The INNOTRACK project concentrated on research issues that contribute to the reduction of rail infrastructure life cycle cost (LCC). The main objective of INNOTRACK has been to reduce the LCC, while improving the reliability, availability, maintainability and safety (RAMS) characteristics. INNOTRACK has been a unique opportunity bringing together rail infrastructure managers (IM) and industry suppliers, the two major players in the rail industry. One of the biggest challenges for railways in Europe is that track costs, the major cost component for infrastructure managers (IMs), have not significantly decreased in the last 30 years. Therefore, the main objective for INNOTRACK is to reduce costs, decrease disturbances and increase availability. In addition to the issues of cost and availability, also noise pollution has become a crucial issue for railway operations.

INNOTRACK has analysed root causes (e.g. failure rates, failure causes) of the current too high cost of track maintenance and renewal. This was done on a European wide basis with individual infrastructure managers (IMs) consulting at a national level and bringing identified problems together at a European Level. The consortium harmonised the nationally identified problems and identified those that are common across Europe. One important conclusion was that most of the identified significant cost drivers and related root causes where indeed problems on a European scale. After drawing together a specification of common European cost drivers, these were integrated into an overall, coherent package of developing measures that together have had as an objective to achieve a 30 % LCC reduction. In addition, these measures were aimed as a major progress in achieving the targets defined in the EC White Paper on Sustainable Transport. The EC White Paper on Sustainable Transport addressed this (September 2002) and set ambitious targets for railway operations. These targets include:
- doubling passenger traffic and tripling freight traffic by 2020;
- improving travel time by 25 % – 50 %;
- reducing life cycle cost by 30 %;
- reducing noise to 69 dB for freight and 83 dB for high speed;
- increasing safety – reduce fatalities by 75 %.
The railway business scenario 2020 also requires that railways capture 15 % of freight and 12 % of passenger market.

The project was structured into small subprojects (SP) that addressed specific areas of the research:

**SP0 - Management and coordination**
The management structure used in INNOTRACK has been a success in the way INNOTRACK could be steered. It has been easy to take decisions and to make necessary changes immediately. The chosen management structure has also made an efficient coordination possible. This has been especially important since INNOTRACK has been organised as a 'matrix' project. It has also been an advantage to have professional management support in INNOTRACK.

**SP1 - Duty, vehicle and track characteristics general model.**
The main usable results from SP1 are the populated databases, the identification of common European problems and their root causes and the assessment of the overall cost reduction. In SP1, the overall cost reduction has been done. This deliverable gives figures of possible cost reduction that can be achieved from INNOTRACK result. It is also a possibility for the IM to prioritise between the results. The national workshops were successful and very useful. For the first time national workshops was carried out with an international perspective. The conclusions of the workshops were also important in that they identified the cost drivers and clarified that the most important cost drivers where international. In fact, the differences between national important cost drivers in different countries where less than expected. This is an important fact and shows that international R&D cooperation is advantageous. In addition, the developed tools and populated databases have been a success.

**SP2 - Track support structure. Track subgrade monitoring and assessment evaluation and superstructure innovations.**
This was the first time a European-wide project in this research area was set up. INNOTRACK has opened the view in this previously very 'national' research area. Different measuring and strengthening methods have for the first time been compared and evaluated. This will provide valuable knowledge for the future. Several results were implemented, evaluated and validated within INNOTRACK such as: reinforcement of a soft embankment area with inclined lime cement columns, improvement of a transition zone using geosynthetics, improvement of a bad drainage zone and test section of corus two layer steel slab track.

**SP3 - Switches and crossings. Predictive models for S&C switch designs standards & LCC analysis.**
In SP3, more basic R&D was needed, since this is an area with a less established tradition of R&D than e.g. SP4. Even if the sub-project for this reason started from a more basic level, implementable results have been provided. Some of these have already been validated in field tests, while others are in on-going validation.

A real step forward has been taken on how to reduce dynamic forces in switches both for lateral and vertical forces. This has been done by identifying and optimising track gauge and stiffness. A new optimised geometry of crossings has been produced. This geometry has also been verified by simulations and in demonstrations. A new generation of hydraulic actuators were developed and demonstrated in the project. Both solutions are mounted in hollow sleepers, which are standardised and being developed to an EC-norm by the CEN. An open standard for Ethernet-based communication between signalling plant and switch has been developed. New algorithms for switch monitoring have been developed and tested.

**SP4 - Rails and welding. Methodology for duty conditions supported track form rail steel material grinding methodology.**
Track trials to study weld degradation that were planned in Germany, United Kingdom and the Netherlands were not possible to carry out within the INNOTRACK project mainly due to lack of track availability. They have partly been replaced by on-going track tests at other locations.

Several guidelines that represent a significant step forward have been brought forward. Example of such are:
- rail grade selection criteria based on a significant amount of high-quality field measurements and knowledge about the dominant damage mechanisms;
- better understanding and predictive models for the degradation of joints and key defects such as squats;
- a first step towards the harmonisation and of laboratory tests for rail steel grades and a significant step forward in being able to compare these with in-track behaviour;
- comparative evaluation of grinding strategies and target profiles with concluding recommendations that also consider logistics and strategic planning aspects.

**SP5 - Logserv. Best logistics practices, new logistics processes.**
INNOTRACK has made an important step forward in the broad field of logistics. This is especially important since the 'Directive 2004/17/EC' of the European Parliament and the Council of 31 March 2004 'Coordinating the procurement procedures of entities operating in the water, energy, transport and postal services sectors' have to be met. Not the least, INNOTRACK has identified several areas of potential improvement on a European scale through in-depth interviews with both IMs and suppliers / contractors. Several of the findings from SP5 have been taken over by other bodies like EIM, CER and EFRTC that can continue the development of these questions in a sustainable manner.

SP6 - LCC. LCC methodology RAMS technology.
Regarding LCC and RAMS it was observed that the use of these techniques was in its infancy on a European scale in the area where INNOTRACK has been focusing. The reason was not so much lack of knowledge of the techniques as a lack of useful input data. For this reason, the work in INNOTRACK was partly different from what was initially planned.

SP7 - Dissemination and training.
INNOTRACK has been exceptional in focusing on implementation during the entire project. Already before the project started, a very clear goal was to fulfil the needs in the area. During the project, INNOTRACK has reviewed results at an effort estimated to EUR 100 000. Very small part of this has been funded by the EC. In the end of the project, support has been given to the end-user to implement the results.

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