The sustainable freight railway: Designing the freight vehicle – track system for higher delivered tonnage with improved availability at reduced cost
General Presentation

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Title: The sustainable freight railway: Designing the freight vehicle – track system for higher delivered tonnage with improved availability at reduced cost

- FP7 EU project under the theme SST.2010.5.2-2
- Total Budget: 9.4 M€
- EC Contribution: 6.6 M€
- Duration: 4 years (started in June 2011)
- Consortium: 29 partners from 13 countries
- Project Web Site: www.sustrail.eu

Aim:
- To improve sustainability & competitiveness of railway freight, taking a whole system approach to vehicle and track degradation to allow freight to run at near line speed, with less impact on the infrastructure
SUSTRAIL provides the approach, structure, and technical content to improve:

- **Sustainability**
  - Capacity to endure with respect to social, economic, and ecological considerations

- **Competitiveness**
  - Ability to provide products and services more effectively and efficiently than competitors

- **Availability**
  - Access to railway freight and passenger traffic with optimal network flow of European railway networks.

This will be achieved by:

- Holistic approach: vehicle + infrastructure
- Short term and medium term solutions
- Demonstration on three real routes (UK, Spain, Bulgaria)
### Key Innovations

**Advanced vehicle dynamics concepts for new wheel profiles**

- Improvements in suspension design responding to the needs of a mixed traffic railway
- Traction and braking systems developments for high speed freight operation
- Novel designs and materials for lightweight high performance freight wagon body vehicles and bogie structures
- A targeted maximum speed of 160km/h and an increased axle load, 25 tons

**Advanced condition based predictive maintenance for critical components of both railway vehicles and track**

- Performance based design principles to move towards zero maintenance ideal for the vehicle/track system
- Novel ground stabilization monitoring techniques to reduce track geometry degradation

**Optimisation of the track system and geometry including switches and crossing**
Sustrail Integrated Approach and Benefits

Integrated Approach

BENEFITS:
- Condition monitoring of both vehicle and infrastructure
- Increasing system reliability (resilient tracks)
- Economic savings: extending the life, durability, safety of railway infrastructures
- Contribution to the European Commission's goal (moving freight from the roads onto rails)
The Project Structure

8 Work Packages divided into 3 main phases

1) Benchmarking and Requirements
2) RTD activities on vehicles and track
3) Demonstration

WP1: Benchmarking
Objective: To determine the 'zero' state, i.e., performance of the current system
- Three mixed passenger-freight routes
- ATER test track

WP2: Duty Requirements
Objective: To determine the current and future requirements of the wider European system.
- Future logistics requirements.
- Track design and vehicle performance requirements.

WP3: The Freight Train of the Future
Objective: To study freight vehicle components and identify low-cost modifications to enable higher capacity.
- Vehicle component design to reduce track impact.
- Freight train monitoring and operation.

WP4: Sustainable Track
Objective: To identify track design parameters that can be modified to reduce impact of freight traffic.
- Performance-based design principles for resilience.
- Intelligent monitoring systems to reduce maintenance.

WP5: Business Case
Objective: Cost benefit analysis of proposed vehicle and track modifications using RAMS and LCC.
- Benefit models and access charging.
- Technical implementation and phasing issues.

WP6: Technology Demonstration
Objective: Demonstration of track and vehicle upgrades.
- Vehicle and track testing at ATER test track.
- Telemetry of upgraded track and vehicle, and routes.
- Performance review.

WP7: Dissemination and Exploitation
Objective: Workshops, conferences, training, guidelines, standards and promotional activities
- SUSTRAIL identity (artwork) and awareness activities.
- Exploitation strategy planning

WP8: Project Coordination
Objective: Administration, legal and financial issues.
- Ensuring clear governance and communication.
- Administration and technical coordination.
### WP1: Benchmarking Common Freight Vehicles

#### Information from 6 partners & 4 countries:

- **Infrastructure managers:**
  - NR (Network Rail, UK); **ADIF** (Administrator of Railway Infrastructures, Spain); NRIC (National railway infrastructure company, Bulgaria)

- **Operator:**
  - **BDZEAD** (Bulgarian State Railways, Bulgaria)

- **Railway authority:**
  - **AFER** (Romanian Railway Authority, Romania)

- **Manufacturer (maintenance):**
  - **SIRV** (CFR SIRV Brasov, Romania)

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#### Table: 1.3.1 Overview of Vehicles in Operation

<table>
<thead>
<tr>
<th>No.</th>
<th>Model / Type</th>
<th>National / European (used by the builder)</th>
<th>UIC Identification marking</th>
<th>Class (UIC classification)</th>
<th>Fabrication Years</th>
<th>Builder (name, country)</th>
<th>Track gauge (mm)</th>
<th>Wheel diameter (mm)</th>
<th>Number of axles</th>
<th>Length over buffers (mm)</th>
<th>Tare weight (tonnes)</th>
<th>Loading capacity (tonnes)</th>
<th>Exploitable capacity (tonnes)</th>
<th>Lifetime (years)</th>
<th>Indicative price (€)</th>
<th>Utilisation / goods moved/year (tonnes*km)</th>
<th>Braking system</th>
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<tbody>
<tr>
<td>ADIF (Administrator of Railway Infrastructures, Spain)</td>
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<tr>
<td>M5</td>
<td>469.000 to 469.175 469.500</td>
<td>22714352086-8 to 110-1 26714352001-8 to 109-9 26714370000-8 41714352055-5 to 065-4 45714352039-5 to 094-0</td>
<td>L - Special flat wagon with separate axles</td>
<td>1995</td>
<td>1668</td>
<td>4</td>
<td>27000</td>
<td>27.7</td>
<td>21.5</td>
<td>Tread brakes / Shoe brakes</td>
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<td>MMB</td>
<td>254.001 to 254.200 254.202 to 254.602</td>
<td>22714765001-1 to 197-1 28714764000-4 to 199-4</td>
<td>S - Special flat wagon with bogies</td>
<td>1977-1978</td>
<td>1668</td>
<td>4</td>
<td>12040</td>
<td>21.8</td>
<td>58.2</td>
<td>Y21-Rse Tread brakes / Shoe brakes</td>
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<td>MMB9</td>
<td>254.701 to 254.740</td>
<td>22714789001-3 to 400-1</td>
<td>S - Special flat wagon with bogies</td>
<td>2002</td>
<td>1668</td>
<td>4</td>
<td>12040</td>
<td>20.4</td>
<td>69.6</td>
<td>Y21-Lse Tread brakes / Shoe brakes</td>
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<tr>
<td>MMOC</td>
<td>550.001 to 550.183</td>
<td>8174541000-4 to 400-1</td>
<td>S - Special flat wagon with bogies</td>
<td>1976-1977</td>
<td>1668</td>
<td>4</td>
<td>19900</td>
<td>24.7</td>
<td>55.3</td>
<td>Y21-Cse Tread brakes / Shoe brakes</td>
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WP1: Test Track Performance Assessment

Tests of the vehicle-track system on the testing track

- Aimed to validate the testing facilities on the test track and investigate other possible tests

Performance benchmark of key vehicle components and infrastructure

- Aimed to develop a benchmark methodology to evaluate both the vehicle and the track performances

AFER Railway Testing Centre Faurei, Romania
Total length 20.2 km, consisting of:

- A large ring - 13.7 km with 6 footbridges and 4 level crossings; maximum speed 200 km/h;
- A small inner ring - 2.2 km with 5 footbridges; maximum speed 60 km/h;

Ordinary open high-sided wagon (UIC 571-2)
Characteristics: four axles, brake platform, Y25 bogies, max. speed – 120 km/h unloaded, 100 km/h loaded
Freight Train of the Future will identify the key areas where recent and imminent developments can lead to:

- Improved running behaviour of railway vehicles resulting in reduced system maintenance and operating costs for vehicle and track.

- Reduced environmental impact and increased sustainability and efficiency.
WP3 The Freight Train of the Future

Approach:

Innovative solutions and designs for both the bogie and the full vehicle, including, where possible, modifications to existing components or sub systems or vehicles

Focused on:

- Running gear – optimized bogie and wheelset design
- Traction and braking – novel or optimized braking system
- Body and bogie structure – lightweight high performance materials
- Condition monitoring – latest technology used to allow less conservative design
  - Condition monitoring of railway axles, to detect cracks in their early stage and prevent crack propagation, raising the safety of freight operation and contributing to reduce maintenance costs for increasing the cost efficiency of the system
  - Energy harvesting
Thank you!

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