

Speedy Replacement of Expansion Joints thanks to MMBS and "Box in Box" System

MAURER combines in Hamburg 2 time saving procedures.

Hamburg. On the elevated Elbmarsch road in Hamburg, which is one of the expressway sections with the highest traffic density in Germany, an expansion joint had to be replaced over the total width of the carriageway. In order to reduce the impact on the traffic flow to the extent possible, the subcontractor employed the MAURER "MMBS" which refers to the MAURER Modular Bridging System. This system facilitates the crossing of the job site and ensures a fast switch between "job site mode" and "traffic mode". The expansion joint was then installed with the so called box in box procedure, thus saving time consuming operations into the bridge structure.

The elevated Elbmarsch road is the longest road bridge in Germany. Without ramps having a length of 3,840m, this multi-field-bridge was built from 1971 to 1974 and is part of the A 7 expressway South of the new Elbe tunnel. After so many years, one of the ageing expansion joints located at the exit Waltersshof direction North had to be urgently replaced.

At this location the carriageway has a width of 20.40m: 3 driving lanes, 2 approach lanes and one stop lane. A replacement of the expansion joint thus leads to impairments of the traffic. The challenge was to keep this impairment to a level as low as possible. "For this reason we proposed the use of the MMBS system", reports Holger Redecker, branch manager of MAURER in Lünen. "The big advantage was that during the day the traffic could flow almost without impairment, and that the switch from traffic mode to job site mode could be implemented very fast."

Bridge simply

The MAURER Modular Bridging System bridges structural gaps and was invented by MAURER to reduce the high costs of establishing a job site when expansion joints had to be replaced. Conventional systems require a costly installation. The MMBS is being fixed firmly at one side of the superstructure, and the other side is being opened and closed on demand. The maximum bridging span is 2.2 m.

Once that MMBS is installed, the switch between job site mode and traffic mode is extremely simple: The job site cover is being opened by way of a linkage and stabilized in vertical position. In closed state the MMBS can be passed at a



Traffic is still flowing: the MMBS steel plates can be passed at up to 70 km/h. Below to the left the structural gap can be seen, with the old expansion joint already removed.

Photo: MAURER/Erik Krüger



A fast and simple process: opening and closing of the modular job site bridging system by way of a linkage.

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speed of up to 70 km/h. The mobile flap is made of steel and, like an expansion joint, accommodates thermal and dynamic displacements into longitudinal direction. Its first usage was implemented in 2011 at the Farlington Viaduct at the A3(M) in Southern England.

Modular Usage

The MMB System is modular and thus can adapt to any widths. In Hamburg there were 17 modules of a total width of 20.40 m. Due to the fact that the expansion joint was installed in three sections, always only a limited number of modules had to be opened, while the traffic passed over the other ones which remained closed.

A further advantage is the multiple usage of the highly loaded steel flaps. "A part of the modules was already employed for the retrofit project of the Paradise Bridge at the A43 expressway, close to the expressway triangle Wuppertal-North", reports Redecker. "Another part was exclusively manufactured for the job site in Hamburg." For the job owners this translated to cost savings by way of a rental agreement, and in respect to the environment also we have a lesser usage of resources.

Replacement "Box in Box"

The second time saver was the replacement of the old three seal joint for a new 2 seal joint type D 160 in employing the "box in box" system.

This means that the new expansion joint was manufactured exactly with their support beams in the same location as the old support beams, such that they could be placed into the old existing joist box.

We have to understand that if the bridge expands, e.g. by temperature increase, the expansion joint will contract, and the support beams move into the superstructure respectively into the abutment. In order to facilitate this movement, joist boxes are being installed into the superstructure which accommodate these support beams. In case of a conventional replacement of an expansion joint these joist boxes have to be removed, including their anchorage. In Hamburg however the old boxes remained at their original location, and the new expansion joint is being integrated into the old joist box. This system that takes advantage of the already existing space is called "box in box".



Working at the structural gap: all moving parts of the old expansion joint were already removed, and now the structural gap is being prepared for the accommodation of the new tailor made expansion joint. The expressway is only partially closed, and the traffic flow continues on the other lanes.

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The retrofit of the elevated Elbmarsch expressway took 6 weeks, with work done at each night from 20:00 to 5:00. First, the asphalt was removed as well as the waterproofing layer. Of the joist boxes which were now accessible, the upper lid was cut off and all movable parts of the old joint were removed. At the inner side of the remaining edge structure new edge beams were welded. The new expansion joint of a length of 22.96 m was installed in 3 sections, then aligned and being welded together at the butt joints and with the lower structure. Strip seals were inserted at a later point in time.

Totally renewed corrosion protection

Special care in this "box in box" system was taken onto the corrosion protection, which was also renewed at those parts which were not replaced. Finally, the open area over the joist boxes was covered with Betoflex®-Polymer concrete.

Superstructure was treated with care

Besides the savings of time, the big advantage of the box-in-box retrofit was that the substructure was not subject to operation. This way risks of possible damages to prestress tendons or cracks were constantly avoided.

The short retrofit time could only be kept because all works were integrated. In Hamburg the execution as well as the coordination of all works could be guaranteed out of one hand, MAURER.

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Quick facts about MAURER AG

The MAURER Group is a leading specialist in mechanical engineering and steel construction with over 1,000 employees worldwide. The company is the market leader in the areas of structural protection systems, (bridge bearings, expansion joints, seismic devices). It also develops and produces professional roller coasters and Ferris wheels as well as special structures in steelwork.

Among the most notable large projects are the entire technological bridging equipment for the Russky Bridge in Wladiwostok, the world's largest cable-stayed bridge. When it comes to steelwork, our showpieces include the BMW World and Munich's Airport Terminal 2. Spectacular amusement rides include for example the Rip Ride Rockit Roller Coaster in Universal Studios Orlando, Dragon Legend, the first Green Coaster at Romon U-Park in Ningbo China, and the Fiorano GT Challenge in Abu Dhabi.

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