SAFER-LC next steps: Lab tests and field implementations

Josep Maria Salanova Grau (CERTH)
## Testing environments

- **Simulation:** laboratory simulation focused on driver behavior
- **Controlled environment:** prototype systems running in close-to-reality situations
- **Real-world field tests**

### Simulation

- DLR Driving Simulator
- SNCF Driving Simulator
- VTT Driving Simulator
- RWTH – mock-up LC field + rail vehicle
- CEREMA Rouen test site for monitoring and remote maintenance
- VTT Additional warning light system at front of the locomotive
- DLR mobile traffic surveillance system
- TRAINOSE + CERTH mobile communications testing
- INTADER level crossings

### Field
### Implementation

<table>
<thead>
<tr>
<th>Environment</th>
<th>Implementation</th>
<th>Execution</th>
<th>Responsible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car simulator</td>
<td>September 2018 - ongoing</td>
<td>First test period January 2019</td>
<td>DLR</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Second test period June 2019</td>
<td></td>
</tr>
<tr>
<td>Driving simulator</td>
<td>To be defined (about 4 months)</td>
<td>May/June 2019</td>
<td>SNCF</td>
</tr>
<tr>
<td>Two simulation environments: Junavaro data simulator &amp; Road traffic simulator</td>
<td>September 2018 – To be defined</td>
<td>To be defined</td>
<td>VTT</td>
</tr>
<tr>
<td>LC mock-up installed at Aachen test sit</td>
<td>January 2019</td>
<td>January 2019</td>
<td>RWTH + CEREMA + IFSTTAR</td>
</tr>
<tr>
<td>Rouen test site for monitoring and remote maintenance</td>
<td>Test site ready Validation ongoing</td>
<td>December 2018</td>
<td>CEREMA + NTNU NTNU</td>
</tr>
<tr>
<td>Additional warning light system at front of the locomotive at a real rail environment</td>
<td>September 2019</td>
<td>To be defined</td>
<td>VTT</td>
</tr>
<tr>
<td>Mobile traffic surveillance system</td>
<td>Site identification ongoing</td>
<td>To be defined</td>
<td>DLR</td>
</tr>
<tr>
<td>Thessaloniki living lab</td>
<td>March 2018 - ongoing</td>
<td>First test period December 2018</td>
<td>CERTH</td>
</tr>
<tr>
<td>5 level crossings</td>
<td>October 2018 - ongoing</td>
<td>February/March 2019</td>
<td>INTADER</td>
</tr>
</tbody>
</table>

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Tests of LC safety measures in the DLR driving simulator

▲ Measures to enhance train detection:
  ▲ Blinking lights near tracks drawing driver attention (6_22, rank 11)
  ▲ Lights on the train to improve train visibility (6_03, rank. 9)
  ▲ Bright train outside for higher conspicuity (6_25, rank. 56)
  ▲ Noise-producing pavement (5_12, rank 60)
  ▲ Sign look for train (7_53, rank 39)

▲ Type of LC to be applied at:
  ▲ Passive LC

▲ Expected safety effect:
  ▲ enhance the probability that an oncoming train gets detected
  ▲ By different mechanisms (e.g. enhancing the salience of the to-be-detected object; capture attention to the relevant location; impel the driver to do a voluntary visual search in the relevant areas)
Smart detection system

- Data acquisition
- Object detection
- Object tracking
- Object classification
- Scenario detection

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ITS-G5 communication system

- New technology elements
  - CBTC interoperability
  - Harmonized CBTC/ITS-G5
  - Cooperative Perception

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In-vehicle advice about incoming train

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## Overview

<table>
<thead>
<tr>
<th>Responsible partner</th>
<th>Detection of dangerous situations</th>
<th>Increase awareness of the users / infr. operators</th>
<th>Analyze human behavior to the implemented measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEREMA NTNU</td>
<td>Photogrammetry and other sensors (infrastructure status)</td>
<td>Alert to rail infrastructure manager</td>
<td>-</td>
</tr>
<tr>
<td>DLR, SNCF</td>
<td>-</td>
<td>Several measures</td>
<td>Various simulators</td>
</tr>
<tr>
<td>VTT</td>
<td>-</td>
<td>Light on the train ITS-G5 + LTE</td>
<td></td>
</tr>
<tr>
<td>INTADER</td>
<td>Camera-based (obstacles)</td>
<td>Several measures</td>
<td>Cameras recording the LC</td>
</tr>
<tr>
<td>DLR</td>
<td></td>
<td>Several measures</td>
<td></td>
</tr>
<tr>
<td>CEREMA RWTH</td>
<td>Camera-based + V2X (obstacles)</td>
<td>ITS-G5 / V2X (car drivers)</td>
<td>-</td>
</tr>
<tr>
<td>CERTH</td>
<td>GPS – internet (potential collision)</td>
<td>LTE (car drivers)</td>
<td>GPS trajectories + cameras inside the vehicles</td>
</tr>
</tbody>
</table>
Interactive session topics

△ Technical issues - Clarifications about the SAFER-LC technical developments

△ Implementation and operation - Feedback - advice about the proposed measures and implementations

△ Assessment - Data to be collected, analyses to be done

△ Other

△ Exchange of experience, lessons learnt and related projects

△ Interest in receiving updates on project status and outputs
Thank you for your attention

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