NeTIRail

Needs Tailored Interoperable Railway Infrastructure

Dynamic measurements in Slovenia

NeTIRail-INFRA final conference, Ljubljana – 24th May 2018

Vlasta MIKLAVŽIN

Slovenske železnice

Prometni institut Ljubljana d.o.o.
Institute of Traffic and Transport Ljubljana l.l.c.

WP2 - Content

- Measuring technologies in Slovenia
- Dynamic measurement technology
- Dynamic measurement equipment
- Dynamic : Geometric measurements
- Dynamic : Corrugation measurments
- Conclusion

Technologies (1)

Measuring technologies in Slovenia

- measurements with traditional high resolution track monitoring equipment integrated into the train (measuring trains)
- monitoring technologies, performed with portable measuring equipment on standard vehicles

Technologies (2)

Measuring technologies in Slovenia

- Measurements of the geometric parameters of the lines: stability, direction, cant, twist, gauge (extension, narrowing); calculation of quality parameter KT500;
- Rail diagnostics: ultrasonic control of rails, rail wear measurement, rail corrugation measurement, control of rails with Eddy Current (head check);
- Measurements of dynamic track parameters: lateral acceleration, vertical acceleration; calculating the coefficient of derailment.
- Visual inspections.

Dynamics

Dynamic measurement technology

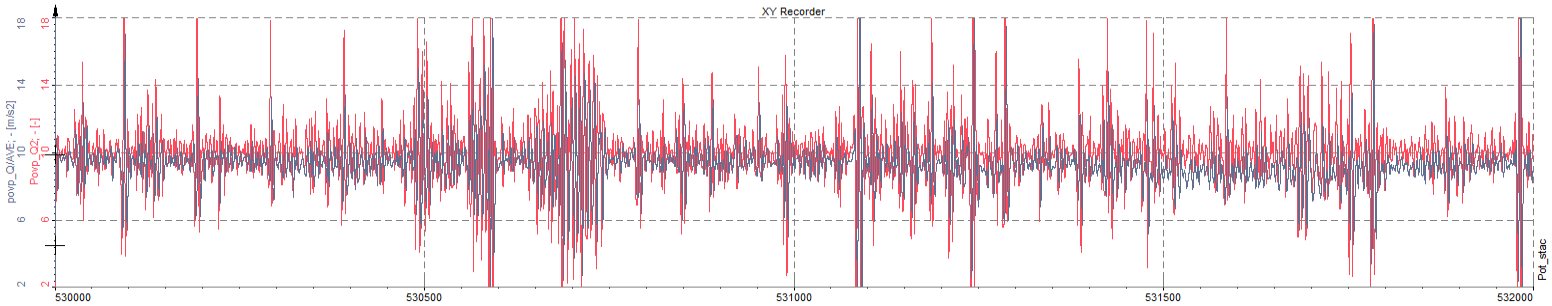
- Portable measuring equipment, sensors mounted on a bogie of passenger train, measuring system
- Preliminary preparation, calibration, installatin, setup file
- Measuring lateral ans vertical acceleration
- Average lateral and vertical acceleration, lateral force
- GPS kilometre position of a train

Equipment (1)

Dynamic measurement equipment

- Low frequency accelerometers: four vertical and four lateral accelerometers; Dewesoft, frequency range 80 Hz, sensitivity 30 and 145 mV/g.
- High frequency accelerometers: four vertical and four lateral accelerometers; Dytran DC response accelerometer, ± 100g range, frequency response 0 - 2500 Hz, sensitivity 40 mV/g.

→ difference in detection of vibration friquecies



Equipment (2)

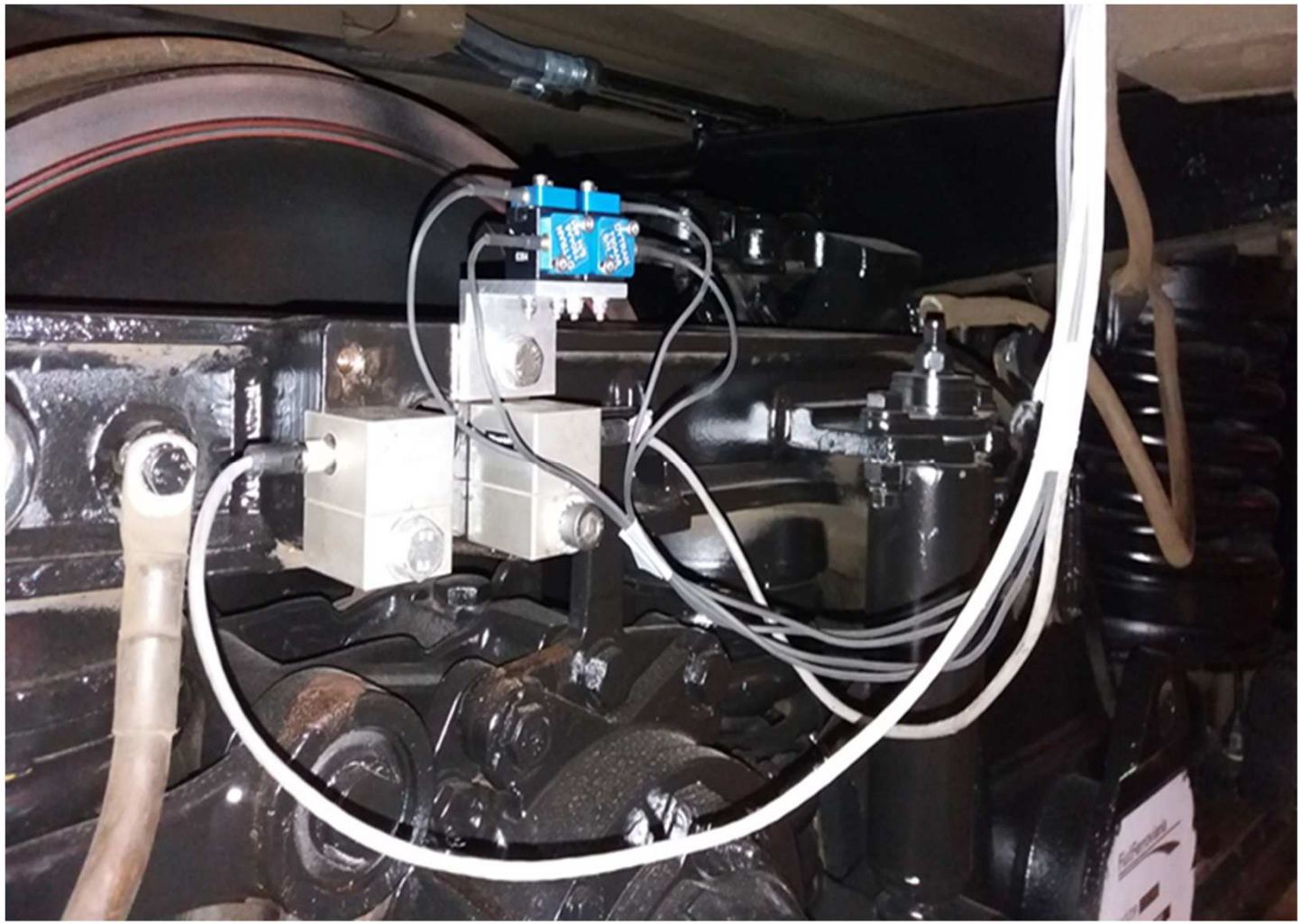
Dynamic measurement equipment

- Low frequency accelerometers Dewesoft

- High frequency accelerometers Dytran

Equipment (3)

Dynamic measurement equipment



Geometry (1)

Comparrison Dynamic & Geometric measurements

- correlation of lateral acceleration (F) with geometric parameters (D, C)
- Lateral acceleration : Direction, Cant

- correlation of vertical acceleration (E) and geometric parameters (A, B)
- Vertical acceleration : Stability, Twist

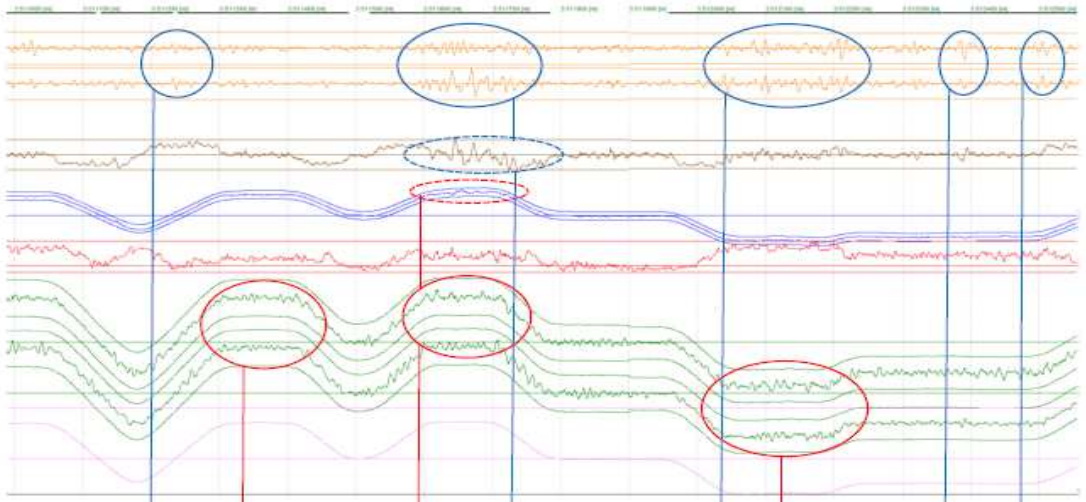


Figure 4–4 Parameters of geometric measurements on 1,5 km section 10L 511.000-512.500 (DrezStac), November 2017.

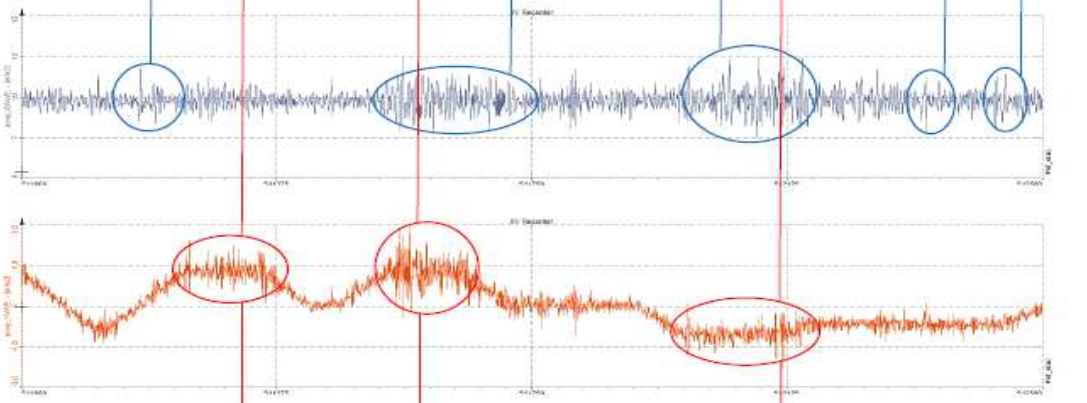


Figure 4–5 Vertical and lateral acceleration on 1,5 km section 10L 511.000-512.500 (DEWESoft), December 2017.

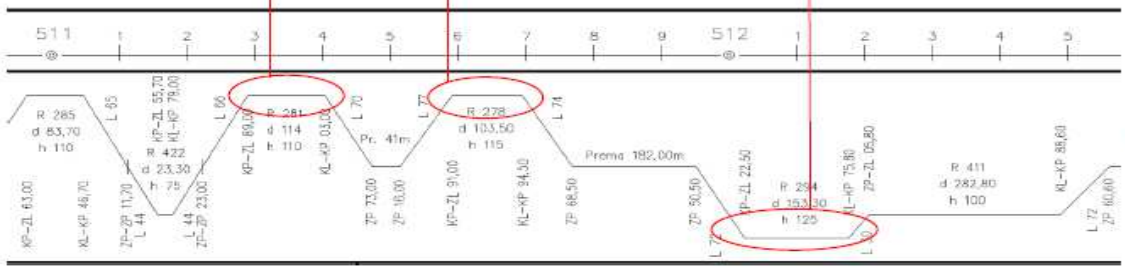


Figure 4–6 Longitudinal profile of 1,5 km section 10L 511.000-512.500.

A – Stability (left and right rail)

B – Twist

C – Cant

D – Direction (left and right rail)

E – Vertical acceleration

F – Lateral acceleration

G – Longitudinal profile

Corrugation (1)

Comparrison Dynamic & Corrugation measurments

- correlation of vertical acceleration and track stability
- Vertical acceleration : Stability

- track sections with corrugation, on right or left rail
- Corrugation : Greater difference in signal density (strength) of vertical acceleration - *between high and low-frequency sensors*???

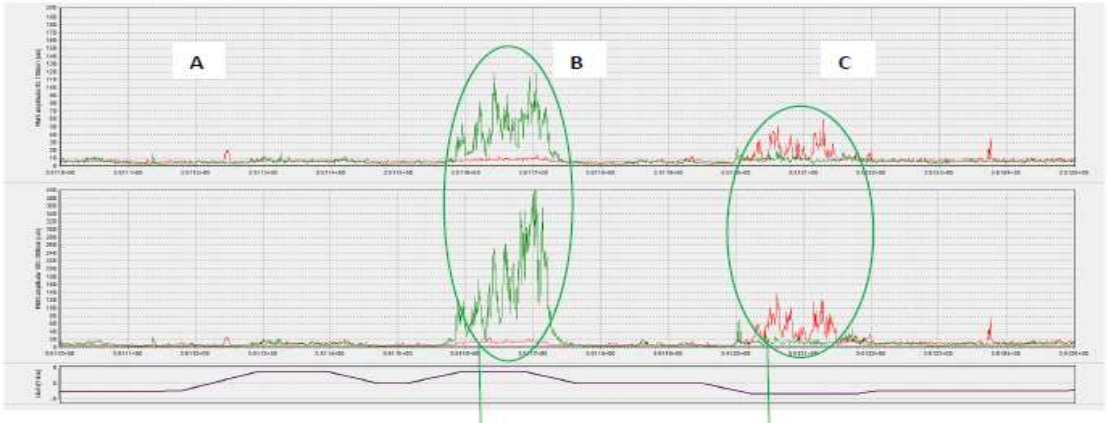


Figure 4–7 Corrugation measurements on 1,5 km section 10L 511.000-512.500 (CorrViewer), red-left rail, green-right rail; August-September 2016.

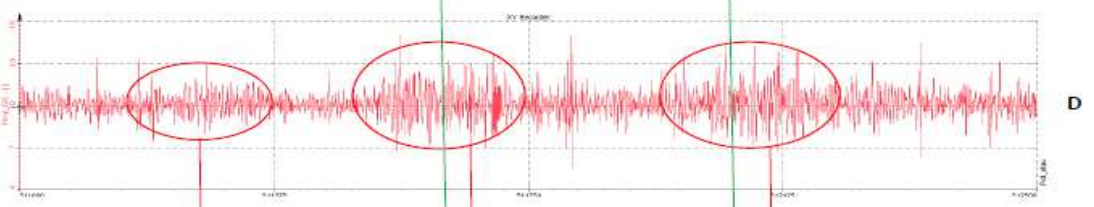


Figure 4–8 Vertical acceleration on 1,5 km section 10L 511.000-512.500 (DEWESoft); December 2017.

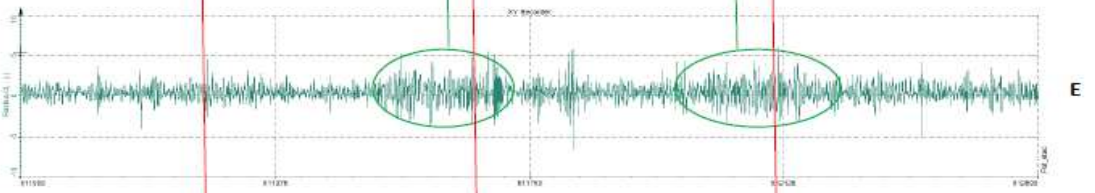


Figure 4–9 Difference in vertical acceleration between high-frequency and low-frequency sensors.

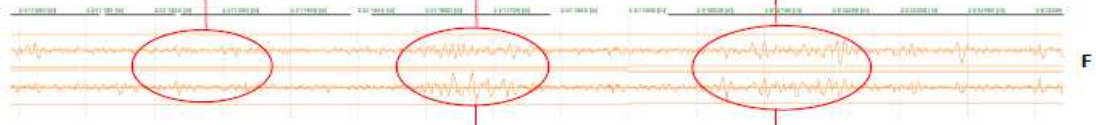


Figure 4–10 Geometric stability on 1,5 km section 10L 511.000-512.500 (DrezStac); November 2017.

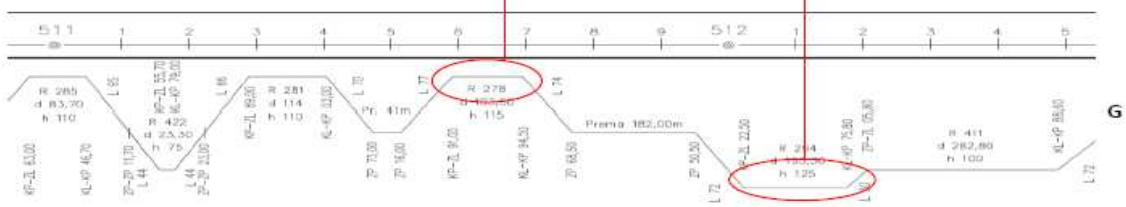


Figure 4–11 Longitudinal profile of 1,5 km section 10L 511.000-512.500.

A – No corrugation

B – Corrugation of right rail

C – Corrugation of left rail

D – Vertical acceleration

E – Difference between high and low-frequency vertical acceleration

F - Stability

G – Longitudinal profile

Corrugation (3)

Comparrison Dynamic & Corrugation measurments

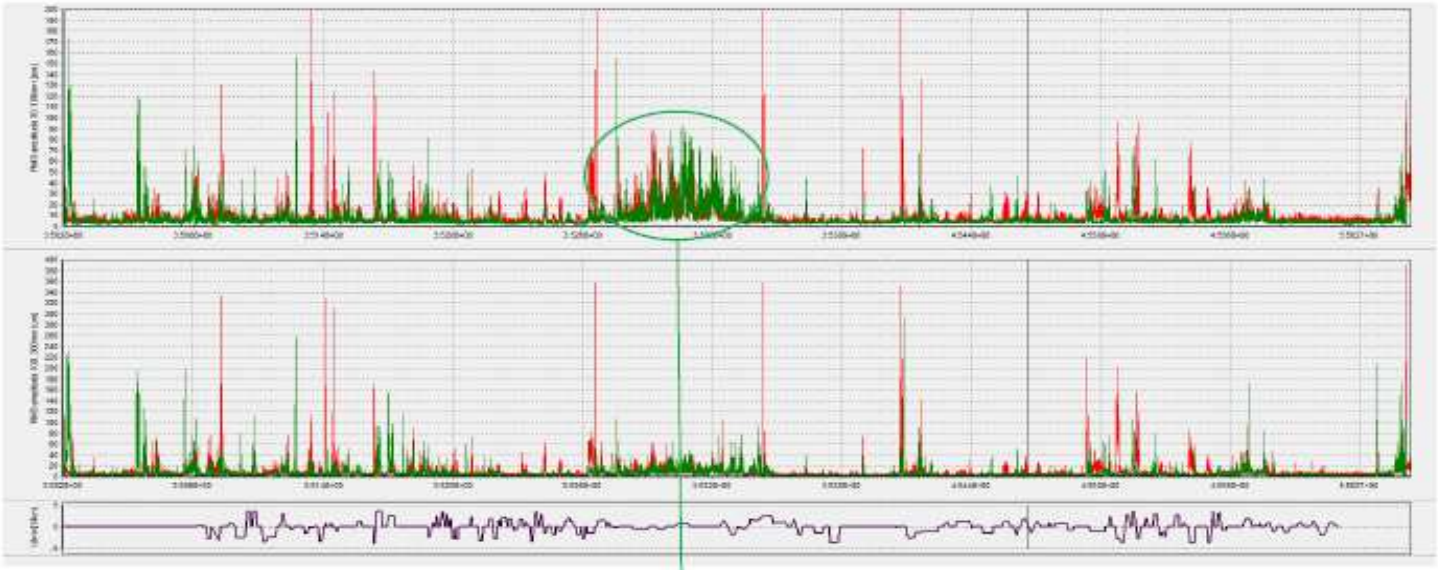


Figure 4–12 Corrugation on rail line 10L state border-Dobova-Ljubljana.

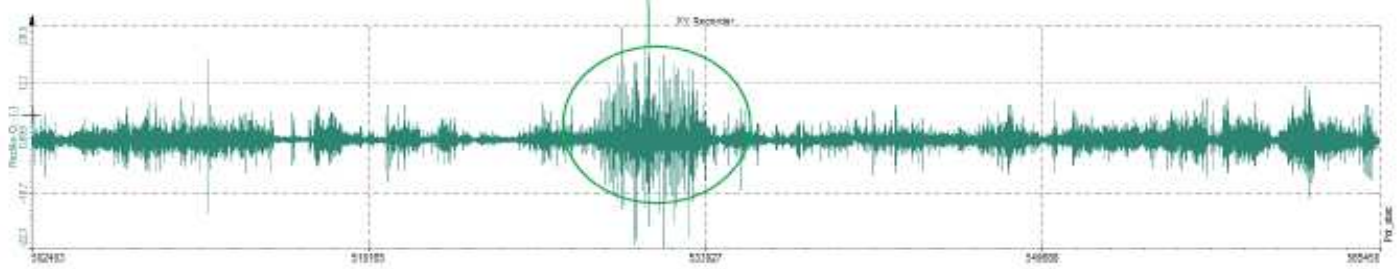


Figure 4–13 Difference in vertical acceleration between high-frequency and low-frequency sensors on rail line 10L state border-Dobova-Ljubljana.

Conclusion

- great reliability on the correlation between dynamic and geometric parameters
- correlation for corrugation with a dynamic vertical parameter, but not so pronounced → sensors should be placed closer to the formation of the corrugation

- **Potencial usability for "early diagnostics"** purposes → *to improve system, additional research, other different sensors tested*

THANK YOU for your attention!

Prometni institut Ljubljana d.o.o.
Kolodvorska 11, SI-1000 Ljubljana
Tel.: +38612914625, +38612914626
Fax.:+38612319277
vlasta.miklavzin@prometni-institut.si
www.prometni-institut.si

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