

Automated control when moving a bridge

A Leica TCA 1800 automatic target recognizing precision total station, controlled by the Leica APS Win Software, was in use when a bridge was moved by 23 metres below the Inter City Express main rail axis Mannheim-Frankfurt. This work on the Mannheim-Blumenau railway line was carried out by the Mannheim office of Bilfinger + Berger Bauaktiengesellschaft. The surveyor responsible for the measured control of the undertaking H. P. Echsle, describes this operation for our readers.

Improvement of the Inter City Express high speed railway line

As part of the improvements to the high speed railway line on the western double track Inter City Express link Mannheim – Frankfurt am Main the barriered level crossing at ground level in Mannheim-Blumenau had to be extended to become a road underpass in a groundwater carrying area. Because this line is one of the German Federal Railway Ltd main north-south routes, rail traffic could only be minimally restricted (slow speed line with a maximum of 70 km/h). For this reason the construction was built in the form of a sliding frame in a ditch directly next to the tracks.

2,400 Tons Heavy and 18 Metres Wide

This sliding frame building element was 18 metres wide, 13 metres long, 8 metres high and weighed 2,400 tons. With computer-controlled hydraulic presses having a force of 3,500 tons, it was pushed 23 metres



Leica miniature prisms were located at all important surveying points. They are clearly seen here next to the red clamps. Photo. Gudrun Keese



Here the Leica TCA 1800 automatic target recognizing total station is being installed on the surveying column at the site. Computer-controlled and recording to the APS Win measuring programs, it took aim at the miniature prisms without the presence of an observer and determined their current position with great accuracy. Photo: Gudrun Keese

under the tracks until it reached its final position.

To achieved this, from the surveying point of view, there were two problems to solve:

- monitoring the element during sliding,
- monitoring the tracks.

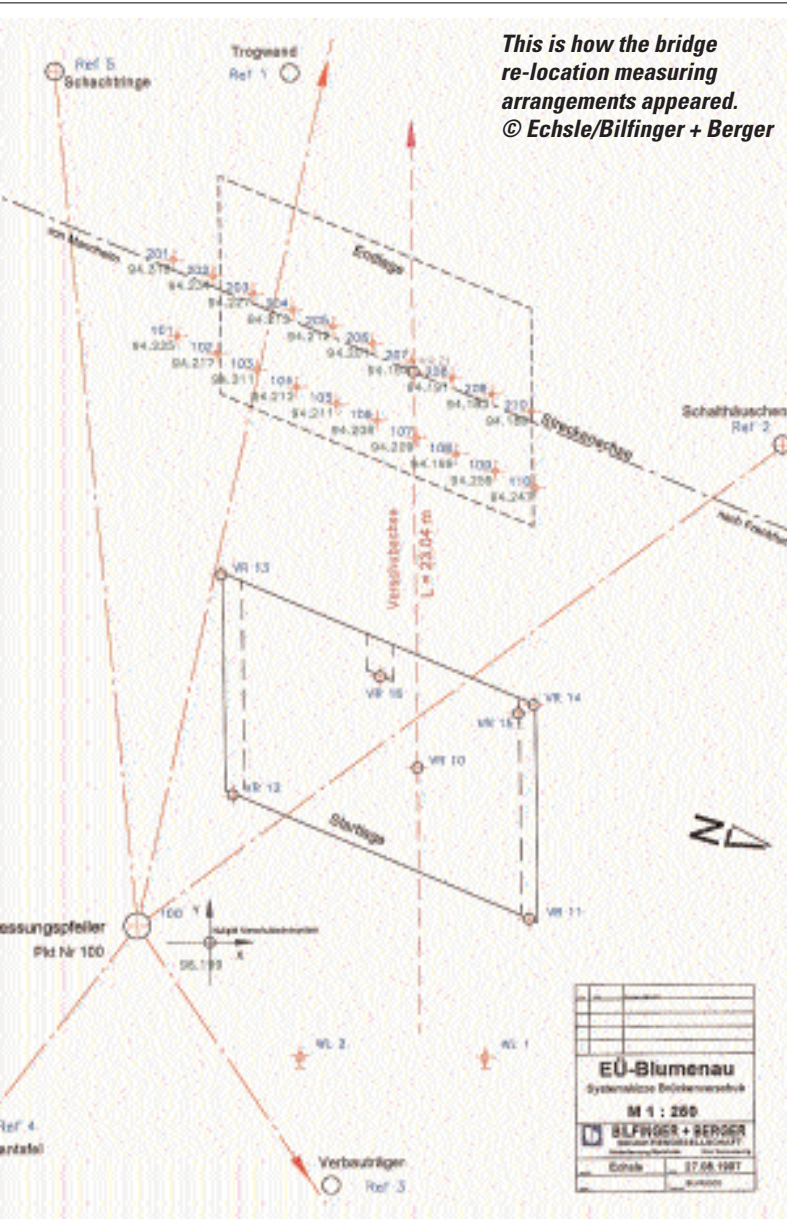
Measuring points signalled with Leica miniature prisms

For this purpose three groups of points were established:

1. Five reference points for location control (Ref 1-5),
2. Seven sliding frame measuring points (VR 10-16),

3. Twenty deformation measuring points on the provisional bridge for the tracks (D 101-110, D 201-210).

Leica miniature prisms were fixed to all these measuring points. The automatic target recognizing Leica TCA 1800 total station

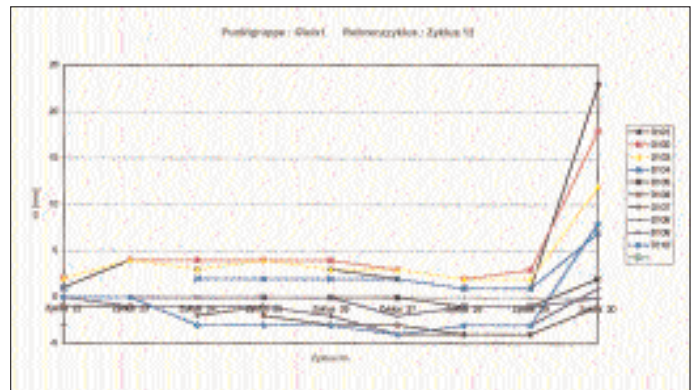


This is how the bridge re-location measuring arrangements appeared.
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which was installed on a surveying column, re-determined the measuring point coordinates during the sliding process after each 20-40 centimetres of the slide path.

Immediate automatically balanced coordinate values

The re-measuring of the sliding process, which was required, was started by a single operator between halts and pauses between trains. The Leica APS Win software controlled the measuring procedure completely automatically. Balanced coordinate values were available immediately,



The deviation at each measuring point was recorded and graphically presented at regular intervals.



The sliding frame element was prefabricated in a ditch 23 metres away.
Photo: Gudrun Keese

and with their help, the movements of the sliding frame were ascertained according to position and height. Controlling the sliding frame was consequently no problem.

The final position was reached with a traverse error of +2 mm on the front edge of the frame and +6 mm at the rear. A final deviation of ± 25 mm resulted for the height of the frame caused by the slide path.

Track settling diagrams with MS Excel

For visualising the deformation in the tracks, settling diagrams were drawn up with the help of the MS Excel spreadsheet

program. The data transfer from Leica APS Win was effected with a self-written program. With the help of this settling diagrams, it was possible to quickly remedy the deformation in the tracks.

The combination of the Leica APS Win Software with the automatic target recognizing Leica TCA 1800 precision total station allows us to acquire and visualise large-scale building movements quickly and accurately.