This project has received funding from the Shift2Rail Joint Undertaking under the European Union’s Horizon 2020 research and innovation programme under grant agreement no. 777594 (OptiYard)

WP2 DATA ANALYTICS

Current data handling capabilities

Mid-term Conference, October, 5th 2018

This document reflects only the author’s view and the JU is not responsible for any use that may be made of the information it contains
OBJECTIVES

- Operating process
- Methods and technics for data gathering
- Most suitable ones for managing the rail freight operation
METHODOLOGY

• Operating processes

• EU projects
  - Automated Rail Cargo Consortium (ARCC)
  - SMARTRAIL On-time
  - Capacity4Rail
  - FR8Hub

• Case studies
  - REMAS
  - VAMOS
  - CD Cargo
  - STM
  - OCR for wagon identification
  - SNCF
  - Olin
FRAMEWORK

• Regulation and Regulatory Requirements for Data Handling
  - Regulations
    ✓ TAF TSI
    ✓ UIC 407
  - Standards
    ✓ RailTopoModel
    ✓ railML
  - Tools
    ✓ RNE TIS
    ✓ RNE PCS
    ✓ RailData ISR

• Recommendations for Improved Information and Communications for Marshalling Yard and Network Management
FUNCTIONAL AREAS AT A GENERIC MY

entry

arrival

classification

ordering / storage

traction relay, traction loop tracks, fueling tracks, washing tracks, storage tracks for damaged wagons, repair and maintenance tracks, tracks with reefer/watering plugs...

departure

surrounding network

area of Marshalling yard (MY)

exit
PROCESSES AT A GENERIC MY

- receiving ETA for train
- receiving train composition
- providing train route
- moving train to MY
- evacuating brake pipe
- securing wagons
- uncoupling of line engine
- moving line engine away (incl. shunt route)
- technical inspection
documents check
decision for blocks & classification tracks
- moving yard engine to wagons (incl. shunt route)
de-securing wagons
preparing uncoupling of blocks
- uncouple non-humping wagons
- moving non-humping wagons into sidings (incl. shunt route)
- moving hump engine to wagons (incl. shunt route)
- uncouple blocks at hump
cut blocks into classification (incl. shunt routes)
- braking blocks by retarders
- closing-up
- securing wagons
decision for departure train composition
coupling blocks
(path request to IM)
- moving yard engine to wagons (incl. shunt route)
de-securing wagons
flat shunting or 2nd humping (incl. preparing decoupling, uncouple, cut, shunt route)
- (securing wagons)
filling brake pipe
brake test
technical inspection
- flat shunting of defect wagons (incl. shunt route for yard engine, uncouple, shunt route for wagon groups)
- uncoupling of yard engine
- moving yard engine away (incl. shunt route)
documents preparation
sending wagons trip plan
- moving line engine to wagons (incl. shunt route)
coupling line engine
de-securing wagons
- simplified brake test
- sending "train ready" to IM
- Forwarding agent's activities
wagon re-labelling
customs clearance
quality control
re-icing, feeding, watering
- fueling, washing
repair & maintenance
- transport of waste controls
phytosanitary, hygiene, veterinary checks
- filling brake pipe
brake test
technical inspection
- flat shunting of defect wagons (incl. shunt route for yard engine, uncouple, shunt route for wagon groups)
- uncoupling of yard engine
- moving yard engine away (incl. shunt route)
documents preparation
sending wagons trip plan
- moving line engine to wagons (incl. shunt route)
coupling line engine
de-securing wagons
- simplified brake test
- sending "train ready" to IM
- technical inspection
DATA EXCHANGE AT CESKA TREBOVA
## SAMPLE INTERFACE IN CESKA TREBOVA

- **DI1 Train Plan Message**

<table>
<thead>
<tr>
<th>Train Plan</th>
<th>Train composition</th>
<th>Train ready</th>
<th>Train forecast</th>
<th>Train running</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Header</td>
<td>• Header</td>
<td>• Message status</td>
<td>• Area Code</td>
<td>• Message status</td>
</tr>
<tr>
<td>• Actions</td>
<td>• PathID</td>
<td>• Train ID</td>
<td>• RU</td>
<td>• Train ID</td>
</tr>
<tr>
<td>• Plan</td>
<td>• Train data</td>
<td>• Train location</td>
<td>• Train data</td>
<td>• Dep station + time</td>
</tr>
<tr>
<td>• Route</td>
<td>• Train composition journey</td>
<td>• Start time</td>
<td>• Scheduled dep + arr time</td>
<td>• Dest station + est. Time</td>
</tr>
<tr>
<td>• Tractions</td>
<td>• Wagon data</td>
<td>• Ready time</td>
<td>• Last GPS</td>
<td>• Scheduled dep. Time</td>
</tr>
<tr>
<td>• Exceptions</td>
<td>• Loco data</td>
<td>• Departure data</td>
<td>• Dep + Arr Track in Station</td>
<td>• Event data</td>
</tr>
<tr>
<td>• Drivers</td>
<td>• Journey section</td>
<td>• Destination data</td>
<td>• Dep+ Arr track on line</td>
<td></td>
</tr>
<tr>
<td>• Dangerous Goods</td>
<td></td>
<td>• Event data</td>
<td>• Dep + Arr confirmed</td>
<td></td>
</tr>
</tbody>
</table>
ETIGER/TIGER DEMO

- Develop rail transport solutions in competitive and co-modal freight logistics chains.

- Re-engineering of port layout including design of rail signalling and control systems. ERP intelligent system management and E-Customs control was analysed as well signalling and safety train operation (on non RFI railway tracks) and container and train tracking & tracing (E-Customs/security services).
New concepts for low maintenance infrastructure was analysed, using standardised and 'plug-and-play' concepts was proposed.
AUTOMATED RAIL CARGO CONSORTIUM (ARCC)

- Improve quality, efficiency and cost effectiveness in European rail freight operations. Analysis was conducted at three different Marshalling yards:
  - München-Nord/ Germany
  - Mannheim/ Germany
  - Hallsberg/ Sweden
VIWAS

- First data collection automatic per wagon with a variety of sensor

- Aiming at the development of:
  - Market driven business models and production systems
  - Security of the critical mass needed for SWL operations
  - New ways for Last mile infrastructure design and organisation
SMARTRAIL

• Currently in use within BD Rail Services

• Utilise QR codes (Quick Response Codes) attached to the side of wagons

• Required info: Real Time Information – most notably the Train Position
REMAS – RESOURCE MANAGEMENT SYSTEM FOR AUTOMATED DRIVING

- New ADAS hindering by economic and safety risks make simulation permissive before rollout (automated driving); and changing juridical and bureaucratic conditions

- System design of REMAS with the RTI (Run-time infrastructure) as Simulation Middleware
Cyber physical system wherein the traffic state is measured using different detector techniques in real (time intelligent traffic control) for optimal use of infrastructure with control of demand for motorised individual traffic raising attractiveness of public transport.
OCR AND RFID AT CD CARGO

- OCR (Optical Character Recognition-based technology) and RFID systems for freight wagon number reading
- Faster check-in (clearance) of wagons to be processed/being processed/having been processed.
- Potential savings of direct labour in the yard before (check-in of arriving trains/wagons) and after the hump processes (check-out of outbound wagons)
STM (SOCIÉTÉ DE TRANSPORT DE MONTREAL)

- Real-time asset monitoring using PI System architecture (OsiSoft) for escalators to improve the control over the fixed asset (pilot experience)
  - Aiming at maintenance cost reduction
OPERATIONAL DATA FOR FUTURE MAINTENANCE AT SNCF RÉSEAU

• OsiSoft package was to reduce the impact of maintenance activities on rail traffic, improving asset surveillance and anticipating/preventing possible incidents
RAIL YARD MANAGEMENT AT OLIN- BÉCANCOUR

• Fleet collecting and transforming data from multiple sensors in shareable real-time data to spread the information efficiently across the plant
# RNE TIS

<table>
<thead>
<tr>
<th>Joint IM-RU Functions</th>
<th>RU (freight) Only Functions *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference Files</td>
<td>Consignment Note Data</td>
</tr>
<tr>
<td>Common Interface</td>
<td>WIMO</td>
</tr>
<tr>
<td>Short Term Path Request</td>
<td>Wagon Movement</td>
</tr>
<tr>
<td>Train Preparation</td>
<td>Shipment ETA</td>
</tr>
<tr>
<td>Train Running Information</td>
<td></td>
</tr>
<tr>
<td>Train Forecast</td>
<td></td>
</tr>
<tr>
<td>Service Disruption</td>
<td></td>
</tr>
<tr>
<td>Deviations from plan (TAP)</td>
<td></td>
</tr>
<tr>
<td>(Train Identifiers)</td>
<td></td>
</tr>
</tbody>
</table>

* Commercial part of TAP is not considered in the table

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source: Stahl, J.: RNE TIS; TAF/TAP workshop; Brussels, 2017
RNE PCS (PATH COORDINATION SYSTEM)
RAILDATA ISR

**ISR Functions**

- **RU NIS**
- **ORFEUS**

- **Wagon Events Receiving & ISR DB**
  - **Wagon Events Forwarding**
  - **Mileage (receive, calculate, send)**
  - **ISR Web centre**
  - **WDI (H30 receive, display, capture & WSM)**

- **Train Running Receiving & RTIS**
  - **Use IT (web + forwarding)**
  - **TRI forwarding**

**RNE TIS**
RECOMMENDATION FOR YARD AND NETWORK COMMUNICATION

- Optimisation module and algorithms at large and complex yard infrastructures
- Integrate with the existing IT environment and with activities toward yard automation, e.g. intelligent assets and automated shunting in yards
- Long distance monitoring of incoming trains from the external network on screens enabling to prepare pre-advanced work planning
- Interaction with the IM for accurate ETA as soon as the train enters the relevant network
- Interaction with the IM using real-time optimisation to deal with unexpected events during the approach of the train or the operation in the yard
- Interaction between IM and MY to find the best solution for both yard and network
- Reset the work plan and new ETD and ETA accepted by the IM, thus enabling the client to have accurate updated information on the situation and the future progress of the train
CONCLUSIONS

- Partial use of commercial use possible for those RUs that own licenses
- Otherwise use of proprietary systems
- TAF TSI messages already partially in use, maybe broaden
- Recommendations for data management at MY will be developed in WP5
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QUESTIONS

Thank you for your kind attention!

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