, availability, training time, etc.)
Conclusion

- Solutions compliant with asset management main guidelines (PAS 55, ISO 55000, IUR’s recommendations on asset management application for railway infrastructures)

- Deployments under progress in several infrastructure managers worldwide, peculiarly in Europe

- Controlling tools for industrial decision-makers generating efficiency gains at the management level in addition to technical and technological innovation

Thank you for your attention

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