TRACK CONDITION MONITORING AT SNCF: AN INTRODUCTION TO METHODS, TOOLS AND PERSPECTIVES
TRACK MONITORING AT SNCF PRESENTATION CONTENT

• PRESENT
How do we monitor track today

• TRANSITION PHASE
New projects & innovations

• THE FUTURE
Towards a new approach of track monitoring
How do we monitor track today
TRACK MONITORING AT SNCF
SOME KEY FIGURES

→ French rail network
  ▪ Tracks ~ 50 000 km
  ▪ Electrified tracks ~ 30 000 km
  ▪ High speed tracks (up to 320km/h) ~ 4 000 km
  ▪ Bridges ~ 27 000
  ▪ Tunnels ~ 1 700

→ Infrastructure domains: tracks, signalisation, catenary, bridges/tunnel
  ▪ Annual maintenance cost ~ 2 Billion €
  ▪ Monitoring ~20% of maintenance cost
  ▪ Track condition monitoring ~50% of monitoring cost (~ 200M€/year)
TRACK MONITORING AT SNCF
GENERAL PRINCIPLES

» Objectives: ensure ride confort, track availability and traffic safety

» Track monitoring methods designed by SNCF
  • IN-2640 – Geometry for conventional tracks (≤220km/h)
  • IN-1896 – Geometry for high speed tracks (>220km/h)
  • ...
   Respect international requirements and are enhanced by SNCF maintenance engineering know-how

» Specify according to the line UIC group (tons/day) and speed
  • Parameters to monitor & associated thresholds (objectiv<alert<intervention<slow down)
  • Monitoring periodicity and equipment to be used
  • Process to follow according to defect severity

» Main track condition monitoring means
  • Dedicated measurement trains
  • Foot patrols – visual inspection and handheld measurement equipment
EXAMPLE OF MONITORED PARAMETERS MEASURED BY DEDICATED TRAINS

➤ Rail defects

➤ Track geometry

Twist

leveling

lining

gauge
EXAMPLE OF MONITOURED PARAMETERS MEASURED BY DEDICATED TRAINS

- Periodicity of track geometry measurement

HST

IRIS 320 every 2 weeks

CL

Mauzin

(T0)

(accelero)

Foot patrols

T0+6 month

Mauzin

(accelero)

Foot patrols

T0+12 month

Mauzin
EXAMPLE OF MONITORED PARAMETERS BY FOOT PATROLS

- Visual inspections during foot patrols
  - Rail fastening
  - Switch measurement patrols
  - Environment/surroundings
  - Rail patrols
  - Ultrasonic patrols
  - Heat patrols
  - Cold patrols
  - …
TRACK MONITORING AT SNCF IMPROVEMENTS LEVERS

- Railway infrastructure evolves differently following traffic and environment
  - Develop new prediction model based on data and physics
  - New and more predictive indicators ➔ collect new data

- Track monitoring periods are adapted to preventive/corrective maintenance
  - Towards a predictive maintenance ➔ need more data

- Lots of different monitoring means
  - Improve tracability
  - Improve visual inspections
  - Improve usability of monitoring data ➔ create value from data base

- Monitoring consumes lots of resources (maintenance agents and equipments)
  - Develop non-intrusive maintenance means and/or mass acquisition equipment
New projets & innovations
TRACK GEOMETRY MEASUREMENT USING IN SERVICE REVENUE TRAINS

- Non intrusive equipment continuously measuring track level and twist
  - Using acceleration measurement
  - Wired or wireless autonomous sensors (WCRR2013)

- Data analytics is used to provide daily reports on track evolution
  - The system is able to track a default
  - It uses measurement redundancy to improve data reliability
  - It correlates measurements with other data and proposes defaults prioritizations

- System designed with the objective of being a part of a IoT for railway infrastructure
TRACK GEOMETRY MEASUREMENT USING IN SERVICE REVENUE TRAINS

Example of reports from demonstrator running on RER E (dense urban area train, Paris)

Next steps: field experimentation of new maintenance method using this tool
TRACK MONITORING USING AUTONOMOUS SENSOR NETWORK

- WSN for loaded track geometry (used for sensitive area)

- Autonomous station for under layer long term monitoring
Automatic detection system through image processing

- Fastening anomalies
- Rail breaks
- Lack of ballast between sleepers
- Fishplate analysis: cracks, missing bolts
- Panoramic camera
- Twist & gauge measurement system
SURVEILLE
System outputs
TRACK MONITORING
SILVIA – SURVEILLE OUTPUTS REPORTING

![Image of SILVIA application interface]

### Statistiques annomalias

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<th>Type d'anomalie</th>
<th>Nombre</th>
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<td>0 Anomalie parasite</td>
<td>0</td>
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<td>286 Attache isolée</td>
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### Filtrer les anomalies

- **Types d'anomalies**:
  - Toutes

- **Etat d'amortissement**:
  - True

### 108 résultats trouvés

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Experimentation started in 2013. 3 trains are running.

- **Anomalies management system**
- **Automated report generation**
- **Repairing of the anomalies**
Developed by our subsidiary EURAILSCOUT

SIM main functionnalities
- Track & switches video-surveillance
- Switch measurements
- Track geometry measurement

SNCF experiments this wagon since beginning of 2014
The recorded images are to be visualized with a specific workstation.

Combination of these videos with measurements opens new perspective for monitoring.
Towards a new approach of track monitoring
TRACK MONITORING AT SNCF
AN EXAMPLE OF METHOD EVOLUTION
NEW APPROACH OF TRACK MONITORING

- Data analysis
- Monitoring/Inspection frequency
- Maintenance engineering

Predictive Maintenance
THANKS FOR YOUR ATTENTION!

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