MARKET IMPACT EVALUATION
ERRAC was set up in 2001 and is the single European body with the competence and capability to help revitalise the European rail sector:
   • To make it more competitive
   • To foster increased innovation
   • To guide research efforts at the European level

ERRAC Project Evaluation Working Group (EWG)
Objectives:
   • Determine the market impact of previous rail research to improve use of research funding
   • Ensure a strategic approach to the prioritisation of rail research

Project Evaluation
   • Individual projects are evaluated after they have been completed to ensure successful dissemination of project results
   • To ensure that the results of previous rail research can be taken into account for future projects
   • To avoid weak market uptake of results by learning the lessons of previous research
   • The EWG will provide intelligence based on the project evaluations for input into future European Framework Programmes
ERRAC Project Evaluation Group

EuROPE-TRIS

EVALUATION FROM MARCH 2008

Project acronym: EuROPE-TRIS
FP: 4
Programme acronym: TELEMATICS 2C
Project Reference: TR1022
Call identifier: FRAMEWORK 4C
Total Cost: € 5,087,403
EU Contribution: € 2,500,000
Timescale: March 1996 - May 1999
Project Coordinator: Pierluigi Guida (FS SpA)

- Presented by: L. Velardi
- Date evaluation: 25.01.08
- Market uptake: Weak
- Follow up projects: OPTIRAILS II
- Other related projects: TRIO, TRIP
Presented by: L. Velardi
Date evaluation: 25.01.08
Market uptake: Weak
Follow up projects: OPTIRAILS II
Other related projects: TRIS, TRIP
European Rail Research Advisory Council

ERRAC Project Evaluation Group

EuROPE-TRIP

EVALUATION FROM MARCH 2008

Project acronym: EuROPE-TRIP
FP: 4
Programme acronym: TRANSPORT
Project Reference: RA-96-RS.1165
Call identifier: FRAMEWORK 4C
Total Cost: € 792,000
EU Contribution: € 500,000
Timescale: June 1997 - May 1999
Project Coordinator: Pierluigi Guida (FS SpA)
Web references: http://cordis.europa.eu/transport/src/europe-t.htm

☑ Presented by: L. Velardi
☑ Date evaluation: 25.01.08
☑ Market uptake: Weak
☑ Follow up projects: OPTIRAILS II
☑ Other related projects: TRIS, TRIO

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Other related projects: TRIS, TRIO

Presented by: L. Velardi
Date evaluation: 25.01.08
Market uptake: Weak
Follow up projects: OPTIRAILS II
Other related projects: TRIS, TRIO
ERRAC Project Evaluation Group

CORRUGATION

EVALUATION FROM MARCH 2008

Project acronym:         CORRUGATION
FP:                                 5
Programme acronym: GROWTH: Competitive and sustainable growth
Project Reference: G3RD-CT-2002-00807
Call identifier: FP5-GROWTH
Total Cost:                    € 7,787,628
EU Contribution:           € 4,199,011
Timescale:                    June 2002 – September 2006
Project Coordinator: Patrick Vanhonacker
              (Dynamics, Structures and Systems International)

☑ Presented by:  L. Velardi
☑ Date evaluation: 25.01.08
☑ Market uptake: Medium
☑ Follow up projects: “ROTAIA” patent
☑ Other related projects: None
ERRAC Project Evaluation Group

TRIS, TRIO, TRIP & CORRUGATION

Meeting of 25th January 2008
European Rail Research Advisory Council

European Railways Optimisation Planning Environment (EuROPE) TRIS, TRIO & TRIP Projects

Planning railway transport services has traditionally been a very burdensome and lengthy process as it involves the utilisation of resources, subject to many different constraints. Due to its complexity, the planning process in the railway industry is difficult to compare to any other enterprise in the service sector. Moreover, the traditional procedures for generating timetables are no longer adequate to satisfy productivity demands in the new structure of European Railway market where, the infrastructure management is separated from "transport providers“ and more operators bring into the bid for track allocation.

Therefore productivity demands, market responsiveness and customer-oriented policies require new flexibility and impose greater timing pressures.
European Rail Research Advisory Council

European Railways Optimisation Planning Environment (EuROPE) - TRIS, TRIO & TRIP Project Scenario

**Today**
A highly integrated, fine-tuned process based on international co-operation of railways.

**Tomorrow**
Creating a new market for train paths, allowing new TOCs to compete

* Forum Train Europe is the twice-yearly European meeting to plan the timetable, held 8 months before the TimeTable comes into force
EuROPE TRIS, TRIO & TRIP Projects

Rationale:
The projects developed in the field of telematics technologies and applications provide enhanced services to transport users through improved efficiency, safety and environmental quality, taking into account policy objectives of the European Union. They thus aimed to contribute to economic growth and the development of European industry. The EuROPE initiative was carried out within the specific TELEMATICS APPLICATIONS Programme (TAP) for Transport Sector in the 4° Framework Programme for Research, Technological Development and Demonstration (1994-1998, 4th FP). The overall scope was to provide railway companies with innovative concepts and demonstrators in timetable planning and, also, to implement EU Directives for access-to infrastructure and operations on trans-European corridors. EuROPE initiative comprised three projects addressed to the new situation:
- TRIP: Transportation Railway Integrated Planning
- TRIS: Teleconferencing Railways Information System
- TRIO: Transportation Railways Innovative Optimisation
Background: EuROPE TRIS/TRIO &TRIP Integration
EuROPE Projects: Workflow

1. **Access to Infrastructure and Usage Policies**
   - TRIP

2. **Access to Infrastructure Procedures and Methodologies**
   - TRIS

3. **Timetable Definition Processes**
   - TRIO

4. **Timetable Planning**

5. **Contingency Planning**

6. **Telemarketing and Dispatching Processes**

7. **Real-Time Train Management and Safety Systems**

8. **Workflow Management**

9. **Enterprise Control System**

10. **Data & Applications**

11. **Planning Optimizers**

12. **Market**

13. **Train Services**
EuROPE TRIS : Background
(Teleconferencing Railways Information System)

Main Objective:
EuROPE-TRIS aims to develop a telematics and software system to support expanding national and trans-European traffic planning needs, focusing on long-term tactical timetabling as well as daily or weekly contingency planning. The project plans to automate the traditional conferences at national and European levels and to optimize the utilisation of the railway infrastructure, in line with the new EU policies for the railway transport market. A further aim is to improve operational planning at traffic coordination centres and their communications with intermodal freight links.
EuROPE TRIO : Background
(Transportation Railways Innovative Optimisation)

Main Objective:
EuROPE-TRIO aims to achieve:

- Outstanding cycle time reductions in the TPP (timetable planning process)
- Cost reductions and productivity improvements compared to the traditional way of “doing the work”
- Overall improvements in production and level of services of railways, such as:
  - More planning flexibility
  - Shorter response time to the market needs (e.g. service variation and schedule updates)
  - Optimised use of resources and
  - Better control of the quality of the offered product (service plans and published timetables)
- Possibility to simulate changes in the work rulings (e.g. trade union constraints in crew schedule planning)
- Work enhancement and intellectual growth for staff, i.e. less manual burden and low added value activities.
EuROPE TRIS : Background

Details
• FP4
• Project Reference: TR1022
• Total Cost: 5,087,403 EURO
• EU Contribution: 2,500,000 EURO
• Timescale: 01.03.’96 - 31.05.’99
• Project Coordinator: Mr Pier Luigi GUIDA (FS)

Partners
• RETE FERROVIARIA ITALIANA Gruppo FS (IT)
• ANSALDO SF (IT)
• Olivetti Wang e Olivetti Ricerca (IT)
• SINTEF (NO)
• Padua Research Consortium- CPR – University of Padua (IT)
EuROPE TRIO: Background

**Details**
- FP4
- Project Reference: 22316
- Total Cost: 1.104.000 EURO
- EU Contribution: 600.000 EURO
- Timescale: 01.06.’97 - 31.05.’99
- Project Coordinator: Mr Pier Luigi GUIDA (FS)

**Partners**
- RETE FERROVIARIA ITALIANA Gruppo FS - (IT)
- AEA Technology (UK)
- Olivetti Getronics (IT)
- ANSALDO SF (IT)
- SINTEF (NO)
- Padua Research Consortium- CPR – University of Padua (IT)
## EuROPE TRIS & TRIO : Background

<table>
<thead>
<tr>
<th>Partners interviewed:</th>
<th>Name of interviewee</th>
<th>Country</th>
</tr>
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<tbody>
<tr>
<td>RFI - RETE FERROVIARIA ITALIANA</td>
<td>☑ Pier Luigi Guida – Project co-ordinator</td>
<td>IT</td>
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<tr>
<td></td>
<td>☑ Vito Achille</td>
<td>IT</td>
</tr>
<tr>
<td>CPR – University of Padua</td>
<td>☑ Matteo Fischetti</td>
<td>IT</td>
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<tr>
<td></td>
<td>☑ Paolo Toth</td>
<td>IT</td>
</tr>
</tbody>
</table>

### Users interviewed:

| NS Reizigers - Netherlands Railways                        | ☑ Leo Kroon                                | NL      |
| DSB-Danish State Railways                                 | ☑ Nikolaj Schlegel                         | DK      |
| APAM ESERCIZIO SpA-Mantova                                 | ☑ Rino Guerra                              | IT      |
| UIC-Infrastructure                                         | ☑ Anne Tanguy                              | FR      |
EuROPE TRIS : Background

Project description:

- **Real-time data** (Fiche 407)
- **Electronic Mail** (Fiche 450.1)
- **PATH DEMAND**
  - TCM Traffic Capacity Management
- **Interoperability**
- **EUROPEAN CORRIDORS**
  - F-TTM Freight Timetable TeleMarketing
- **Harmonisation**
- **Intermodal Timetable Systems**
- **Dispatching**
  - Links with Intermodal Companies
- **Train Operators**
  - National Timetable Systems
- **Standardisation (EU Dir.19/95)**
EuROPE TRIS : Background

Project description (contd): the solution approach

The three sub-systems - Traffic Capacity Management (TCM), Timetable TeleConferencing (TTC) and Freight-Timetable TeleMarketing (F-TTM) - have been defined according to the three main timetable planning steps.
EuROPE TRIS : Background

TRIS CONTEXT

RAILWAY PRODUCTION MODEL

- Tactical Demand
- Timetable Design
- Short Term Demand
- Capacity Management & Marketing
- TRANSPORT OPERATORS
- TIMETABLE PLANNING
- CONTINGENCY PLANNING
- TRIS
- ε vents
- REACTIVE PLANNING & OPERATIONS
- RAIL PLANTS AND TRAINS
- Medium Term CONTROL
- Short Term CONTROL
- Real Time CONTROL
- TCM
- TDC
- TDS
- F-TTM
- TIMETABLE PLANNING
- CONTINGENCY PLANNING

European Rail Research Advisory Council
EuROPE TRIS&TRIO : Background

Major validation sites:

Major test sites for the validation and demonstration stage have been as follows:

Traffic Capacity Management
- Rome (Italy) FS
- Derby (Great Britain) British Railways Board- R&D Division
- Trondheim (Norway) SINTEF

Timetable Teleconferencing
- Rome (Italy) FS
- Vienna (Austria) ÖBB

Freight Timetable TeleMarketing
- Rome, Milan, CEMAT
- Verona, La Spezia (Italy) CEMAT
- Vienna (Austria) ÖBB
- Bern (Switzerland) SBB

TRIO System
- Rome, Venice (Italy) FS
- Trondheim (Norway) SINTEF
EuROPE TRIS: Background

Achievements: Architecture

assists the preliminary process for access to infrastructure when train operating companies request paths on given lines and propose schedules, and the infrastructure manager (IM) has to respond within a given time, offering feasible solutions including paths and appropriate track fees. In this context, the TCM can be also defined as the "commercial" or preliminary stage of the infrastructure supply/demand market exercise, from which a first and technically feasible timetable schedule can be derived.

supports the traditional railways conferences (meetings) via new multimedia video-conferencing.
EuROPE TRIS : Evaluation

Achievements: F-TTM

The F-TTM provides the support for managing the track capacity after a timetable has been put into operations and short-term planning becomes important. Therefore it has to accomplish its short-notice (e.g. weekly or daily) updating or re-scheduling and the slots allocation for unscheduled or special freight trains. In this context, the system addresses what can also be defined as “contingency planning” or sometimes “dispatching”.

...
EuROPE TRIO: Evaluation

Achievements: Demonstrator Architecture

The general concept is to make all the specific rail planning sub-processes work around a co-ordination function which guarantees common data integrity, message exchanges and activity schedule management. Various train operating companies can be linked to the system whose co-ordination point is the infrastructure management.
**EuROPE TRIO : Background**

**Project description:**

- **TIP (Timetable Integrated Passenger)** - Commercial schedule design, based on traffic demand.
- **TIS (Timetable Integrated Simulator)** - Can simulate the running of trains on a given network in order to verify the feasibility of schedules and to support the timetable validation.
- **TIV (Timetable Integrated Vehicles)** - Determines the number of vehicles required to implement the timetable found by TIP.
- **TIC (Timetable Integrated Crew)** - Develops schedules for the train crews according to sector constraints (e.g., trade labour regulations, laws, etc.).
- **RAPID (Railways Planning Integration Driver)** - Is the “co-ordinator” of the timetable planning process which provides an interface with all the other modules of TRIO and TRIS (TCM and TTC).
The objective to manage the whole planning process in an integrated way was maybe too ambitious. Nonetheless, some modules have come together in the RFI’s platforms (PIC, ASTER, MIPS) and some concepts have fed new tools at international railway level (EUROPTIRAILS) and in the industry field. I.g. a tool named TURNI was developed on the TRIS and TRIO trail, and nowadays is adopted by Danish and Netherlands railways (DSB and NS) for suburban train drivers scheduling duties and as rotation of staff.
Main Objective:
EuROPE-TRIP provides a framework of quantitative method to:

- **Compute** railway line capacity, particularly in view of long distance European corridors
- Analyse the costs of using the rail infrastructure
- Describe the access to infrastructure by rational and quantitative modelling (theory of games) and the principles of cost allocation for policy rulings how to share infrastructure costs among several operators
- Develop a simulator model in order to analyse the market behaviour and support the IMs and policy makers in setting up strategies for the access to infrastructure
EuROPE TRIP: Background

Details
• FP4 under contract DGVII-Transport
• Project Reference RA-96-RS.1165
• Total Cost: 792.000 EURO
• EU Contribution: 500.000 EURO
• Timescale: 01.06.’97- 31.05.’99
• Project Coordinator: Mr Pier Luigi GUIDA (FS)

Partners
• RETE FERROVIARIA ITALIANA Gruppo FS -Infrastructure Manager (IT)
• Steer Davies and Gleave LTD.- Consultancy (UK)
• Tor Vergata University of study (IT) Education (IT)
• CEMAT Industry (IT)
## EuROPE TRIP : Background

### Partners interviewed:

<table>
<thead>
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<td>✓ Pier Luigi Guida – Project co-ordinator</td>
<td>IT</td>
</tr>
<tr>
<td>SDG</td>
<td>✓ F. Beltrandi</td>
<td>UK</td>
</tr>
</tbody>
</table>
EuROPE TRIP : Background

**Major validation site:**

The major test site for the validation of the “Cost methods” was brought up on the Italy-France corridor. Below the main figures

<table>
<thead>
<tr>
<th></th>
<th>France</th>
<th>Italy</th>
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</thead>
<tbody>
<tr>
<td><strong>High-speed Lines</strong></td>
<td>Calais-Bourge en Bresse</td>
<td>Firenze-Roma (<em>Direttissima</em>)</td>
</tr>
<tr>
<td></td>
<td><em>Km 726</em></td>
<td><em>Km 261</em></td>
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<tr>
<td><strong>Commercial Lines</strong></td>
<td>Calais-Modane</td>
<td>Modane-Firenze</td>
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<td><em>Km 1046</em></td>
<td><em>Km 891</em></td>
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<td>Tot</td>
<td><em>Km 1772</em></td>
<td><em>Km 1152</em></td>
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<tr>
<td>Manned Stations</td>
<td>≈ 70</td>
<td>≈ 120</td>
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</tbody>
</table>
Project description: solution approach

In order to address infrastructure management planning and to provide alternative scenarios and economic assessment, TRIP has developed:

- Line capacity analysis: a “multi-layer” method was introduced to estimate line capacity, including analytical methods, scheduling models and simulation.

- Infrastructure using cost: a framework of definitions and analysis rules was outlined to create a common reference model, where rail infrastructure costs are considered on a life-cycle basis.

- Access to infrastructure modelling through the application of economic concepts (theory of games and auction methods)

- Infrastructure business model: an experimental approach in order to develop a prototype software model through a “system dynamics” method
EuROPE TRIP: Evaluation

Achievements:

- Line Capacity analysis: several simulations were brought up in congestion, path scheduling, etc.
- Infrastructure using cost: a study on the railway structure cost including maintenance, traffic control, energy, depreciation and staff exp.
- Access to infrastructure modelling: theory games and auction application on railway market
- Infrastructure business model, via model system/Demonstrator Interface
The EuROPE TRIS, TRIO and TRIP projects have defined an innovative approach to the railway market, either in terms of systemic vision or technical solutions. In fact, for the first time the adopted methodology integrates the access-to infrastructure into path analysis/ allocation and service management (timetable planning, with vehicles and crew needs, traffic control system).

The projects were carried out when the IMs and RUS were going to replace the national integrated railways all around in Europe, new scenarios had been defined and an European Agency for railways had not been created yet. At the same time, they did not meet the initial interest of the railway undertakings/IMs -especially TRIP – because the companies, heavily involved in the liberalization had not seen importance of the telematic application in strategic planning.

Nevertheless some concepts and ideas (especially from TRIS and TRIO) have been exploited and developed within other European following projects, feeding the research of present European applications (EUROPTIRAILS e.g.)
1. Were the results implemented in the design of the new products and services? Were these new products/services put into commercial operation –

   The results provided concepts that have been used in developing new tools, at the moment utilized, at European level (EUROPTIRAILS by Rail Net Europe) and domestic level (the Integrated Platform for service management –PIC- the freight platform ASTER, the optimization software MIPS by the Italian IM RFI).

2. Is new legislation and standardization based on findings from this research projects - No

3. Are the results of the projects implemented across Europe or only in a small number of Member States

   – At the moment, EUROPTIRAILS is the official tool for traffic monitoring optimization of Rail Net Europe, an European network founded in 2004 by 31 IMs, in order to harmonize conditions and shape the rail infrastructure business.
4. Are the results of the projects implemented outside Europe before being accepted in Europe – No

5. Did the projects increase competitiveness of the European railway sector abroad with regard to products, services, standards and system design – No, but it helped develop a concept and a methodology that fed new tools in the field of international rail traffic.

6. Did the projects increase competitiveness of the railway transportation compared to other transport modes – not yet

7. Are the results of the projects taken into consideration when preparing public tenders – no
8. Does the implementation of the projects results help facilitate cross-border operations by problem-solving in the domain of interoperability – yes, concerning EUROPTIRAILS

9. Does the implementation of the project results help facilitate inter-modal operations by problem-solving in the domain of inter-modality – No,

10. Can benefits be assessed in financial terms –

   With regard to the commercial implementation TURNI, adopted nowadays by many Italian public transport companies also, the Danish and Netherlands railways have been estimated a 6-7% efficiency improvement in train drivers scheduling duties over a 5 years period.
11. Applicability of results to future scenarios
   – yes, mostly if the model offered by TRIS and TRIO projects has been improved and customized in terms of scheduling vehicles and crews, it would be used by the RUs and new operators, in order to efficiency their internal planning process so to bid new services at a best price.

12. Usefulness of research procedures for future projects (incl. modeling)
   - The EUROPE TRIS and TRIO experience was useful to the projects that followed and provided guidelines and a methodology for further implementations. TRIP approach, also, would provide railway experts with new dynamic model for strategic planning at European level.
EuROPE TRIS, TRIO, TRIP: follow ups

The projects TRIS and TRIO had a strong relationship to the OPTIRAILS II project (OPTImisation of traffic through the European RAIL traffic management System) within 5th FP (1998-2002), where has been worked out the system requirement specifications of the European traffic management in the ERTMS frame, and consequently nowadays to the concept of EUROOPTIRAILS application. At domestic level, elements coming from the three projects can be found in the RFI’s platforms (PIC, ASTER, MIPS).
ERRAC Project Evaluation Group

CORRUGATION
Wheel rail corrugation in urban transport

The project has been developed under the aegis of Competitive and Sustainable Growth, one of the four thematic programmes of the Fifth RTD Framework Programme (1998-2002), conceived to tackle the key challenges facing European industry – sustainable transport, efficient and quality-based production, materials for the 21st century, measurement for quality control and more.
In particular, CORRUGATION focus on the development of critical technologies for land transport in order to improve efficiency performance (noise and vibration suppression).
Wheel rail corrugation in urban transport: Background

**Main Objective:**

The project aims at developing solutions for the very expensive corrugation problem in metro and tram networks. Corrugation reduces the lifetime of rails and wheels, causes irritating emitted rolling noise and leads to safety concerns. The only efficient solution nowadays is periodical rail grinding, an expensive work. The general objective of this project is to reduce the corrugation growth with 50% in time by developing track and rolling stock solutions other than grinding.
Wheel rail corrugation in urban transport: Background

The main objective will be achieved through the following intermediate objectives:

- definition of all relevant parameters that influence corrugation and development of the required measurement equipment to evaluate these parameters. Measurement of the relevant corrugation parameters at different track sections of the end-users;
- definition, with great precision, of the macroscopic and microscopic wheel/rail contact forces;
- simulation of the wear characteristics on a dedicated test rig;
- design of low-cost anti-corrugation measures for tracks and wheels in function of the type of corrugation encountered;
- installation and validation of the designed measures in test tracks and on the dedicated test rig and follow-up;
- definition of the corrugation mechanism in any specific track section of any network from the relevant corrugation parameters.
Corrugation: Background

Details
- FP5
- Project Reference: G3RD-CT-2002-00807
- Total Cost: 7,787,628 EURO
- EU Contribution: 4,199,011 EURO
- Timescale: 01.05.’02- 30.09.’06
- Project Coordinator: Mr. Patrick Vanhonacker

Partners
- Dynamics, Structures and Systems International sa - (BE)
- RATP Public Transport (FR)
- STIB Public Transport (BE)
- Lucchini Sidermeccanica (IT)
- Etc.
## CORRUGATION : Background

### Partners interviewed:

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Name of interviewee</th>
<th>Country</th>
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<tbody>
<tr>
<td>Dynamics, Structures &amp; Systems International D2S</td>
<td>P. Vanhonacker</td>
<td>B</td>
</tr>
<tr>
<td>RATP Public Transport</td>
<td>D. Levy</td>
<td>F</td>
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<tr>
<td>Tecnogamma TEC</td>
<td>F. Carpanese</td>
<td>I</td>
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<tr>
<td>Lucchini Centro Ricerche e Sviluppo LUC</td>
<td>S. Cervello</td>
<td>I</td>
</tr>
<tr>
<td>Acab Acoustic Control Laboratories AB</td>
<td>N. Nilsson</td>
<td>SE</td>
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<td>Railtech</td>
<td>J. Cailliau</td>
<td>F</td>
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<td>Frateur – De Pourcq SA</td>
<td>D. Rotthier</td>
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<td>SL Infrateknik</td>
<td>A. Sjöberg</td>
<td>SE</td>
</tr>
<tr>
<td>European Research Directorate</td>
<td>J. De Bock</td>
<td>EU</td>
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</tbody>
</table>
1. Research in the course of the project indicated the importance of the quantification and measurement of existing corrugation. Also the importance of the quality of the grinding process was stressed. Apart from safety aspects, the project illustrated the importance of the tolerances on wheel profiles as they can lead to excessive corrugation.

2. **Continuous** vertically very soft and horizontally very rigid **embedded rail** was demonstrated to be very effective against corrugation.

3. Very **resilient rail fasteners** were demonstrated to be very effective against corrugation. In order to be effective the vertical dynamic fastener stiffness has to be below 10kN/mm.
CORRUGATION

Major validation sites and demonstration stage:

*Embedded Tracks*
- Bobigny (RATP network-France)

*Resilient rail fasteners on wooden sleepers*
- Bruxelles (STIB’s metro network-Belgium)
CORRUGATION

Achievements:

1) **Measurement devices**
   An instrument - *Rail Surface Analyser* - has been developed to quantify the existing corrugation and testing the grinding quality. It has also been used to evaluate the developed solutions.

2) **Embedded continuously supported resilient tram track**
   A special track was designed to achieve a high vertical resiliency and high or low horizontal resiliency able to shift the modes into frequency bands which are not prone to generate corrugation.

3) **Metro application**
   A pre-compressed fixation fastener was developed with two elastic layers - a rail pad and a base plate pad - and special springs.

4) **Top of Rail lubrication** has demonstrated to reduce the friction forces and can therefore be very effective against corrugation. A special application device with specific lubrication fluids which can be applied in minimal quantities and which are based upon the use of teflon avoids the classical side effects (oil spilling).
CORRUGATION: Background

Achievements:
1) The Rail Surface Analyser is now commercially available at APT rail (www.aptrail.com)

CORRUGATION: Background

Achievements:

2) Embedded continuously supported resilient tram track patented:

3) Resilient discrete rail fixation system for metro track:

Source: www.corrugation.eu/solutions
CORRUGATION : Evaluation

1. Were the results implemented in the design of the new products and services? Were these new products/services put into commercial operation

   – yes, the main Corrugation project outcomes have been a rail measurement device, a patented embedded rail tram track and a metro rail fixation; all these products are commercially available

2. Is new legislation and standardization based on findings from this research project

   – No

3. Are the results of the project implemented across Europe or only in a small number of Member States

   – At the moment the project results seem to be implemented only in Sweden (Stockolm subway) besides the networks involved in the project (STIB, Belgium and RER, RATP, France), in terms of test campaign or as daily maintenance tool.
4. Are the results of the project implemented outside Europe before being accepted in Europe – **Concerning the “ROTAIA” patent follow up, this tool was experimented in China since 2000, thus before the project starting.**

5. Did the projects increase competitiveness of the European railway sector abroad with regard to products, services, standards and system design – **no**, but it helped a “**measure methodology**” that increases the efficiency of rail maintenance

6. Did the project increase competitiveness of the railway transportation compared to other transport modes – **no**

7. Are the results of the project taken into consideration when preparing public tenders – **no**
CORRUGATION : Evaluation

8. Does the implementation of the project results help facilitate cross-border operations by problem-solving in the domain of interoperability – no

9. Does the implementation of the project results help facilitate inter-modal operations by problem-solving in the domain of inter-modality – no

10. Can benefits be assessed in financial terms – we don’t have information

11. Applicability of results to future scenarios
   – yes

12. Usefulness of research procedures for future projects (incl. modeling)
   - xxx
CORRUGATION : Reasons for outcome

✓ The project “CORRUGATION” has approached for the first time a specific technical problem within an European Research framework, where academy and industry have fulfilled a joint effort.

✓ The project has defined a “culture of measurement”, in order to deepen the Corrugation and optimize the grinding (RER and RETP network in Paris)

✓ The technical solutions have been exploited and developed within European industry, achieving 3 patents: 2 rail corrugation measurement devices (by APT and Tecnogamma companies) and 1 embedded resilient tram track.
CORRUGATION : follow ups

1) Device “ROTAIA”
   A patent was developed by TECNOGAMMA and sold in CHINA (MOR), France (RATP), Korea (Metro Seoul SMRT and Daejou), Taiwan (Ming Yu), Spain (Ferrocarril De la Catalunya), Germany (Schweerbau), Ireland (Irish Railways).

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2) Embedded track
   a test campaign is carrying out in Stockolm subway in order to patent a new track type also in Sweden.