

# Jointless floor construction – reducing problems

*“Despite a general skills shortage in the industry, Twintec’s directly employed production and support teams are renowned for producing virtually fibre-free floors laid to the highest standards of flatness in large-area jointless pours without the need for remedial grinding.”*

**Twintec Industrial Flooring of Rugby, part of the Twintec International Group of Companies based in Luxembourg, has recently designed and installed a jointless, steel-fibre-reinforced concrete (SFRC) ground-supported floor slab for Innovate Logistics, located just off the A19 road at Seaham, County Durham.**

DARRYL EDDY, TWINTEC INDUSTRIAL FLOORING

Mansell Construction Services Ltd (NE region) was the main contractor with Cameron Taylor (Leeds) carrying out the structural engineering work. As part of this development, Mansell has constructed a 15m-high warehouse, which covers an area of 12,000m<sup>2</sup>. The flatness tolerance for the entire floor area conformed to FM1 as stipulated in the 2003 edition of Concrete Society Technical Report 34 (TR 34)<sup>(1)</sup>. Twintec was also contracted to construct the 4500m<sup>2</sup> of external paving and hardstanding using the same jointless, SFRC technology, with a few amendments to suit its external application.

## Design coordination

Vital to the finished quality of any floor slab is the commitment of all parties on site to achieve a shared goal. Mansell placed the order for the flooring works at a very early stage in the contract, which allowed detailed design development to take place with all parties involved. The exact requirements of the client, the main contractor and associated trades were therefore clearly understood and incorporated into the project in good time. Coordination with other elements of the works ensured that the project ran smoothly and to programme.

## Internal design

The specification required a floor slab suitable for use in a heavily trafficked and heavily loaded distribution centre. A standard pallet racking configuration was to be installed with individual racking leg loads of 80kN (200mm back-to-back spacing) and a blanket uniformly distributed load

(UDL) of 50kN/m<sup>2</sup> applied.

Twintec’s SFRC proprietary design software allows plastic moment redistribution to be taken into account while still using an elastic method of design. This is a well-established design methodology, supported by TR 34 and with a track record of several million square metres in the UK alone. The local ground conditions were excellent, allowing Twintec to produce a 160mm-thick, ground-bearing, jointless, SFRC floor slab, using a C28/35 concrete reinforced with 40kg/m<sup>3</sup> of AFT 1/50 undulated steel wire fibres.

## External design

Externally, the slab needed to cope with a different loading pattern, temperature variations and freeze/thaw cycles. The design used was the same as the internal one, the only changes being the use of monofilament polypropylene fibres from SI Concrete Systems in lieu of air entrainment, increased expansion capability and the use of galvanised steel profile construction joints. The use of a jointless slab on such a scheme leads to the following benefits:

- 75% reduction in the amount of joints
- fewer opportunities for joint breakdown and associated costs / disruption
- reduced possibility of standing water and therefore increased safety
- life cost savings as fewer joints to reseal in time
- improved ductility of slabs
- protection of all joint arrises by using armoured joints (and associated ease of joint sealant due to steel arrises)
- more versatile surface
- fewer joints leading to fewer loading restrictions
- reduced preparation and production programme
- large panels constructed by a specialist team with mechanical equipment ensuring consistent quality of end-product.

## Sub-base

To create very flat floors, a very flat, well-compacted sub-base is required. Twintec’s partner company, PDH, carried out the trimming and compaction of the final 80mm of sub-base using a local quarried stone with high fines content, (40mm down). Unique to Twintec and PDH is the double-trimming method, where firstly a laser-controlled Komatsu D37 EX is used in one direction, followed immediately by

**Figure 1 below: Jon Wilcox, Twintec Project Manager, attending an on-site seminar.**

**Figure 2 below right: The external floor slab at Innovate Logistics.**



(Photos: Twintec Industrial Flooring.)



a laser-controlled compact leveller travelling at 90° to the first pass. The material is then compacted in the usual manner. While a little more expensive than the simple laser dozer system, this method produces outstanding results and can still manage an output of up to 3000m<sup>2</sup> per day.

#### Site-batched concrete

The modest local concrete supply, which was insufficient for large daily pours, posed a logistical challenge to the project which demanded a high volume of concrete to be delivered daily at a guaranteed rate and with consistent quality. Six concrete mixer trucks with capacities of 6 and 9m<sup>3</sup> were used to supply the site. The short distance between the batching plant, the fibre integration machines and the workface meant that Twintec kept good control over the quality, consistency and workability of the concrete and also the rate of production.

#### Steel-fibre-reinforcement

High-tensile undulated steel wire fibres (50mm-long and 1mm in diameter) were supplied by SI Concrete Systems to reinforce the concrete. Proper mixing of the fibres was essential, ensuring that a uniform distribution took place throughout the batch. In Twintec's experience, the most effective way of incorporating steel fibres is with a pneumatic integration machine.

#### Flatness

It was considered by some that to achieve the FM1 tolerance as specified in TR 34, using large-pour techniques without any remedial grinding would be impossible. However, Twintec has long been recognised as an expert in

such techniques, largely due to its policy of constantly seeking to improve methods and control site quality. Improvements to equipment have been necessary; for example, Twintec has adapted the hydraulic system on their laser screed machine and developed systems such as multi-directional skip floating techniques, and materials have been reformulated to suit such techniques. The finished floor slab is virtually fibre-free and the survey results for flatness are outstanding; the floor was fully compliant with the specified FM1 tolerance.

Using 3000m<sup>3</sup> of concrete, 100 tonnes of steel fibres, 70 tonnes of Twintop dry-shake topping and 1500 litres of Twinseal 90 curing agent/sealer, Twintec produced both the internal floor slab and external yard in just nine casting days over a two-week period.

#### Concluding remarks

Despite a general skills shortage in the industry, Twintec's directly employed production and support teams are renowned for producing virtually fibre-free floors laid to the highest standards of flatness in large-area jointless pours without the need for remedial grinding. To accomplish this, projects are planned well, managed effectively, resourced correctly and the operatives are properly trained and supervised. ■



**Figure 3: Sub-base preparation using the double-trimming method.**

#### Reference:

1. THE CONCRETE SOCIETY. Technical Report 34, *Concrete in industrial ground floors – a guide to design and construction*. 3rd Edition, Camberley, 2003.



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Industrial Flooring

Twintec are at the forefront of the design and installation of steel fibre reinforced concrete floor slabs. With an in-house design team on hand to provide design solutions Twintec are available from the earliest stage of a project to assist End Users, Consulting Engineers and Main Contractors.

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