RILA™ GEODETIC BACKBONE FOR RAIL INFRASTRUCTURE

Fugro’s train-borne RILA solutions enable track and associated assets to be recorded and analysed with unprecedented accuracy so your railway asset management is future-proof and significantly more cost-effective.

Smart maintenance – clever surveying.
This article describes a new tamping method recently trialled by Fugro in the UK. The preliminary results were successful and indicate that Fugro’s new method provides insights into maintaining track geometry that reduce dynamic forces, ultimately reducing maintenance costs for track and train operators. It is assumed that readers of this publication understand the principles and need for tamping so, rather than providing a detailed explanation, we will look at the two main approaches: reference geometry and absolute track geometry.

Reference geometry
Reference geometry principles are applied via several methods, from a smoothing pass to a measurement run undertaken by the tamper prior to the tamping run, whereby the machine supervisor implements a best-fit solution created within limited lifts and slew values. However, the disadvantages of applying reference geometry tamping over time are ‘longitudinal movement’ or ‘drift’ of the transition between straight and curve. This can generate multiple radii within one curve, where long-wave track faults are not treated, which create extra acceleration forces between the train and track and increase the dynamic loading of both. Track alignment deteriorates faster, necessitating more tamping and creating a negative spiral. Not only does this increase operational maintenance costs, but the track’s lifetime is also reduced, which increases the depreciation costs of the track components.

Absolution track geometry
To overcome these disadvantages, absolute track geometry tamping was introduced and made available by the tamper manufacturers. For example, Plasser & Theurer uses curve laser and EM-SAT and Matisa adopts its Palas system. Absolute track geometry tamping relies on the availability of fixed coordinates: these are XYZ positions based on the Ordnance Survey (OS) grid established using geodetic techniques. The OS grid covers the whole of the UK and each point has a unique XYZ location. In the UK, the West Coast Main Line has been geodetically surveyed and every Overhead Line (OHL) mast has a spigot (bolt) with a known XYZ location. These geodetic-fixed spigots form the backbone of the geodetic alignment fixation, whereby longitudinal movements of transitions and long-wave track faults are overcome. Of course, the disadvantage is that geodetic surveys are time-consuming, costly and require people on or near the track.

Fugro’s tamping trial
The purpose of Fugro’s tamping trial was to eliminate the disadvantages of both these approaches. Mile reference 187 to 188 of the Dartmoor Railway was chosen as a test site by Network Rail. This line is operated as a heritage railway during the week and by GWR at the weekend. With the support of the heritage railway, a geodetic survey was performed using Fugro’s RILA system mounted on the back of a road/rail Land Rover.

The RILA data was post-processed and a best-fit alignment was designed to optimise the curve radii, transitions and straights. As both data sets (RILA and alignment) are built up of a string of XYZ coordinates, computing the lifts (vertical track adjustment) and slew values (horizontal adjustment) is straightforward.

A Colas Rail Matisa B 41 UE tamper was assigned to perform the works. The Matisa GECO tamper guidance computer requires two different information source files. In simplified terms, the first set contains the geometry description of the best-fit alignment - for...
example, start point; mile 187 to mile 187.3 straight; mile 187.3 to mile 187.5 transition; mile 187.5 to mile 187.8 R=1600, etc. - until the end. The second file contains the lifts, slews and cant information at 10 metre intervals, and also the run-in and run-out area for the tamper.

**Successful result**

To establish whether the test was successful, Fugro had to prove that the tamper had achieved the computed lift and slew at each point along the track. An independent track baseline was installed and the horizontal ($h_1$) and vertical ($v_1$) distance to the existing track was recorded at 50 metre intervals. After tamping at the same interval points, the new horizontal ($h_2$) and vertical ($v_2$) distances were recorded. In theory, $h_1-h_2$ is the GECO-entered slew value and $v_1-v_2$ is the GECO-entered lift value. The trial was deemed a success when the difference in the RILA-achieved slews and lifts and GECO-entered slews and lifts was smaller than 5mm.

The graphs in Figures 3 and 4 show the results: the red lines are the required slews and lifts, and the blue lines are the achieved slews and lifts. Overall, a great improvement was achieved, but not as dramatic as expected. Whilst analysing the data, it became clear that the tamper had smoothed the track between each 10 metre point in an attempt to achieve the geometry specification.

Following the promising outcome of this initial test, Network Rail has identified a number of main line sites for further testing. At these sites, correction data (lift and slew) at one metre intervals will be provided to the tamper’s guidance computer.

**Conclusion**

Fugro’s new tamping method, utilising design lift and slews at one metre intervals, has been proven to improve track alignment and quality over the pre-intervention track in comparison with the current convention of 10 metre intervals. By applying the design in a more controlled manner, the machine makes fewer interpolation calculations between the design points, which results in a significantly better implemented design. Fugro’s approach supports more sustainable whole-life geometry and increased track quality, which ultimately reduces maintenance costs and improves safety.

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**Figure 7:** The successful completion of the trial at Bow Station.