BUILDING UP ON RAILWAY COORDINATES

Introduction Railway Project 2009
Coordinates for track machine guidance
Reference data
Exploitation of the full coordinate potential
Railway project 2009
Feedbacks
Conclusions

The Railway Project 2009

The main goal of the “Railway Project 2009” was to outline the conditions required to achieve interoperability of railway infrastructure data all along the European Railway lines based on absolute coordinates.
Measure the position vectors from the track machine towards coordinate defined reference points

Calculate from these vectors the track machine position in absolute coordinates

Determine the difference between the track machine position and the ideal theoretical track axis

Guide the track machine to put the track back to the ideal positiontheoretical track axis
COORDINATE BASED TRACK MACHINE STEERING

**Red:** Before 1986. Relative working method
**Green:** After 1996. Absolute working method

**Absolute coordinate marking:** no more triggering points

**Relative versiones marking:** dozens of triggering points

triggering angle initiating train oscillation and generating a long wave track deformation process

TOPORAIL, SWISS TRACK CALCULATION SYSTEM
SHELL DATA MODEL WITH INTERACTIONS

Structured Railway Data „Shell Modell“

Organisational interaction

Specialised

GIS domain

Reference Data domain

Domains

Track Data Reference Data Track expert domain

Reference Data Shell Modell

Structured and a transparent representation of all interface data

Organisational interaction

SHELL DATA MODEL WITH INTERACTIONS

100% COMPLETE DATA

Users view

Best Variant

Update track project

Work process

Interface: automatic consistency and completeness tests

Actual track database

Track project

Central track database

Project

Demolition

Actual Track data after project

Background

Building Up on Railway Coordinates (4477) 7 April 14, 2010

Building Up on Railway Coordinates (4477) 8 April 14, 2010
### DEVELOPMENT OF TRACK QUALITY

<table>
<thead>
<tr>
<th>Year</th>
<th>Total length [km]</th>
<th>Best track quality part [km]</th>
<th>Part of best quality [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>2721.202</td>
<td>1080.428</td>
<td>39.7</td>
</tr>
<tr>
<td>1986</td>
<td>2579.004</td>
<td>509.229</td>
<td>19.7</td>
</tr>
</tbody>
</table>

The best track quality part comprises the track segments on which a note between 10-22 was measured by the track quality measuring car. The note is quoted on a scale between 10 for a perfect track and 110 for the worst possible track. The best track quality part doubled in 10 years.

### SUBJECTS OF RAILWAY REFERENCE DATA

- **Route data (KM lines)**
- **Track data**
- **Working surface**

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**Figures**

FIG Congress 2010, Sydney, TS 6H_4477

Théo Engel (Switzerland), Bodo Lahr (Germany) and Jürg Kaufmann (Switzerland):
WORK PROCESS DRIVEN DATA MANAGEMENT

**Infrastructure work process**

- Run
- Plan
- Demand process
- Financial process
- Planning process
- Build
- Run
- Plan

**Local Data-storage**

- Interface and consistency tests
- Full interoperability between all infrastructure data
- Systematic data-storage: Centralised, topological structure, uniforme reference

**Background**

**RAILWAY INFRASTRUCTURE MAINTENANCE**

**Infrastructure work process**: Governs exhaustively the kernel tasks of maintaining the (railway) infrastructure assets by planning, building and running them at highest data quality level and based on systematic data-storage.

This final development stage will enable:

- standardised mechanisms to store, archive, authenticate access, transfer, preserve, curate, certify and interpret railway data;
- improved availability of primary digital data sources;
- a shift away from approaches based on the secondary sources which are often incomplete and incorrect;
- use of the data as the central element for the professional facility management;
- improved analysis, acquisition, visualisation of data.
WORK ENVIRONMENT IN RAILWAY MAINTENANCE

- short working periods
- dark
- often bad weather conditions

- no errors allowed
- continuous operation
- reliable steering

100% data quality

THE RAILWAY PROJECT 2009

The main goal of the “Railway Project 2009” was to outline the conditions required to achieve interoperability of railway infrastructure data all along the European Railway lines based on absolute coordinates.
INTRODUCTION ETRS89

TRANSFORMATION
OUTCOMES OF THE RAILWAY PROJECT 2009

- Need to work Cross Border adopted
- To base on ETRS is feasible
- Map projection stays in responsibility of national railways
- All countries are to achieve an undistorted reference frame
- Accuracy to be achieved is 1 cm
- The height problem needs further investigation
- All phases to be integrated and supported
- In addition data modeling, quality concepts, standard data exchange interfaces and update concepts are to be elaborated and implemented

CONCLUSIONS

Coordinates have a double function:

Reference data making interoperability between European railways possible

Base for future automatic track maintenance guaranteeing high Precision

Open questions:

Will the instrument industry be interested, willing and able to support the railways with the development of continuous GNSS-based hardware and software for high precision track machine Steering?

The work goes on!
THANKS FOR YOUR ATTENTION

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