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Dealing with wide-opening joints

There are occasions when floor slab usage requirements force designers to have joints that they know will open very wide. A wide joint in a floor slab is clearly a disadvantage because it will lead to damage to the trucks' bearings (especially with small hard wheels as on motorised pallet trucks), damage to the items being carried and of course damage to the floor arris edges.

Figure 1: Joint close-up and general view of the AlphaFix joint levelling and post-tensioning cables at Morrison's warehouse, Kettering.

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(Photos: Permaban Ltd.)



Damage to floor arris edges can be obviated with the use of a suitable armouring system in the design. Damage to existing slab arris edges can also be dealt with by using the Permaban Arris Repair System. However, the problems created by wide-opening joints remain a costly nuisance and impede efficient operation of the activities in the building.

Permaban has experienced unavoidable wide-opening joints around the edges of post-tensioned floor slabs, in doorways to freezer-store floor slabs and some large bay jointless floor slabs.

When the temperature of a concrete slab is reduced to -30°C in a freezer-store floor it shrinks far more than (but additional to) the normal drying shrinkage. This causes the saw-cut joints and the free-contraction joints to open much wider than normal. By producing joint sealants that can be installed at these very low temperatures, Permaban facilitates for the joint to be sealed after all the drying and thermal shrinkage have had their full effect on the joint opening.

There is a limit to how wide a joint can be treated only with joint sealant when the joint is trafficked – 8mm is a maximum limit for saw-cut shrinkage control joints. Above this, and always for free-contraction joints in heavy-duty situations, the authors recommend steel armouring of the arris edges by use of AlphaJoint as recommended in Concrete Society Technical Report 34⁽¹⁾ and BS 8204 Part 2, Section 8.5⁽²⁾.

For situations where the joints are expected to open 20–40mm then a sliding armoured joint with replaceable top-plates is required.

Conventional approach

Figure 1 shows a conventional approach to this, which Permaban provided for Morrison's 65,000m² distribution centre in Kettering in 2005 installed by Stanford Industrial Concrete Flooring (*CONCRETE* Sept 2005⁽³⁾). The main floor area was post-tensioned, resulting in a slab without joints but with a larger opening at the perimeter and to the slab adjacent to the dock leveller slab (see Figure 2).

The joint used at Kettering comprises 15mm-thick \times 60 \times 60mm angles supporting the 10mm-thick \times 100mm-wide removable plate with two 10mm-thick side strips robust enough to protect the concrete arris. Installation and micrometer-accurate levelling was achieved by the use of AlphaFix Installers with the post-tensioning cables passing under the joint. No reinforcement or load transfer across the joint was required in this 300mm-deep slab. Before completion the screws down one side of the removable plate were taken out to allow free movement.

After 12 months the joint had opened some 40mm. Permaban attended site to take measurements for replacement plates and then attended site again when the 140mm-wide stainless steel replacement plates were fitted. The overall width of the joint was 200mm, necessitating great care when installing to ensure the joint was level horizontally across the joint.

By these means the 40mm movement was accommodated while fully protecting the joint arris edges. Traffic passes over the joint without bumping and with no damage to the goods, trucks nor floor.

Particularly in food-related premises, the design of the joint should prevent the gap under the joint allowing the ingress of vermin.

Since 2005, in discussions with various clients throughout Europe, Permaban has seen the need for further



development from the conventional approach. Also the other types of joints available for these situations such as the 'S' configuration or 'interlocking finger-type' joints are very wide to start with and unsuitable from hygiene and long-term performance considerations.

New range of joints

This led to the development of a new range of armoured surface-bridging joints with much better tolerance than can be achieved with conventional steel angles and overcomes the limitations of replacement plate, 'S' type and 'finger type' joints with an entirely new approach of filling the shrinkage opening with a steel infill strip. The width of the new AlphaSlide joint is only 70mm, thus reducing the potential for the joint being installed out of level horizontally. But this still permits 40mm joint opening without a gap between the joint sections, which would normally be an open joint for the full depth of the slab. Plate Dowels are incorporated to provide load transfer and allow movement in two planes. Figure 3 shows the AlphaSlide as cast with no joint opening.

When the joint opens as a result of the concrete shrinking, the AlphaSlide joint opens leaving a gap the sum of the shrinkage but only for a depth of 10mm as the opening below this is covered by the steel support bearing plate (see Figure 4). This gap is then filled with a steel infill strip of the appropriate width eliminating any gap in the joint. The 10mm-thick steel infill strips are produced in various widths between 10mm and 40mm, are pre-drilled and counter-bored and installed using socket head-cap screws into the captive nuts located in the steel support

bearing plate (see Figure 5). If the joint opens further the infill strips can be simply replaced to accommodate any increase in the width of the gap, thus ensuring a smooth ride across the joint with no gap for dirt and detritus to enter and feed any rodents.

Medipav recently completed a 9800m² post-tensioned slab in Perugia, Italy. The *CONCRETE* front cover picture shows construction of this slab after the concrete has been placed and levelled with Somero SXP-D laser screed. The AlphaSlide joint shown is precision-installed with AlphaFix installers.

The development of AlphaSlide compliments the existing range of robust metal leave-in-place joints, which are available to suit all types of floor uses.

Some free contraction joints in concrete floor slabs can be predicted to open wider than should be acceptable to the building occupier. In these cases the designer is now able to specify a prefabricated joint detail to satisfy client needs for smooth-running, durability and hygiene. ■

Figure 2 top left: Edge of post-tensioned slab adjacent to the dock levellers at Morrison's warehouse, Kettering showing the installed joint without the final wearing plate.

Figure 3 top right: Shows the AlphaSlide as cast with no joint opening.

Figure 4 above left: Shows the AlphaSlide Joint opened (up to 40mm joint opening) after shrinkage of the concrete. Image shows there is no shrinkage gap visible at the surface.

Figure 5 above: Shows the joint after opening and the steel infill strip being installed using socket head-cap screws.

References:

1. CONCRETE SOCIETY. *Concrete Industrial Ground Floors – A guide to their design and construction. Technical Report 34, 3rd Edition, The Concrete Society, Camberley, 2003.*
2. BRITISH STANDARDS INSTITUTION, BS 8204-2. *Screeds, bases and in situ floorings. Part 2 – Concrete wearing surfaces. Code of practice. BSI, 2003.*
3. ARNOLD, R. Joint armouring and load transfer. *CONCRETE*, Vol.39, No.9, September 2005, pp.6–7.