

MAURER Expansion Joint Retrofit

An alternative to a complete replacement



MAURER Expansion Joint Retrofit System „Box-In-Box“ - lifting the new expansion joint into the old and prepared block-out

Expansion Joints are structural members under dynamic loads, and can remain in use for decades by way of regular maintenance and replacement of the wear parts like sliding bearings, sliding springs, control springs, sealing elements, and by maintaining the corrosion protection.

Should damages accumulate by way of cracks in the steel structure, the life time of the expansion joint has come to an end. Next to a complete replacement of the expansion joint there are alternatives available by way of retrofits which offer the client economical and technical advantages. Thereby, the anchoring structure of the joint remains in the bridge deck, because it has to accommodate only negligible fatigue strains, and its lifetime is being defined mainly by the corrosion protection. Corresponding to the type of expansion joints, various options for retrofit are available.

- **Short execution time**
- **Flexible arrangement of the working sequence**
- **Minimum intervention in the structural fabric**

1. Retrofit of a Single Seal Expansion Joint

In case that the edge beams are so much damaged that a watertight fixation of the strip seal is no longer possible, or the gap between the edge beams should be too narrow to replace the sealing elements, the single seal expansion joint can be retrofitted with relatively little effort. To do so, the expansion joint must be opened at both sides by a width of ca. 20 cm. That is, the asphalt (or concrete) in the carriageway and the concrete in the footway section has to be dug out. The edge beam is being cut away at the level of the flange part. The lower structure remains in the bridge deck and receives a new corrosion protection. On this remaining lower part a new edge profile is being welded. Finally, a new strip seal is being inserted. That is, all critical parts of the single seal expansion joints can be replaced without violating the bridge superstructure or the abutment. This retrofit can be carried out without any problems by partial blocking of traffic (half-side), such that the inhibition of traffic is reduced to a minimum.

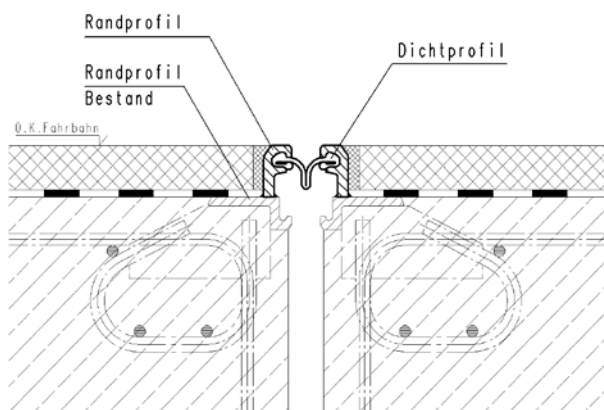


Fig. 1 - Retrofit of a single seal joint, after completion of works

2. Retrofit of a multi seal joint into a single seal expansion joint

Such a retrofit is only possible when the movements of the bridge will become less over the course of the years. In case of concrete bridges, the displacement share of shrinkage and creep will have subsided almost completely after a few years, and consequently a multi seal joint can be retrofitted into a single seal joint. A renewed structural calculation will determine the possibility.

In this option, all movable and wearing parts will be completely removed (centre beams, support beams, bearings, springs, sealing elements). Also in this case, the existing anchorage will remain in the bridge structure.

In comparison to the retrofit of a single seal expansion joint, in this case the expansion joint need not be set free at its both sides, because the new edge beams will be set into the gap, in front of the existing edge beams.

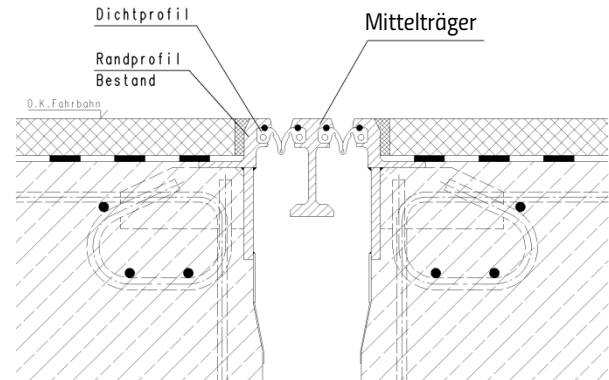


Fig. 2 - Retrofit of an existing multi seal expansion joint

For this, at the inner side of the existing gap consoles will be welded, onto which the new edge beam will be welded. The steel structure will receive a completely new corrosion protection, and the retrofit is completed with the insertion of the sealing elements.

This retrofit is of special interest for a client, because:

- there is virtually no intervention in the bridge's structure
- the maintenance efforts are greatly reduced. Only the sealing element remains as a wearing part.

Also in this case, the retrofit can be achieved by half-side blocking of the traffic.

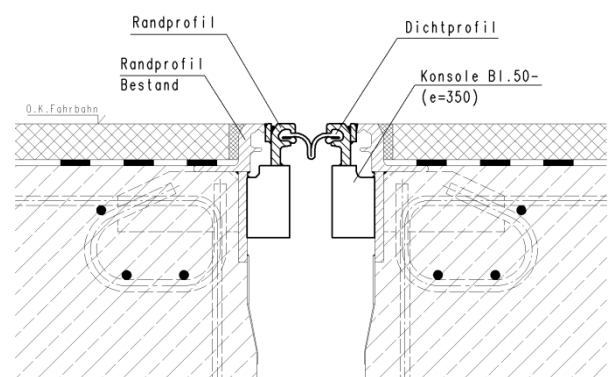


Fig. 3 - Single seal expansion joint, after completion of works

3. Retrofit of a multi seal expansion joint into a single seal expansion joint with noise reduction

Should the client prefer an expansion joint with reduced noise emission, for example in inner cities, the retrofit can be carried out from a multi seal expansion joint into a single seal expansion joint with reduced noise emission of type XW1. This type of expansion joint can accommodate even 100 mm of displacement, which is more than a standard D80 can achieve.

In the carriageway area, the asphalt or concrete has to be undug at both sides by a width of around 20 cm, in order to create sufficient space for the connection of the wave shaped expansion joint to the existing anchorage. In front of the existing expansion joint, consoles will be welded in alternate mode, in order to fix the edge beams in their wave shaped geometry. In the area of the footway, new edge beams will be set in front of the existing edge beams. After the welding works, the corrosion protection will be renovated and the strip seal inserted. Again, this retrofit can be achieved by way of half-side blocking of traffic.

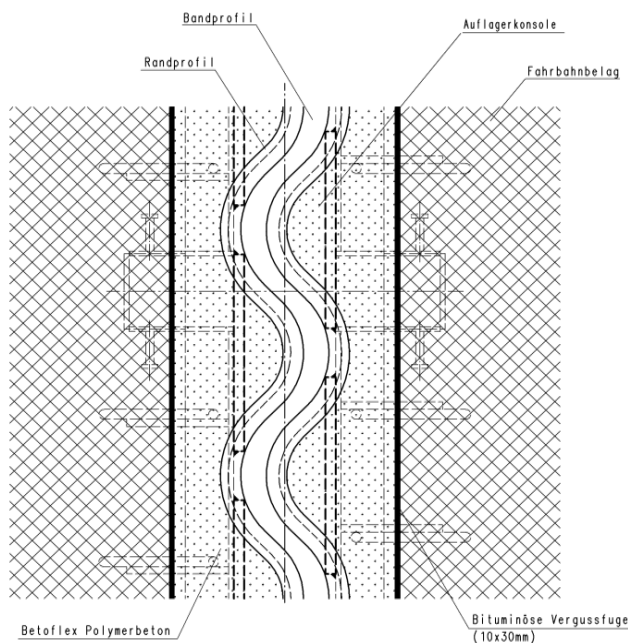
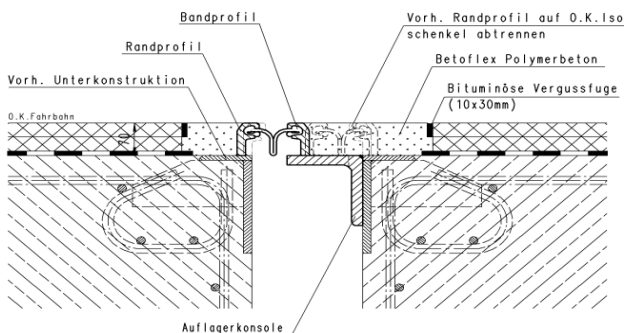


Fig. 4 - Retrofit of a multi seal expansion joint into a single seal wave shaped expansion joint, section and ground view

4. Retrofit with the „box in box“ system in case of multi element modular expansion joints

In case of modular expansion joints, instead of a new expansion joint also the „box in box“ system can be considered. After shrinkage and creep has subsided, a new and smaller modular expansion joint can be inserted into the existing and remaining anchorage. The new modular joint will be adapted to the geometry of the existing one which is to be replaced.

First at the carriageway asphalt (respectively concrete) and the waterproofing will be removed at a width of 1 m at both sides of the expansion joint, such that the existing support boxes are set free and the lids of the boxes can be cut away and removed.



Fig. 5 - Removal of cover layer, protection layer, and waterproofing

In the area of the footway, the footway box will be set free while maintaining the existing reinforcement. Thereafter, all movable parts of the existing expansion joints will be separated into smaller units and removed.

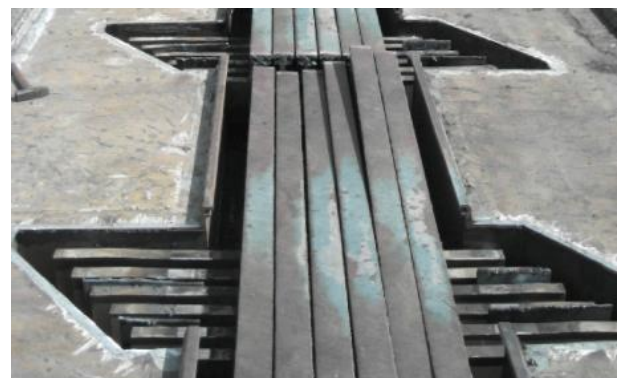


Fig. 6 - Expansion joint is exposed before removal

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The support boxes as well as the edge beams with their anchorage remain in the bridge structure.

At the inner side of the edge structure consoles will be welded. This structure is then being sandblasted and subject to a new corrosion protection.



Fig. 7 - New corrosion protection of the remaining part of the expansion joint

The new expansion joint will be delivered inclusive of joist boxes and the inner sealing elements in one part, lifted into the renovated block out, levelled and welded with the existing edge beams.



Fig. 8 - Welding of the new expansion joint into the old structure

The new edge beams will be placed on top of the consoles which were welded beforehand. In addition, steel plates will be placed between old and new joist boxes, for securing their position. The corrosion protection at the welding seams is then renewed.

Thereafter, the space between the old and the new joist boxes is being filled with grout, and the 2 outer sealing elements will be inserted. Finally, the waterproofing and the asphalt works will be carried out, as well as the concreting at the footway sections.



Fig. 9 - Placement of mastic asphalt

After asphalt application and concreting works, elastic fillers have to be inserted in the footway section, respectively bituminous grouting in the carriageway.

This retrofit can be carried out in two sequences by half-side blocking of traffic. Except for works on setting free the footway joist box, no intervention in the bridge structure will be necessary.

This type of retrofit of an expansion joint is a special advantage for the client just in case of prestressed carriageway plates and limited space in the superstructures, caused by prestressed tendons or a high degree of reinforcement, because there is no intervention in these sensitive areas.

It is therefore a serious alternative to a new installation of an expansion joint, particularly for older bridge structures where the design drawings of the existing bridge decks are no more available.

The photos show the individual phases of the retrofit of an expansion joint type D560 into a D480. The entire project works, including the blocking of the traffic, lasted five weeks, of which two weeks for the demolition, waterproofing and concrete works and three weeks for the works on the expansion joint, including the corrosion protection work.

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