Technology and maintenance of tracks at ÖBB

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We plan, build, operate and maintain railway infrastructure

18,000 employees
(of which 1,700 apprentices)

6,400 trains daily
146 million train kilometres per year

250 million passengers

1,069 stations and stops

4,826 kilometres rail network

8 rail freight terminals

42 railway companies on the network

2,5 billion Euro investment each year

23 billion Euro balance sheet total

3 billion Euro total earnings

50 million Euro earnings before tax (EBT)

Climate protection
Power from 10 hydroelectric power stations

18,000 employees
(of which 1,700 apprentices)

6,400 trains daily
146 million train kilometres per year

250 million passengers

1,069 stations and stops

4,826 kilometres rail network

8 rail freight terminals

42 railway companies on the network

2,5 billion Euro investment each year

23 billion Euro balance sheet total

3 billion Euro total earnings

50 million Euro earnings before tax (EBT)
Track Recording within the Maintenance Process

High-Tech Inspection for Economic Maintenance
OeBB Infrastructure’s Measurement Vehicles

Meas. technology permanent way
measurements up to 250 km/h
measures 20,000 km/year dGPS-
synchronizing equivalent conicity online

Meas. technology signalling syst.
Continous train running control:
Level measurement,
phasing signals, cross points
functional check of magnets

Meas. technology catenary
OHL position + OHL force
measurements up to 250 km/h
measures 15,000 km/year
dGPS-synchronizing automatic pole detection

set the proper activity - at the right place - at the best time
Data Processing According to Management Level

Classify safety relevant defects

Detect track quality

Determine wear reserve

Condense process distribute

Detect safety relevant defects

Determine track quality

Determine wear reserve

Control budget

Renewal tamping grinding

Tamping defect elimination

Data Processing According to Management Level

Classification stage: OeBB Infrastruktur AG / SAE/ FB FWT/Messtechnik (public)
werner.hanreich@oebb.at: Track Recording within the Maintenance Process
NATAS –
New Austrian Track Analyzing System
We merge, analyse and illustrate several information to provide the roadmaster to:

- set the proper activity
- on the right place
- at the best time

for economic management of rail infrastructure.
NATAS History

Starting with 1 sheet

- Time based maintenance
- Breakdown correction

Now 4 sheets + new sheet substructure

- Condition based maintenance
- Pro-active maintenance
- Sustainable maintenance

2004
2015
2016
NATAS Dataflow

Collection
- Track geometry
- Ultrasonic (US)
- Eddy current
- Ground penetration radar (GPR)
- Master data
- Maintenance Information
- Limits

Data Cleaning
- Plausibility check for valid signals
- Location shifts for good alignment

Analysis
- Charts and Reports for optimized planning of:
  - Grinding/Milling
  - Tamping
  - Rail exchange
  - Railpad exchange
  - Track exchange
  - Undercutting
1. Vertical Track Quality

- Twist 3m, 16m + Limits, Curvature
- Absolute value of Superelevation
- Longitudinal Level D2
- Longitudinal Level D1 + Limits
- History of Standard Deviation (100m) of Longitudinal Level
- Deterioration rate
2. Horizontal Track Quality

- Gauge + Limits, Rail foot, distance, Lap, Curvature
- Difference of left and right
- Longitudinal Level D1
- Alignment D2
- Alignment D1 + Limits
- History of Standard Deviation (100m) of Alignment
- Deterioration rate
3. Rail condition

- Gauge + Limits, Rail foot gauge, Lap, Curvature
- Rail inclination
- Equivalent Conicity
- Axle box acceleration
- Corrugation
- Side wear
- Vertical wear
- Head Check depth
- Rail type and age
4. Activities and Master data

- Maintenance and construction activities
- Topology of line, facilities
- Longitudinal slope
- Rail type, rail grade and sleepers
- Age of rail and sleepers
5. Track substructure (new 2016)

Substructure facilities, track distance, cutting, embankment, walls, ditches, drainage type, noise barrier

- GPR data, humidity of ballast and intermediate layer, fouling, waviness
- Heatmap of standard deviation longitudinal level
- History of standard deviation (100m) of longitudinal level
- Deterioration rate
Example: Rail and surface analysis

Combining and integrating:

- Rail wear data measured by the track geometry recording cars
- Head checks depth recorded by eddy current
- Rail defects detected by ultra sonic
Example: Evaluation of activities

Combining and integrating:

- Perfect located historic data for standard deviation longitudinal level D1

- Information about the construction work
Example: Evaluation of activities
to be analyzed
sustainable
Life Cycle Management
The Track System consists of several components in several basic and maintenance conditions and with different service life's.

**Cost driver of the track system in Austria is the yearly depreciation of the assets**

2 main strategies for an economic track:
- best initial quality (track components and track laying)
- extending service life by doing proper maintenance

**60 E1 rails**
**Concrete Sleepers with Under-Sleeper-Pads**
45 cm ballast bed thickness (under the rail foot)
Switches with movable point and the “Hydrostar” driving, setting, locking and detecting system from VAEE (voestalpine)
Fully mechanised track laying, modern tamping machines (4 X) + DTS
UTP long term experience
USP – Frankenmarkt
Load 23 Million Gross Tons/Year (380 MGT)

Experience ÖBB – Test Track, Installation September 2001

Test track
V = 110 km/h (68 mph)

USP

c = 152 mm (6 in)

Straight track 1
Station Pöndorf
UTP
Straight track 2
Data according EN 13848-5
Frankenmarkt, 4014 Track 1
Standard Deviation Longitudinal Level

mm
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0

275.0 275.2 275.4 275.6 275.8 276.0 276.2 276.4 276.6 276.8 277.0 277.2 277.4 277.6 277.8

km

sigh_M003_07112001_100m
sigh_M012_01072004_100m
sigh_M025_30082007_100m
sigh_M038_10062010_100m
sigh_M006_29082002_100m
sigh_M016_28072005_100m
sigh_M028_17072008_100m
sigh_M043_21072011_100m
sigh_M009_10072003_100m
sigh_M021_20072006_100m
sigh_M034_10082009_100m
sigh_M046_12072012_100m

USP
Frankenmarkt, 4014 Track 1
Standard Deviation Alignment

Dr. Rudolf SCHILDER

USP
Straight track 1
Straight track 2
Station Pöndorf

mm
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0

Year

Straight track 1 km 274.900 – km 275.500
Station Pöndorf km 275,500 – km 276,149
USP km 276,149 – km 276,950
Straight track 2 km 276,950 – km 277,800
Frankenmarkt, 4014 Track 1
Standard Deviation Longitudinal Level

Deterioration Rate (2011-2016)
- Straight track 1: 0.16 mm/year
- Station Pöndorf: 0.16 mm/year
- USP: 0.04 mm/year
- Straight track 2: 0.16 mm/year

Deterioration Rate (as of 2016)
- Straight track 1: 0.20 mm/year
- Station Pöndorf: 0.16 mm/year
- USP: 0.05 mm/year
- Straight track 2: 0.14 mm/year
ÖBB

USP Experience in turnouts

Track 1, Transition zone, 12 sleepers USP

Track 1, Turnout 103, 102 USP

Track 2, Turnout 101 MF
USP Experience in turnouts

Track 1
UIC60 BE19A 1994

Track 2
UIC60 BE19A 1992

Movable Frog
W101
EW UIC60-1200-1:18,5 Fz(Be) HBS-HB,Li

Single Block Frog
W104
EW UIC60-1200-1:18,5 Fz(Be)Re

USP

W102
EW UIC60-1200-1:18,5 Fz(Be)Li

W103
EW UIC60-1200-1:18,5 Fz(Be)Re

in service
new installed
USP
Transition zone (12 sleepers)
Results - change of the max. cant defect (UHmax)

Auswertungen – Veränderung des max. Überhöhungsfehler

blue W104+W101 no USP

red+orange with USP

Green tamping

movable frog, no USP
bewegliches Herz, unbeohlt
unbesohlt

besohlt

nur W101

Jahr
Longitudinal Level Standard deviation
S&C 60-500 – 1:12 – FZ(B)

Results - change of the longitudinal level (standard deviation)

Auswertungen – Veränderung der Längshöhe (Standardabweichung)

Graph showing the change of longitudinal level over time with different markers indicating specific conditions.

- nur W101
- bewegliches Herz, unbesohlt
- unbesohlt
- besohlt

Years: 2003 to 2017
USP: Quality after work is better AND deterioration is lower