The SUSTRAIL Project: an Integrated Approach for an Increased Performance of the Freight Rail System

General Presentation

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Why changing, the EU perspective (White Paper 2011)

Freight transport volumes are expected to grow by 38% by 2030

A modal shift of freights from road to other transport mode (rail and waterborne) of 30% by 2030 is needed

Congestion is becoming unsustainable. Moving freight by road is one of the main causes

Changes are needed, necessary, opportunistic

Source: Eurostat Values in %	2010 Roads	Railways	Inland waterways
EU-27	76.4	17.1	6.5
Germany	64.9	22.2	12.9
Greece	98.0	2.0	-
Spain	95.8	4.2	-
France	82.2	13.5	4.3
Italy	90.4	9.6	0.1
Sweden	60.7	39.3	-
United Kingdom	88.7	11.2	*0.1*

EU27 rail freight forecasts, 2005&2050 market share (TRANSvisions, 2009)

	%tkm 2005	%tkm 2050
%Road	47	40
%Rail	12	18
%Maritime	41	42

Sustrail at a glance

In this scenario, the EU partially funded project Sustrail was launched on June 2011 aiming at *Improving sustainability & competitiveness of railway freight, taking a whole system approach to vehicle and track degradation to allow freight to run at higher speed, with less impact on the infrastructure*

- 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)
- Project Website: www.sustrail.eu

Partnership

Project Coordinator

CONSORZIO TRAIN

Technical Coordinator

NetworkRail

PARTNERS

Infrastructure Managers and Operators

adif

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Industrial Partners

LUCCHINI RS

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The University Of Sheffield.

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Railway Associations

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SUSTRAIL

SUSTRAIL provides the approach, structure and methodology to improve

Sustainability (Pillar I)
- Capacity to endure with respect to social, economic, and environmental considerations

Competitiveness (Pillar II)
- Ability to provide products and services more effectively and efficiently than competitors

Availability (Pillar III)
- Access to railway freight with optimal network flow

of The European railway networks

This will be achieved by:

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

A systemic approach

Novel design materials for lightweight high performance freight vehicles, bogies and brake systems

Improvements in braking and suspension design

Advanced vehicle dynamics, including new wheels profile for a low impact freight vehicle

Optimised of track system design and geometry coupled with low impact vehicle.

Track condition monitoring to reduce track degradation

Demonstration of technological solutions

Investigation of economics impacts LCC and RAMS under the project Pillars of Sustainability, Competitiveness, and Availability

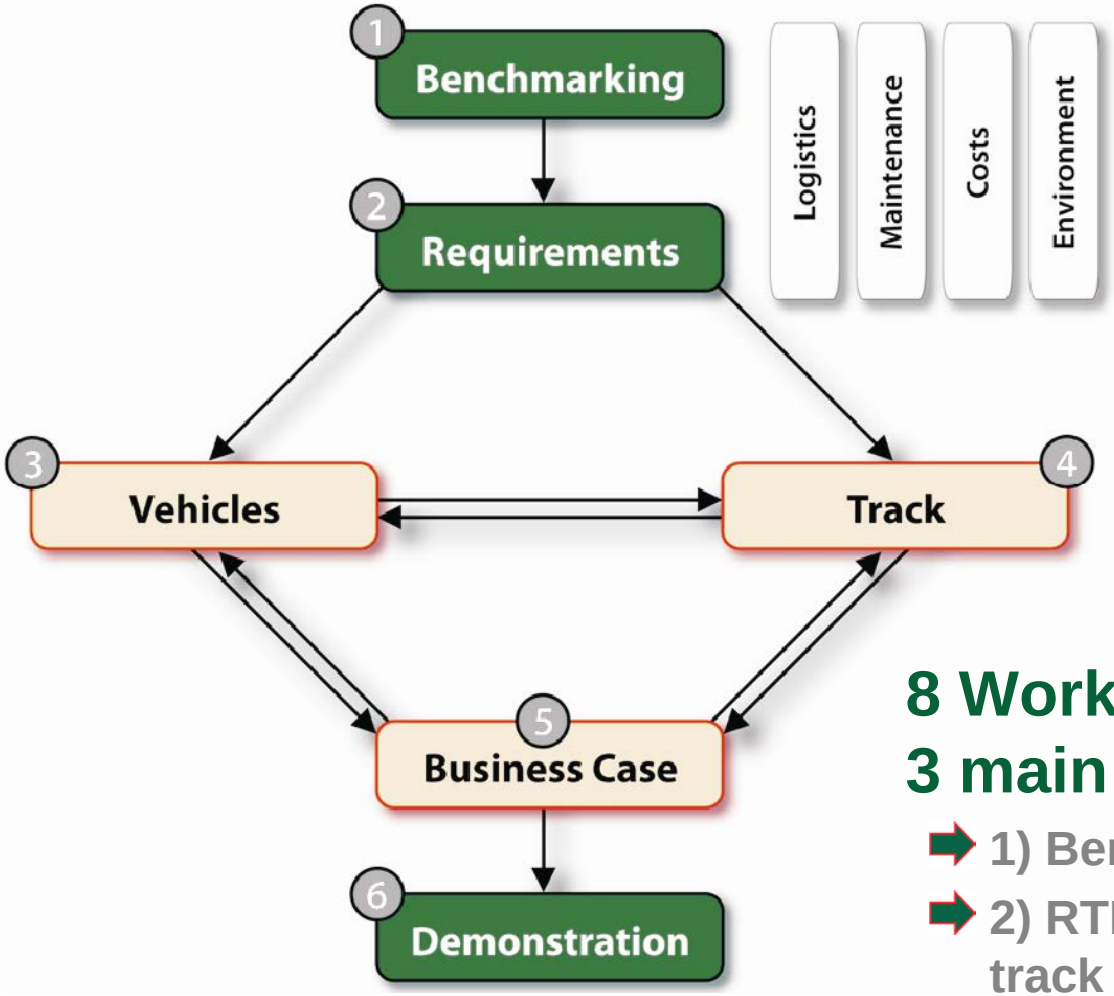
SUSTRAIL

Expected Benefits

The SUSTRAIL approach, based on innovations in both rolling stock and track structures, has impact on both infrastructure and vehicles

- Condition monitoring of to support maintenance activities made within the total system
- Increasing system reliability through the application of performance based design principles for resilient tracks
- Economic savings by extending the life, durability, safety and reliability of railway infrastructures
- Reduction of energy use, resulting in a reduction of greenhouse gas emissions

Project Overview



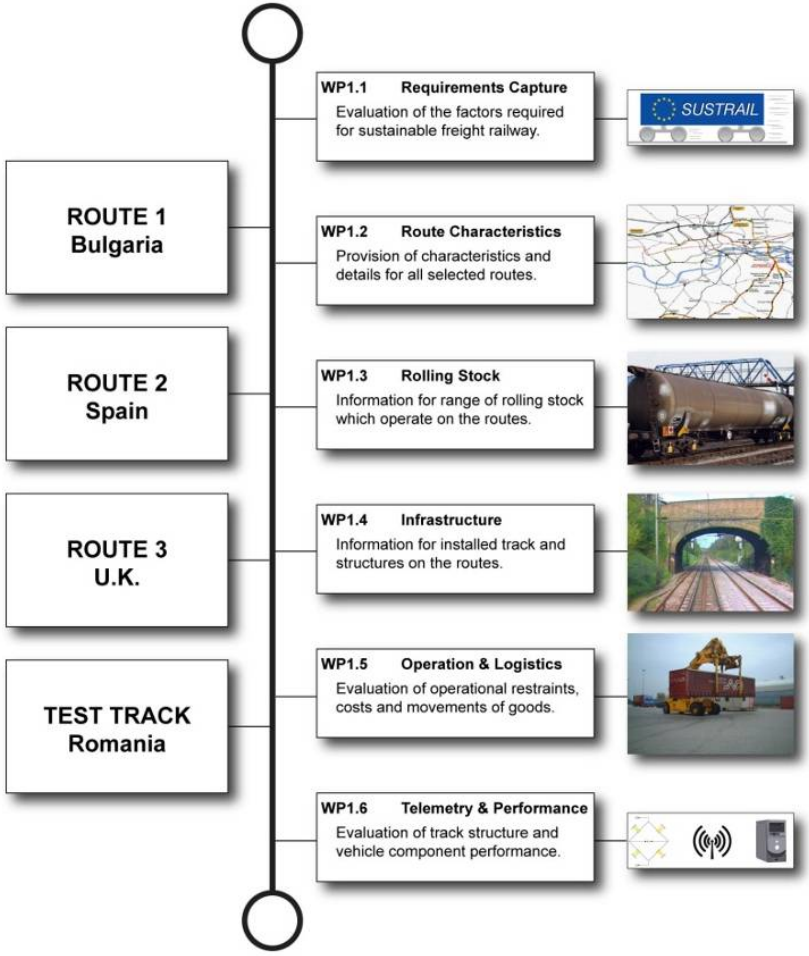
8 Work Packages divided into 3 main phases

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

To established the “zero state” performance of the current freight system in terms of requirements, characteristics, operations and logistics with reference to selected exemplar routes

- 1. Bulgaria: Serbian Border to Turkey
- 2. Spain: Mediterranean Corridor from Barcelona to Valencia
- 3. UK: Felixstowe and Southampton to Warrington

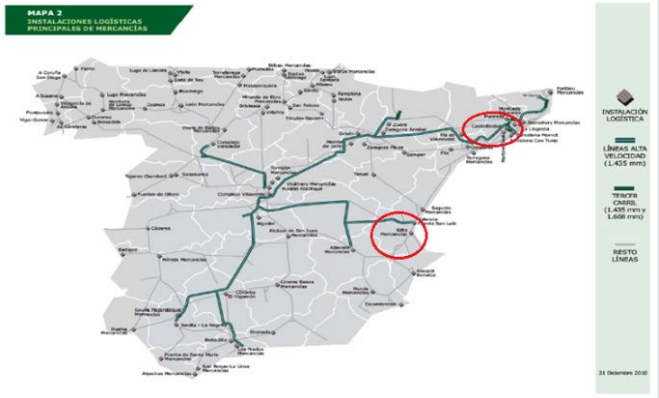
+ the AFER Test Track, Romania



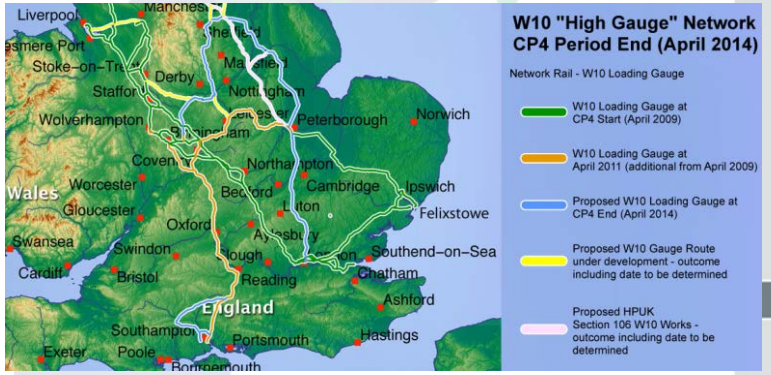
Selected exemplar routes

- 1. Bulgaria: Serbian Border to Turkey
  - Average train length 500m

- 2. Spain: Mediterranean Corridor from Barcelona to Valencia
  - Electrified, double track, mixed



- 3. UK: Felixstowe and Southampton to Warrington
  - slow lines, stops by passenger service



Main findings

- Intermodal flows and use of container flat wagons (R,S) are growing in all 3 cases - support intermodal growth
- Widespread use of Y25 and derivative bogies
- Growth strategies focus on:
  - gauge enhancement
  - ↑ axle load
  - longer trains (750m)
  - investment in terminal facilities
- Differences:
  - Bulgaria experiences high levels of transit traffic (50%) - especially intermodal
  - UK: freight train speeds often significantly below line speed, e.g. 120km/h versus 160km/h
  - Spain: strategy to increase rail mode share from low 4.1%; interoperability is key given gauge issues.

Recommendations and priorities

- Modest increase in freight speed (e.g. 120-140kph UK; 100-120kph ES,BG)
- Optimise axle loads
- Reduction in energy used by rail vehicles
- Improve bogie design to reduce lateral forces

Priority Level	Duty Requirements for Improvement	System
High	1. Modest increase in freight speed (e.g. 120-140kph UK; 100-120kph ES,BG)	whole
	3. Optimise axle load limits (22.5t / 25t / 17-20t)	whole
	7. (20%) reduction in energy used by rail vehicles + Vehicle Green Label	vehicle
	12. Improve bogie design to reduce lateral forces (by 50%)	vehicle
Medium	5. Reduce vertical ride force to match passenger vehicle at equivalent axle load (by suspension improvements)	vehicle
	8. (20%) reduction in unsprung mass of freight vehicle	vehicle
	2. Uniform vertical stiffness (track) - optimise between 50-100 kN/mm	track
	9. Optimise (potentially double) service life of track components	track
	10. Combine components that have a similar service life (harmonise MTBF)	track
	6. Reduced rate of tolerable defects	track
	4. More reliable insulated rail joints (life*5)	track
Low	11. Independent power supply (wagon or train based) - for braking & refrigeration	vehicle
	13. Increased loading space	vehicle

Aims at designing the Sustrail freight vehicle that can led to:

- improved running behavior
- reduced environmental impact and increased sustainability and efficiency

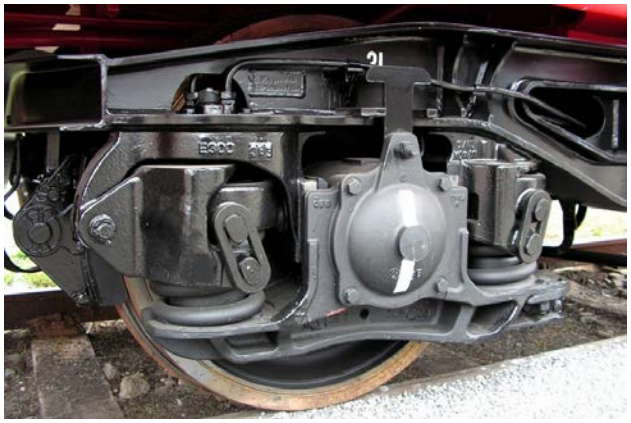
focusing on:

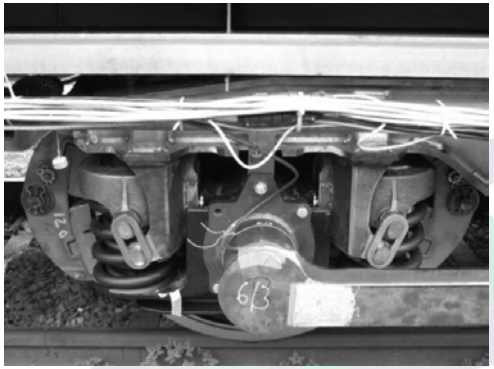
- Running gear – ***optimized Y25 bogie and wheelset design***
- Traction and braking – ***novel or optimized braking system (disc brakes) for noise emission reduction (3db)***
- Body and bogie structure – ***increased capacity & lightweight materials***
- Condition monitoring – ***less conservative design***

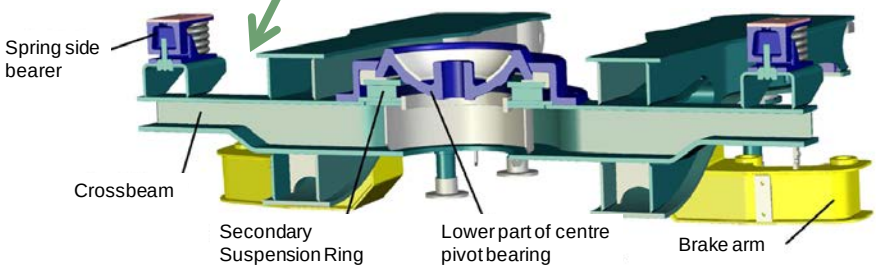
Main highlights - bogie

SUSTRAIL bogie with:

- double lenoir lnks
- steering links
- secondary suspension.



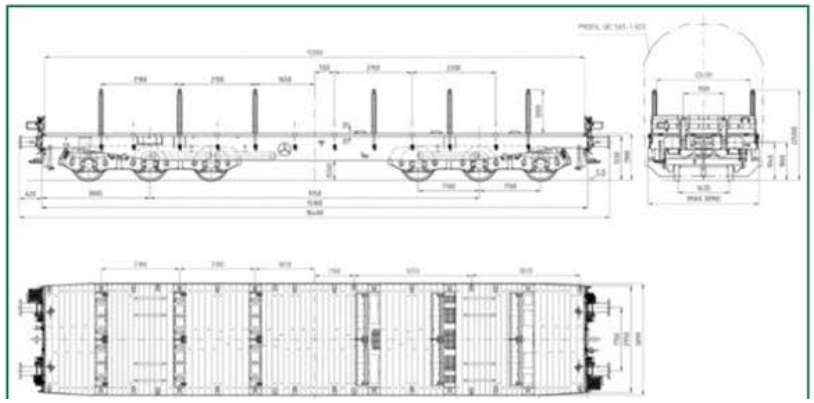


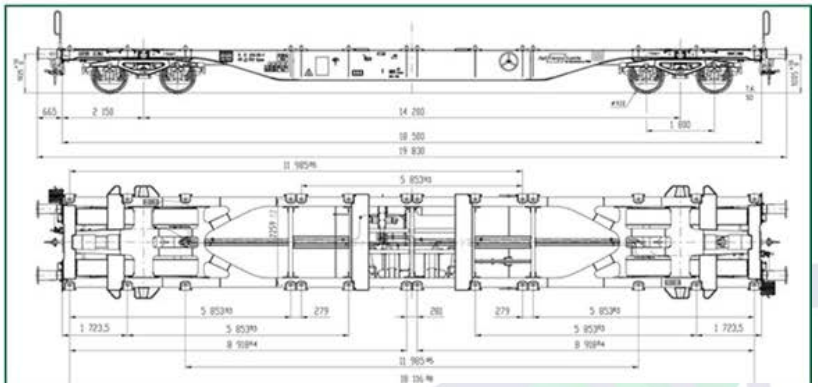


Sustrail freight bogie: realistic, competitive, efficient

Benchmark freight vehicle

➡ Special freight vehicle with bogies (Class S)



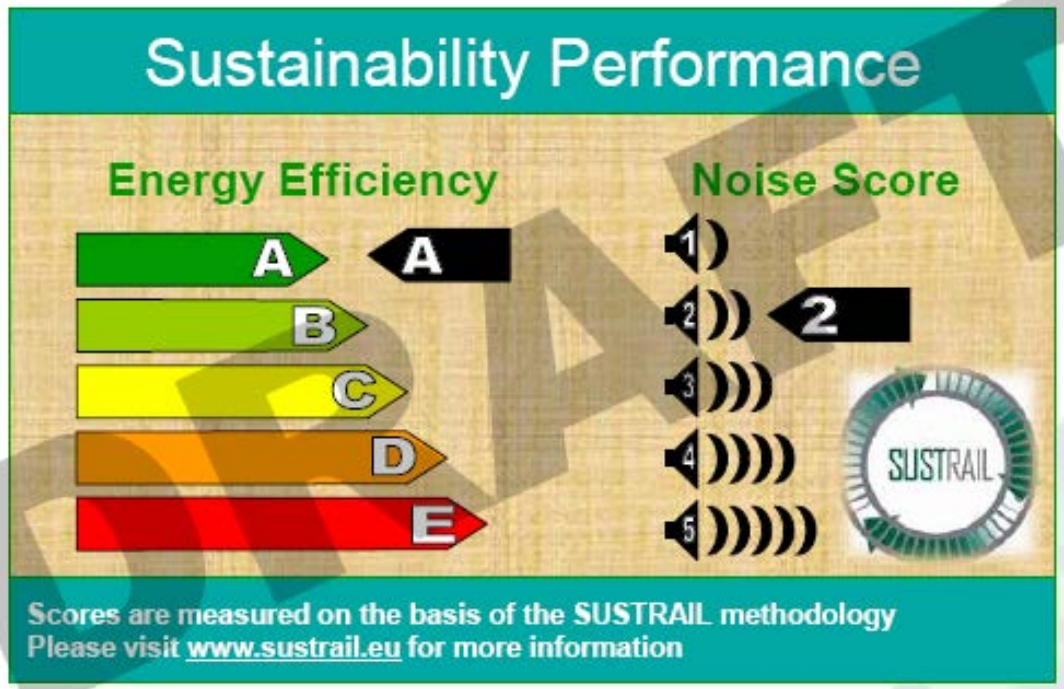


Sustrail freight vehicle:

flexible, multi-functional, sustainable

	How to achieved it?
1	Length optimisation
2	Novel profiles for vehicle structure
3	High strength steels for the wagon frame
4	Side walls (construction options/stanchions)
5	Recycled materials floor (e.g., plastics)
6	Tarpaulin cover
7	Aerodynamic fairings (composite)
8	Integration of monitoring systems

A possible certification of the Sustainability of the Sustrail Vehicle in terms of efficiency and noises, through a Green Label

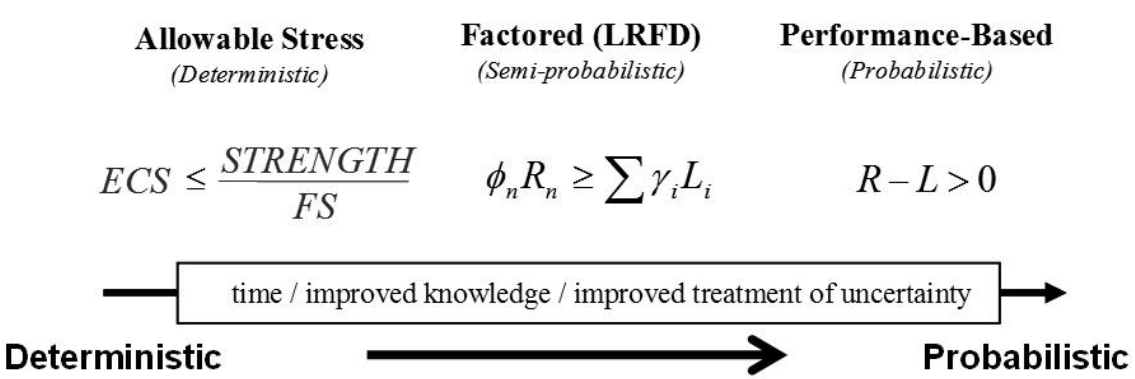


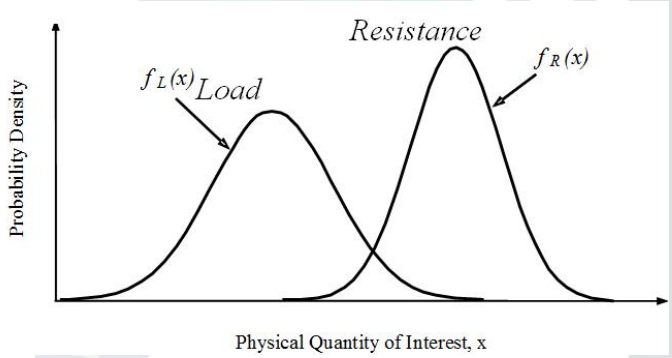
Aims:

- to reduce impact of freight traffic on the infrastructure
- to increase the capacity of track to resist loads from faster freight vehicles

by:

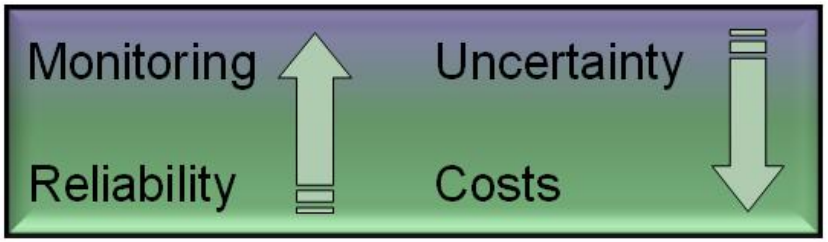
- moving from a deterministic to a performance-based design approach in track design optimization, track maintenance and renewals towards a “zero” maintenance challenge

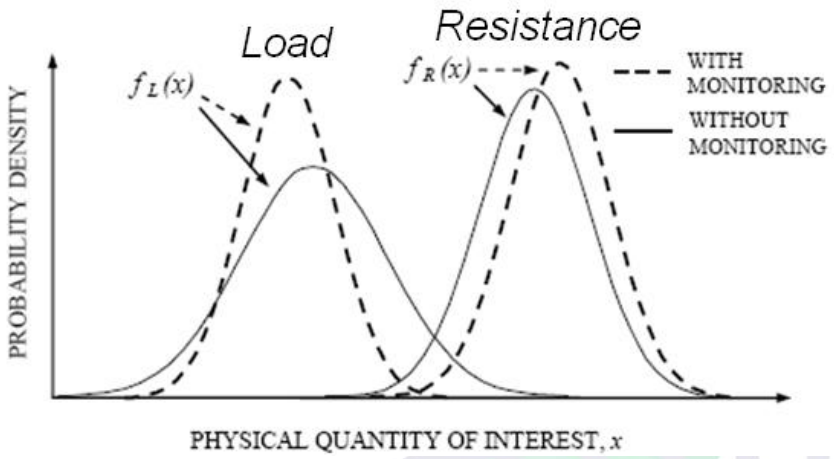




by:

- using intelligent monitoring systems to reduce maintenance





Focusing on

- Supportive ballast and substrate
- Track geometry at critical locations (onto/out of bridges, etc.)
- Switches and crossings

Type of problems Sustrail would like to face and solve

Low Rail Rolling Contact Fatigue & deformation

Rail Squats are a form of Rolling Contact Fatigue

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13 February 2013 Last updated at 17:50

Share

South Yorkshire landslip rail line closed for weeks

Train services between Doncaster, Scunthorpe and Cleethorpes will be suspended for at least eight weeks after a landslip, Network Rail said.

It said an "enormous" spoil heap at Hatfield Colliery at Stainforth, South Yorkshire was "pushing up the track".

The landslip lifted a section of railway track and is still moving.

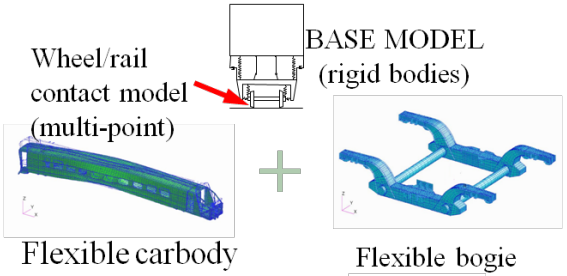
Hatfield Colliery said it was assessing the situation

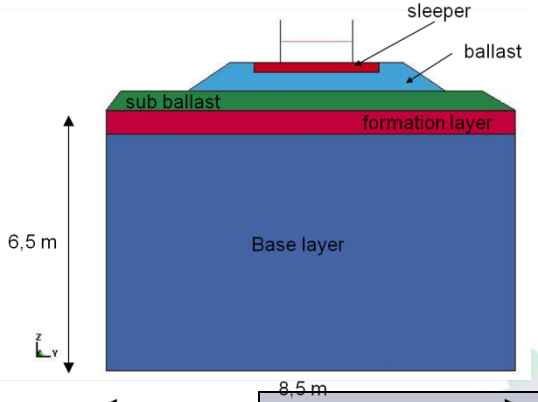
Buses will replace trains between Doncaster and Scunthorpe and an **amended timetable** will run until the heap is stabilised and the track repaired.

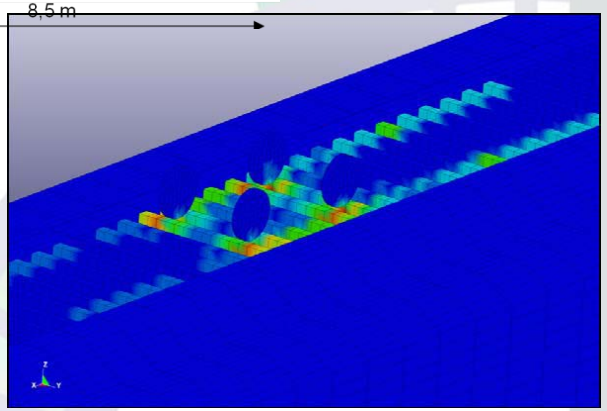
Related Stories

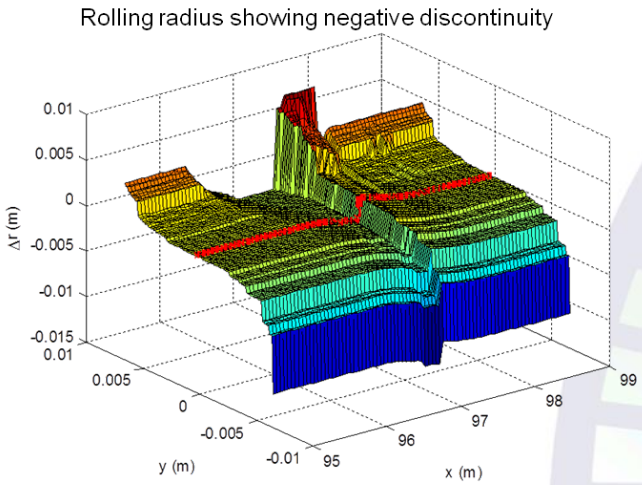
Massive landslip

Simulation works to identify solutions to solve problems



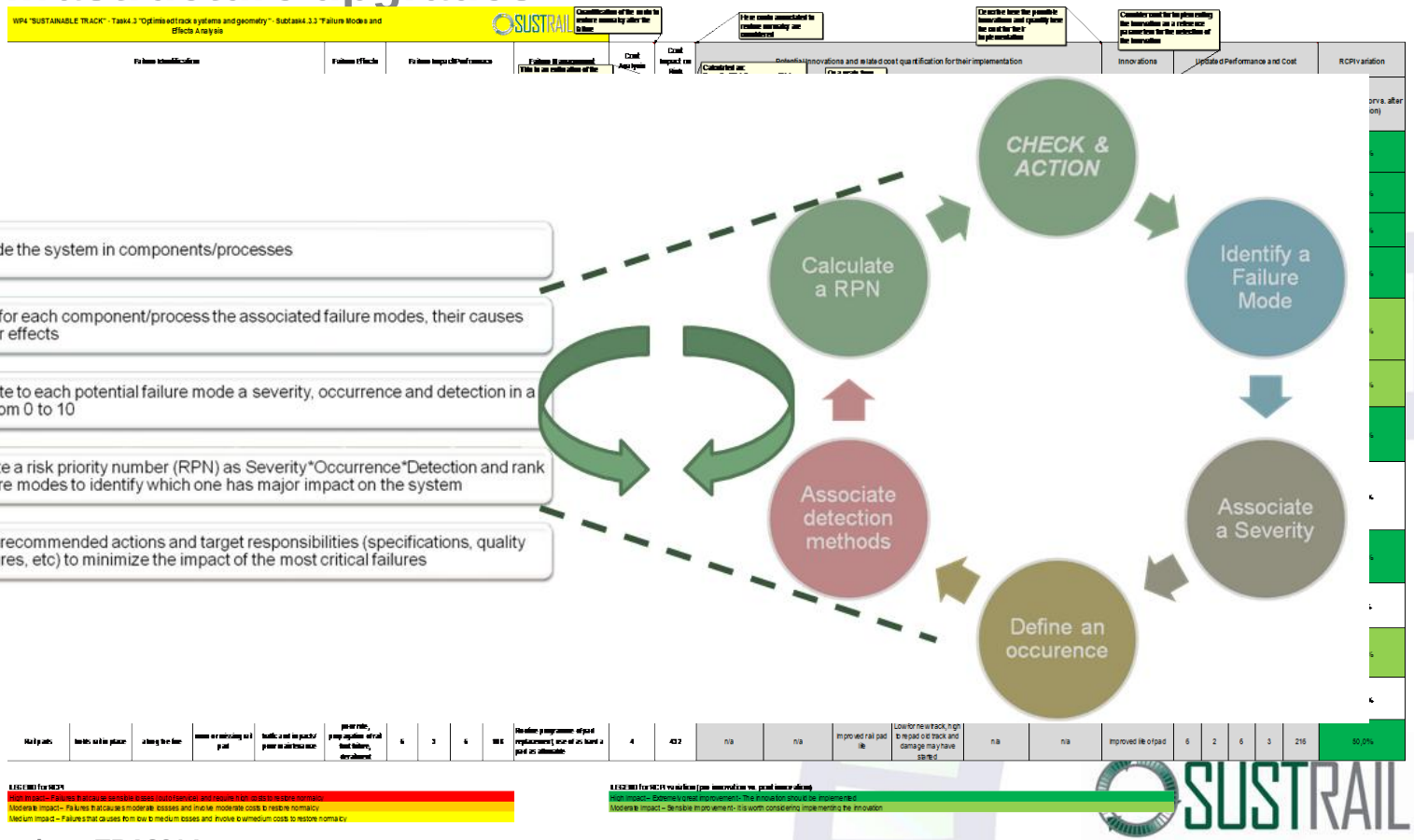






Analysis of main failures and associated solutions

- Including costs assessment and link among failures and infrastructure upgrades

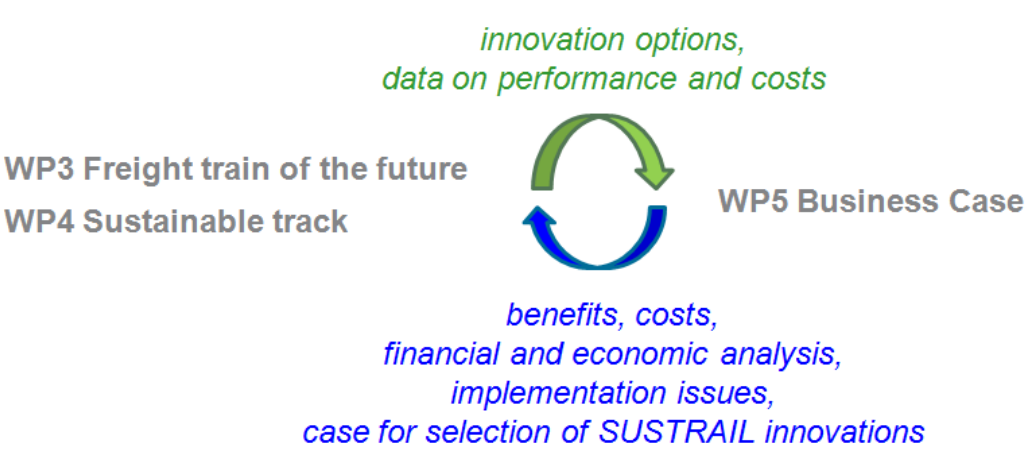


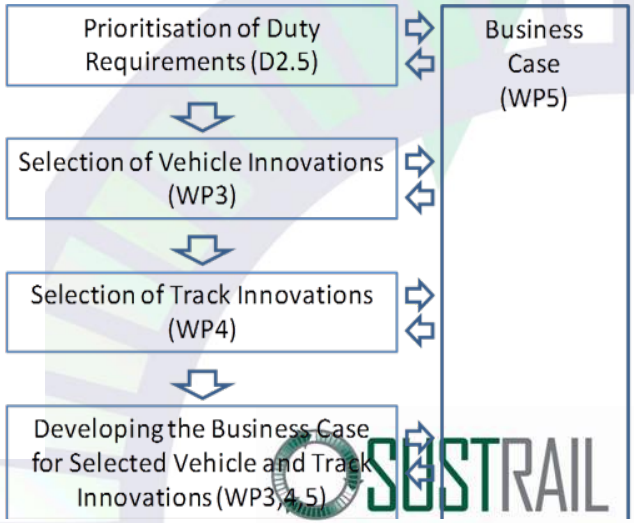
Business Case

Aims at:

- 1) Making the Business Case for innovations in the freight vehicle-track system.
- 2) Making Recommendations for whole-system implementation, including phasing in of novel technologies and strategies

Working as an “iterative filter” when linking to Vehicle and Track innovations based on duty requirements





Scenarios

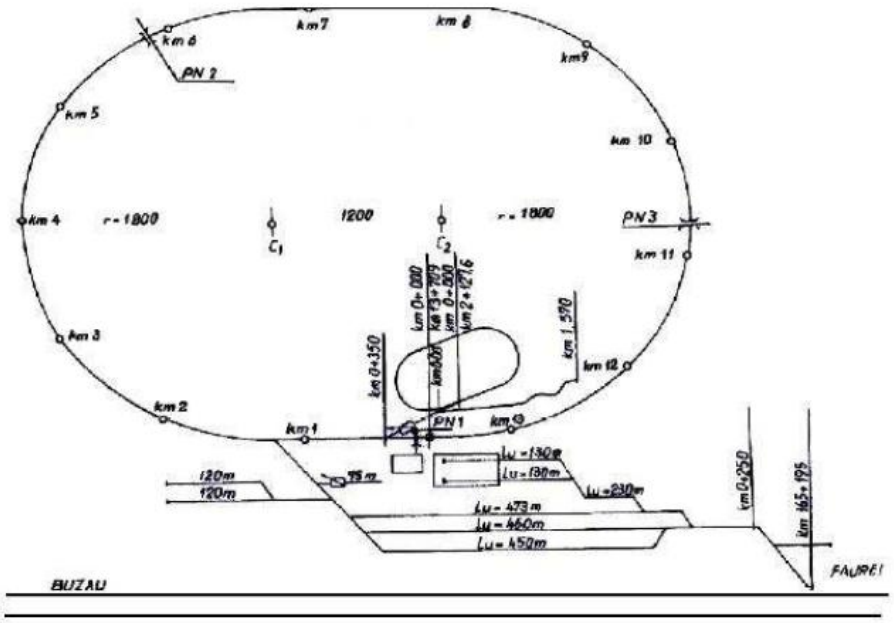
- 6 scenarios foreseen

Scenarios	Baseline vehicle (Y25)	Improved 'Conventional' Vehicle	Futuristic Vehicle
Baseline Track	i	ii	iii
Improved Track	iv	v	vi

- 5 tests of interest:
  - Futuristic Vehicle on Improved Track (vi) versus Baseline (i)
  - Conventional Vehicle on Improved Track (v) versus Baseline (i)
  - Baseline vehicle (Y25) on Improved Track (iv) versus Baseline (i)
  - Futuristic Vehicle on Baseline Track (iii) versus Baseline (i)
  - Conventional Vehicle on Baseline Track (ii) versus Baseline (i)

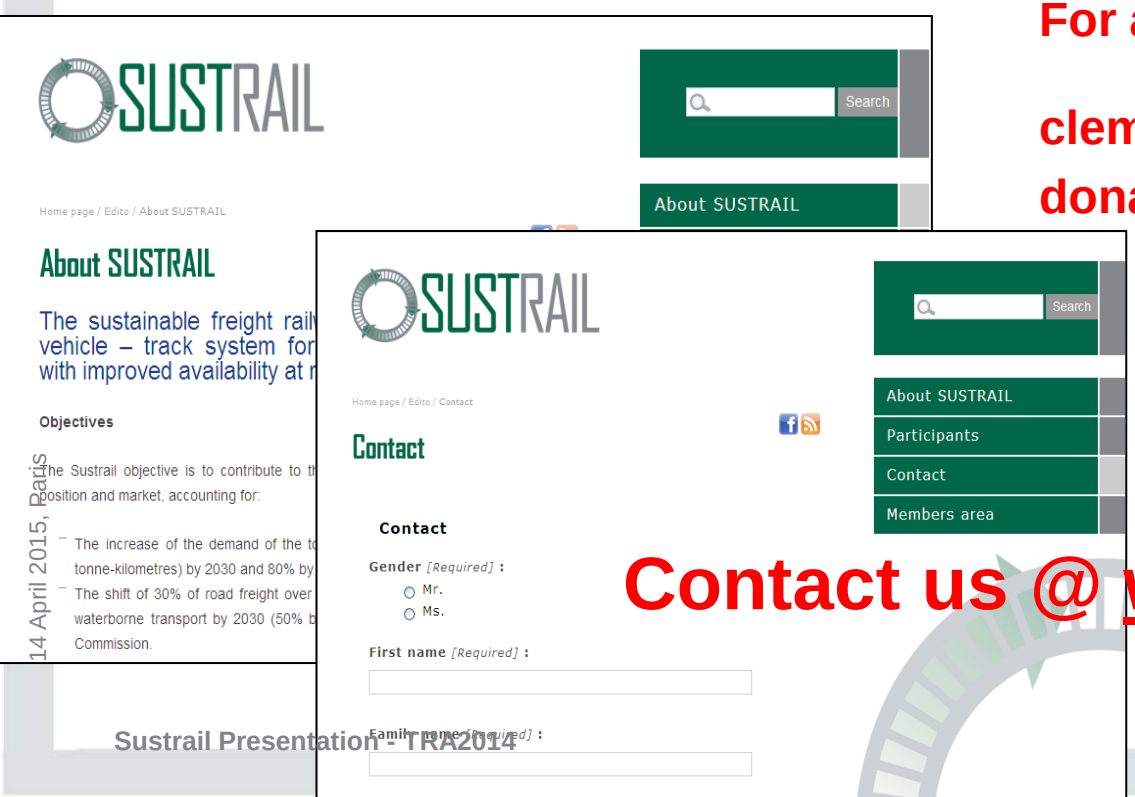
Demonstration of track and vehicle upgrades

- Vehicle and track testing at AFER test track, Faurei, Romania
- Telemetry of upgraded track (exemplar routes and test track) and vehicles
- Performance review and recommendations



Conclusions

SUSTRAIL will run until May 2015 addressing *Sustainability*, *Competitiveness* and *Availability* aspects of European railway networks by means of an integrated approach aimed at innovations impacting on both infrastructure and vehicles



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