

Jointless floors

The concept of floors with no joints is obviously attractive to building users. However, it is important to recognise that all floors, including 'jointless' floors, have construction joints between floor panels. Jointed floors have additional sawn joints cut into them, typically at 6m spacing. Both types have their merits in different applications. Pile-supported floors will invariably be jointless, while ground-supported slabs can be jointless or jointed. The choice for ground-supported slabs should be based on the costs associated with the construction method and the resulting benefits for the floor user. **Tony Hulett of Face Consultants** discusses those construction methods and the benefits but has confined it to ground-supported floors only.

Jointless floors are usually reinforced with steel-fibre reinforcement and have construction joints to provide boundaries to panels and to allow for concrete shrinkage.

In the UK, jointed floors are usually reinforced with steel mesh fabric; they also have construction joints to provide boundaries to panels and have additional saw cut joints. Both the construction joints and the sawn joints allow for concrete shrinkage.

Ground-supported jointless floors are more costly than jointed floors of the same thickness. This is primarily because steel-fibre reinforcement costs more than an equivalent steel mesh fabric and because steel-fibre-reinforced floors usually require a dry-shake topping to reduce the number of fibres appearing at the surface. These costs considerably outweigh the costs of the saw cutting of jointed slabs.

Contrary to some common perceptions, dry-shake toppings are not required for abrasion resistance and the topping therefore represents an avoidable cost. Typical, well-finished concrete provides a very adequate floor surface for warehouse or similar use and the dry-shake toppings commonly sold as fibre suppressants provide no additional durability over the concrete used for the floor. The use of toppings also increases the risk of surface delamination.

Suggestions that jointless floors can be thinner than jointed floors should be treated with caution. Floors are designed for loading at or close to joints and the slab thickness is therefore dependent on the load transfer capacity of the joint. The calculated capacity of a sawn joint is generally about 30% of the applied load. This is considered to be a safe or conservative value. Claims that construction joints in jointless floors have greater capacity than sawn joints should be treated with caution, particularly given the likely wide openings of such joints.

Performance – joints

Building owners are obviously concerned with long-term maintenance costs and associated down time while maintenance work is carried out. As the primary cost item is that of repairs to joints, it is unsurprising that reducing the number of the joints should be considered desirable. However, the number of joints is not the only consideration, as the width of those joint openings or the presence of cracks has to be taken into account.

Traditionally, jointless floors have been laid with up to 50m between the joints and 60m has been known. This has resulted in very wide construction joints with openings in excess of 40mm having been recorded. Such joints do not stand up well to the impacts from warehouse trucks.

Jointed floors generally have construction joints with smaller openings, as some of the shrinkage is accommodated at the sawn joints. Nevertheless,

construction joint openings of the order of 20mm or more have been seen on larger panels.

In many floors built in recent years, sawn joints have opened minimally and shrinkage is generally accommodated at the construction joints. This is because of the care given to sub-base construction, resulting in low restraint to shrinkage. In these cases, the wear rate on these narrow sawn joints is minimal.

In some cases, the sawn joints have opened to greater extent and these joints wear more quickly and joint sealants become detached, as shown in Figure 1. As with all joints, there is the possibility of localised damage, an example of which can be seen in Figure 2.

Performance – cracks

Jointless floors in lightly loaded applications appear to have been generally free of cracks. In contrast, jointless floors that are more heavily loaded with racking or block stacking tend to suffer from cracking. In recent years, the floors in a number of large distribution centres have suffered extensive cracking in aisles between storage racking, such as shown in Figure 3. It is apparent that this cracking is caused by the restraint to shrinkage caused by the pinning effect of loaded racking.

It is very unusual to find cracks in jointed floors but in floors that are more heavily loaded with racking or block stacking, there will be more restraint to shrinkage, reducing the amount of shrinkage accommodated at the construction joints and increasing the openings of the sawn joints.

Comparison

The width of construction joints can be limited to acceptable openings in both types of floor by limiting the distance between construction joints. Jointless floors tend to exhibit greater openings and therefore it is advisable to have construction joints at closer intervals.

If this approach is adopted, then in simplistic terms it might be considered that for floor designers there is a trade-off between the risk of cracks and the risk of damage to sawn joints.

Do cracks matter?

This is a complex question. It depends on the extent of the cracking and the degree to which it is permanently repairable. Cracks are caused by the drying shrinkage of the concrete. Floors dry out from the top surface and cracks are generally wider at the top surface.

Most cracks do not extend to the full depth of the floor and generally do not cause structural problems. However, under some circumstances the floor can become completely cracked and this can lead to very serious problems and, in the worst cases, complete removal of the floor.

In most cases, the physical effect of the crack will



Figure 1: Sawn joint in a free movement area.



The choice between jointless and jointed options is primarily a trade-off between the possibility of cracks and the certainty of dispensing with sawn joints.



be limited to the potential for breakdown of the floor surface at the crack. The normal remedy for these cracks is to fill them with low viscosity resin and – for this to work – the crack needs to be of a minimum width at the surface. If the crack is too fine, it is impossible to get any liquid resin into it. This minimum crack width for repair is generally held to be between 0.5 and 0.8mm.

The difficulty of dealing with these repairs is that the cracks take some time to open to this width. Drying shrinkage cracks form over the first 12 to 18 months of the life of the floor. The rate of opening is quicker at the beginning of this period, with the rate reducing as time passes. So a crack that ends up at, say, 0.8mm after 18 months will be, say, 0.4mm wide at around three months.

A 0.4mm-wide crack is enough to suffer damage at the surface, as can be seen in Figure 4, but is too narrow to repair. Even if it were possible to fill with resin at this stage or when slightly wider, the crack will continue to open and the resin filling will become dislodged. So the reality is that it is difficult to repair cracks until they have stopped opening at about 18 months. By this time, the surface of the floor at the edges of the crack can be badly damaged, particularly by the small, hard wheels of pallet trucks.

There is a common misconception that cracks are simple, clean openings in the floor that can easily and permanently be repaired. As can be seen from Figure 4, this is not the case and some cracks become a long-term maintenance headache.

Do sawn joints matter?

There is little data on the overall costs of maintaining sawn joints. Anecdotal evidence points to the extremes of either many problems or very few problems. Observation of warehouse operations suggests that open areas subjected to intensive pallet truck operations have relatively more wear to sawn joints. However, unlike cracks, sawn joints are in preformed straight lines in predetermined locations. With careful design, many sawn joints will be positioned away from maximum traffic. It is also the case that with resin mortars and hard sealants, these joints can be readily repaired with long-lasting outcomes.

Making the right choice

As we have seen, the choice between jointless and jointed options is primarily a trade-off between the possibility of cracks and the certainty of dispensing with sawn joints, although developers should expect to pay more for jointless slabs as construction costs are higher. In the right circumstances, it is thought that this can prove to be a good investment with lower long-term operating costs.

The choice should be made for sound engineering and cost-based reasons. The avoidance of cracking is generally an important factor in the long-term performance of floors where floor running trucks are in use. Jointed floors may therefore be a good choice where there are heavy static loads and particularly if the loads are to be applied soon after construction – which is usually the case.

In contrast, jointless floors may be a good choice in open areas used for light block stacking such as in fresh food distribution or marshalling areas in distribution centres, where the benefits of having limited numbers of joints exposed to pallet trucks are most obvious. Jointless floors might also be a good choice in food processing facilities, where resin finishes are to be applied.

There are very good reasons for having both types in many facilities. ●



Figure 2: Damage at a sawn joint.

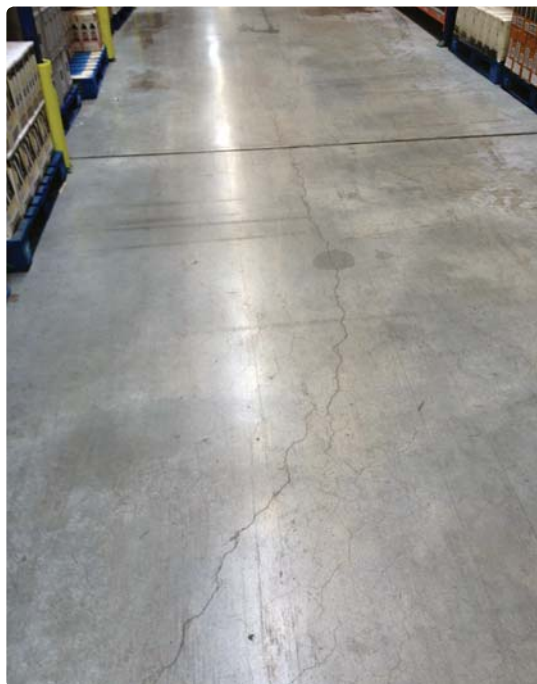


Figure 3 left: Mid-aisle cracking in a jointless floor.



Figure 4: Damage at cracks.