

# Ingenious Bridge Replacement

Installation of 22 new sections of the Moresnet railway bridge in Belgium turned out to an ingenious and unique transport and lifting operation. The 1107m long bridge, the longest in Belgium, crosses the Geul valley. During a two-year project every eight weeks two 280-tonnes old steel bridge sections

The Moresnet railway bridge, located close to the Belgium, Dutch and German border, is part of the economically important railway line connecting the Belgium seaports with the German industrial hinterland, mainly the Ruhr area. The bridge, built during World War I by the occupying German forces, was destroyed and re-built 3 times. Since the last reconstruction in 1949 the viaduct was now in a state of repair, requiring a speed limit of 20km/hr. As part of a major renovation plan the Belgium Railways granted Belgium contractors Galère, part of the Dutch Hollandse Beton Groep (HBG), in combination with Belgium bridge building specialists Aelterman, an order worth E23.5 million to renovate the viaduct in order to allow normal railway traffic at 60km/hr starting 2005.

The bulk of the renovation work consists of replacing all 22-bridge sections. All old sections are 48m long and weigh 280 tonnes. The new sections weigh 700 tonnes and measure 48 long, 7,1 wide and 10m high. Because of the hilly country side the height of the bridge varies from 23 to 63m. 5 Large pillars and 16 smaller ones carry the

structure. In the second part of the structure a 350m long bend, with a radius of 1600m, further complicates the operation. To meet the complex challenge to replace 2 bridge sections within a 50-hour timeframe heavy lift and transport contractors ALE Lastra from Breda, The Netherlands, together with their Belgium client Aelterman, designed an ingenious and innovative method. It consists of following three main steps: 1. Final assembly of pre-fabricated bridge elements at a temporary factory at a nearby shunting-yard 2. Moving the new bridge sections to site by rail 3. Replacing the old sections by new ones by means of a special lifting platform.

## Special Lifting Platform

Aelterman prefabricates the new bridge sections, as large as road transport allows, at their works in Gent, Belgium. The steel modules arrive at their temporary facilities at the rail shunting-yard in Moresnet. Assembling takes 3 steps, including the installation of a concrete deck with a double track on top. In this way every 8 weeks Aelterman



In order to move the 1000t lifting platform and bridge section a special assembly of two 20-axle rail bogies is required. The bogies run parallel.

completes 2 new and ready-made bridge sections. Replacement by ALE Lastra is next during a long weekend. In fact ALE Lastra's work already starts earlier. As soon as the first section is ready, they skid it out sideways, out of the hall and over the first 2 tracks. Although this is a routine operation, the fact that it requires loading underneath the special lifting platform that is already in place over the next set of tracks complicates the operation.

The specially designed and built lifting platform, in fact there are 2, consists of a horizontal lattice steel structure weighing 120 tonnes. Because of the limitations on the bridge the platform had to be as long as a bridge section. Therefore the required 30m high and 35t weighing jack-up legs had to be fitted at both sides of the platform. In order to facilitate loading from the site, additional temporary legs are fitted to the front and end of the platform to enable both jack-up legs, facing the bridge section, to be lifted. Once the new section is skidded underneath both jack-up legs are lowered again, the temporary ones are removed and the platform can now be lowered on to the section. When both are connected the 400-tonne capacity legs are raised again to enable the bridge section, now with the platform on top, to be skidded sideways over the next 2 railway tracks. In this way it makes place for the second platform to be moved in place, loaded on top of a specially designed rail bogie platform trailer.

### The rail bogie platform trailer

In order to move a new bridge section to site, with the lifting platform on top, ALE Lastra designed a special solution. They created a 40-axle rail platform trailer, similar to a modular hydraulic trailer or dolly set up used for heavy transport by road or house moving, but now consisting of 2-axle rail bogies. Because of the dimensions of the load, a total transport weight of about 1,000 tonnes and a relatively high centre of gravity (CG) the 40-axles had to be spread evenly over two parallel tracks and split in two groups of 8-axles. Each group carries one end. Another group of 4-axles supports the middle. Because of further complicating factors in the about 3km long journey to the Moresnet viaduct, each group of bogies was interconnected by beams both in length and, finally, also one across. In this way one loading beam remained per group. In order to adapt to the radius of the bend halfway the journey all bogies are designed to allow limited steering. And, because this bend also features a height difference between the in- and outside track of about 100mm, the high CG requires compensating the height difference by integrating



The about 3-kilometre long and partly complicated rail spur leads the first bridge section from the assembling location to the Moresnet bridge. The second bridge section is already awaiting the return of the rail bogies.

cylinders in the beams supporting the load. A further set of horizontally positioned cylinders, in combination with a limited free movement of the load supporting beams in the horizontal direction, also allowed for adapting to the variable width between both tracks, ranging from 1.95 to 3.00m.

The rail bogie platform trailer comes in to play to load the first bridge section on a Friday, prior to the actual operation starting Saturday. When the section is skidded over the second set of tracks, the legs of the lifting platform are....

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Four Gottwald railway cranes owned by the Belgian Railways provide the traction and braking power to guide the bridge section through a bend and on to the viaduct.