IVT

Institute for Transport Planning and Systems
Project Summary

Curve "breathing" behaviour in small radius curves with continous welded rails

Institute for Transport
Planning and Systems

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Behaviour of radial breathing in sharp curves of continuous welded railway tracks

Background

Since the 1930s railway tracks were increasingly welded continuous. Maintenance costs are much lower and life cycle of rails is longer. Nowadays the neutral temperature of rails is fixed at 25 °C in between the temperature extremities. Compression stress in summer and tensile stress in winter are not compensated by rail joints. A high position stability of the track is indispensable, though no lateral buckling may occur. However, in sharp curves the track is pushed to the outside by high temperatures. In standard gauge, these displacements are admissible, though curves with a radius below 200 m are still build with rails joints. These produce high maintenance costs (10.000 CHF/joint x year). Metric gauge railways are allowed to weld all types of radiuses: Lateral displacement is accepted and called “curve breathing”. This reduces thermic inducted stress and decreases the risk of spontaneous buckling.

Research

For improving the actual standards in force, the national transport authority (BAV) initiated a surveillance of the breathing behaviour of sharp curves. 4 track curves with different types of track material were continously monitored during a year. It was shown, that curve breathing is real, not as desired uniformly, but irregular along the curve in form of a sine wave. (fig. 1). The regularity of this wave, shown in all 4 monitored curves let hypothesize that the reason are not irregularities in the track superstructure. Hypothesis of this research is, that the monitored wave has a physical geometrical nature. As both rails are stressed equally, both want to expand the same way. A regular displacement of the curve would afford a greater expansion of the exterior rail. Consequently, the sine wave is the only deformation possible, which allows an equal extension of both rails.

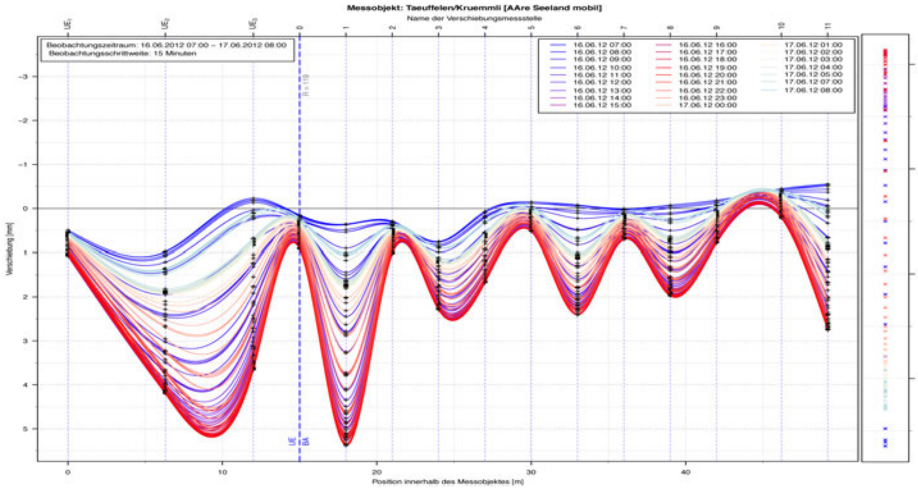

Figure 1: Curve breathing

Track stiffness of the observed tracks were pretty the same. Now we are monitoring a track with a much higher stiffness. The educated guess is, that a higher stiffness leads to longer wave lengths, which has a lower impact to the rolling stock. Practically this is achieved by metallic Y-sleepers. These have 3 points of support instead of 2. As Y-sleepers have different disadvantages, it is tested by which other method a high stiffness is achieved.

Client

BAV - Bundesamt für Verkehr
VöV - Verband öffentlicher Verkehr

Contribution IVT

Managing research programm, measurement of curves, static modell

Applied methods

Sequentially and continously measurements of sharp curves, laboratory experiments

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