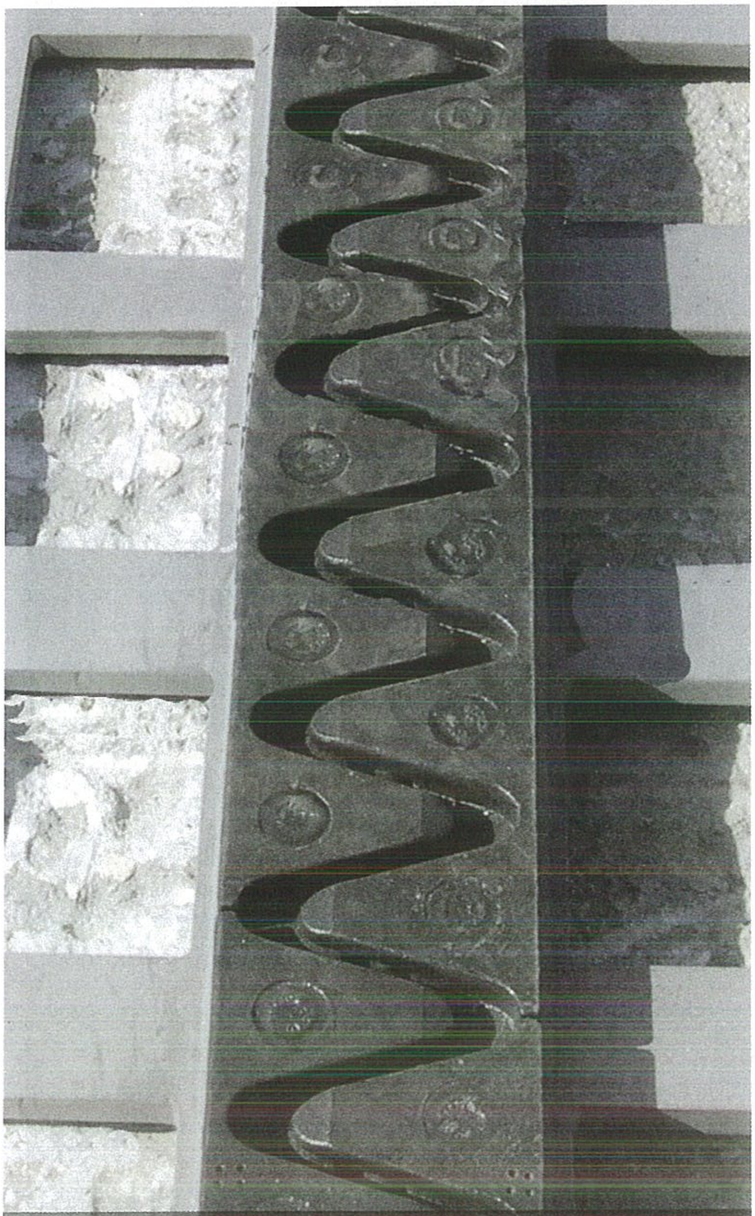
USER FRIENDLY

Bridge expansion joints can be replaced with little or no impact on traffic - and without compromising performance and durability. Report by Thomas Spuler and Colm O'Suilleabhain



Single gap joint with noise-reducing plates on its surfaces and extended anchorages - before placing polymer concrete

Expansion joints on a bridge will almost certainly have to be rehabilitated or replaced several times during the bridge's life. The potential for serious disruption to traffic when such works are carried out should be carefully considered when planning the works and selecting the replacement joint type. In the past, a certain amount of disruption to traffic would have been expected and accepted, even by the travelling public, but tolerance for congestion and traffic diversions continues to diminish as traffic volumes and driver expectation increase. The bridge maintenance sector is therefore under pressure to develop and implement expansion joint replacement solutions that minimise the impact on traffic without compromising quality and durability of the new joint and various solutions ar now available.

For small deck movements of up to 80mm - or 100mm if the joint features noise-reducing surface plates - a single gap joint is very often the best option from the perspective of long-term performance and durability. But the installation of a standa single gap joint in an existing structure can be a time-consuming exercise, requiring sizeable recess to be made in the deck at each side of the bridge gap so that the new joint can be securely concreted in place.

This work may require a significant amount of time, particularly for the process of breaking out the existing joint and concrete to a depth of 300mm or more and curinc the newly-placed concrete. The disruption to traffic caused by such works can be widespread, hence an alternative type of single gap joint has been developed for suc applications, which uses high-strength polymer concrete to secure the edge profiles in place. This enables the size of the anchorages to be greatly reduced and avoids th need for any type of reinforcement. It simply requires that the substructure be stron enough to resist the forces transmitted from the joint, and that it be clean, to enable polymer concrete to bond properly.

The total depth required by the new joint is typically between 60mm to 80mm, enabling it to be placed within the depth of a carriageway's asphalt surfacing and eliminating the need to break out any concrete or interfere with steelwork or reinfor ment steel. The polymer concrete also cures much more quickly than normal concre gaining the strength needed to support traffic in just four to six hours. The use of th type of joint thus minimises the impact on traffic using the structure while the work are carried out.

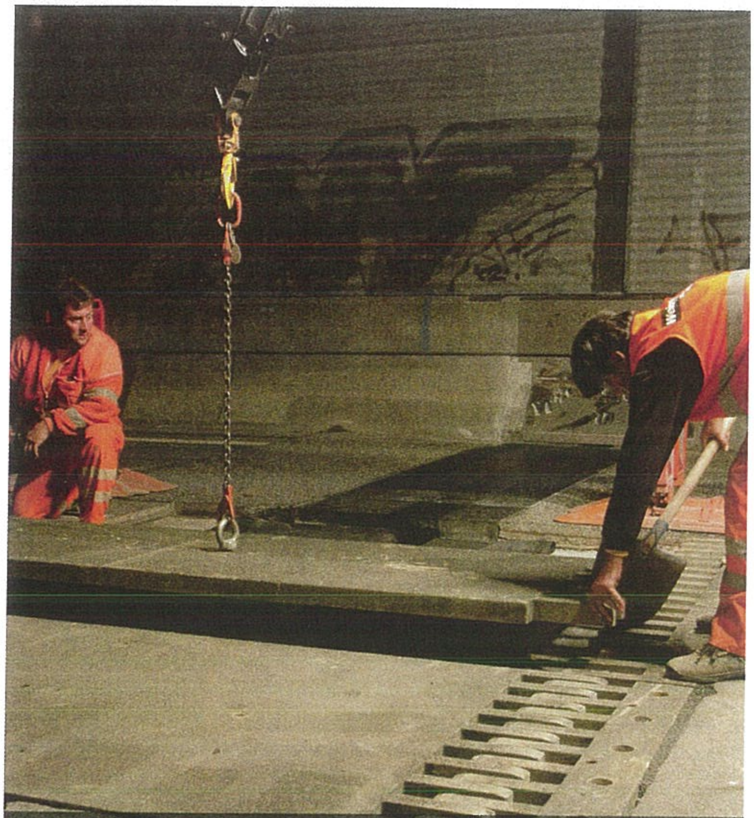
For deck movements of more than 100mm, the single gap joint is generally neithe feasible nor permissible, so an alternative must be selected. Movements of up to a metre or more can generally be accommodated by sliding finger joints, which in mar cases are the ideal solution for owners.

Although a sliding finger joint is very limited in its ability to accommodate transv and vertical movements, and rotations about any axis, it is quiet under traffic and ca require little maintenance. However, installation to replace an existing joint can caus significant disruption to traffic, if the selection of an appropriate type of sliding fing joint is not give appropriate consideration and the replacement process not carefull planned. To minimise the work required for replacement, and hence also disruption traffic, a sliding finger joint with a shallow-depth, modular design has been develop

The Tensaflex joint is a flexible metal-elastomer bonded system which primarily consists of two rows of individual finger plate elements, one row along each side of bridge gap. The fingers on one side project across the gap and slide on the base pla of the elements at the other side, between their fingers, as the bridge deck expands contracts. Thanks to the dimensioning of the joint and the elasticity of the material used in its fabrication, the projecting fingers are pre-tensioned downwards and ther fore remain in constant contact with the opposing sliding surface.

The finger plate elements are simply anchored to a flat, solid concrete subsurfac using conventional chemical anchors. The shallow depth of the joint limits the dema for space in the main structure, again potentially saving the need to break out large amounts of concrete, making its use feasible where breaking out of steelwork or

Installation of sliding finger joint with shallow-depth modular design



Placing of mini flyover plates across work area at end of night shift

reinforcement bars is to be avoided. Its modular design also enables it to be stalled without heavy lifting equipment, lane by lane, so an expansion joint across a ısy road can be replaced in a series of individual closures, with only one lane closed : any time.

But even if closure of a single lane is only permitted at night-time and weekends, carefully planned approach using the so-called 'mini-flyover' system can be used allow traffic to cross the site during the daytime, while the construction works are ırried out at night-time, one lane at a time. In this way, unhindered traffic flow during ȝak times can always be facilitated during initial installation. When the time comes renovate the joint, its individual finger plate elements can be easily and quickly placed by hand, for example, in one night, on a lane-by-lane basis, without the need r breaking-out or heavy equipment. It is also possible to replace only the joint under e lane with heaviest traffic, should this section require replacement earlier than the st. The use of this type of sliding finger joint thus enables disruption to traffic to be inimised throughout the life of the main structure.

Even modular joints, which are designed to accommodate very large movements, can ten be renewed with minimal impact on traffic. This can be achieved by replacing the isting joint with a new one without breaking out the concreted-in parts of the old one. nce the concreted-in parts of a modular joint are not subjected to dynamic loading, ose parts are likely to be in much better condition than the mechanical parts they pport, and can thus continue to serve their purpose as part of a renovated joint.

The lamella beams that form the driving surface of the joint must be replaced, as ust the support bars beneath, which span the bridge gap. However, the edge beams id the anchorage boxes at the ends of the support bars, which are concreted into ısition in the deck, can be cleaned, painted and left in place.

A new mechanical section, consisting of lamella beams, support bars and anchorage ıxes is then lifted into position, with the anchorage boxes, which are designed to be small enough and suitably located, placed inside the retained anchorage boxes of the old joint. The new section is then secured and connected as required to the retained steelwork, and finishing works are carried out, including reinstatement of the road surfacing at each side of the joint.

Renewal of a modular joint by this method saves the time and effort required to break out concreted parts of the joint, and minimises the traffic disruption caused by the structure being partially demolished and reconstructed.

As demonstrated, expansion joint types and replacement techniques have already been developed which can reduce the impact of replacement works to a fraction of what might otherwise be expected. They achieve this, to a large extent, by minimising the amount of existing structure that must be removed, and hence the reconstruction needed. This enables costs to be optimised; by planning renovation work to reduce demolition and waste, the cost can often be reduced.

Such expansion joint replacement technology can be considered user-friendly in every sense. Bridge users benefit from the minimisation of disruption to traffic while works are carried out; maintenance contractors benefit from shorter construction programmes, less, if any, need for reinforcement and concreting work, and a reduction or elimination of the need for heavy demolition and construction plant.

Meanwhile the owners of those structures where the technology is used, benefit from the elimination of unnecessary structural work and the reduction in construction costs.

Other stakeholders benefit in significant ways - local residents are spared the noise and dust pollution that accompany demolition works, and the environment - and hence society at large - benefit from the re-use of existing materials, reduced energy use and exhaust fumes caused by site equipment and traffic disruption

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