40 years of concrete industrial flooring

Some 40 years ago, at the age of four, I remember watching my Dad and Granddad mixing and laying concrete in our backyard in sunny Scunthorpe. Several days of preparation and eight hours of real hard graft later they were able to look on satisfyingly at their handiwork – 15m^2 of concrete (yes, 1.5m^3) with what nowadays is politely called a shovel finish.

Darryl Eddy, Commercial Director, Twintec Industrial Flooring, Scunthorpe, Lincolnshire

Three little boys with Darryl Eddy on the right.

Twenty years later, as a junior engineer I was working on sites in the north of England where I saw, for the first time, wide bay construction methods and power floats; I couldn't believe how things had changed.

Last year my Dad visited the 56,000m^2 floor slab that Twintec Ltd was constructing for Clugston Construction in Scunthorpe and was amazed at what he saw: concrete batching plant; machines that added steel fibres into the concrete trucks; laser screed machines that compacted and levelled the concrete; a machine that sprinkled a topping onto the concrete; double and triple ride-on power floats. The laser controlled sub-base preparation dozer was trimming and compacting the stone flatter and more evenly than that 40-year-old slab in our old back yard.

Yes, much has changed in 40 years: materials, machines, equipment, and more than anything else, output and quality. These advances and improvements have directly affected end users, who can now build bigger and better distribution centres with great flexibility of use.

But even with such dramatic improvements, there is still a need for skill and experience. All of this technology needs to be mastered and managed well and, at times, it is not possible to use all of the advanced equipment available. Therefore, modern floors are a combination of excellence not only in machinery and equipment, but also in materials, organisation, commitment and good old-fashioned skill.

Case study

An excellent example of how developments in technology, materials and modern equipment have changed the face of the flooring industry was the new Distribution Centre in Corby, Northamptonshire. Clugston Construction, working for Morrisons, chose Twintec to design and build a steel-fibre-reinforced concrete (SFRC) floor slab for a large frozen food distribution warehouse. The consulting engineers were AWT Partnership.

Following other successfully completed projects throughout the UK, Twintec designed and installed a jointless, ground-bearing floor slab using its own advanced fibre technology steel fibres. The choice of steel fibres as reinforcement provides a 'jointless' and very versatile surface which, combined with a fully compliant FM2 special flatness, as specified by The Concrete Society's Technical Report 34[(1)] (TR 34), is ideally suited to the intensive trafficking that occurs in modern distribution warehouses.

The project has a total combined area in excess of 12,000m^2 for the internal floor slabs and is a prestigious addition to Twintec's impressive major projects portfolio. A commitment by all parties involved contributed to the outstanding success of this project. Clugston 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 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.

Project requirements

The specification called for 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 100kN and a blanket uniformly distributed load of 40kN/m^2 applied.

Design

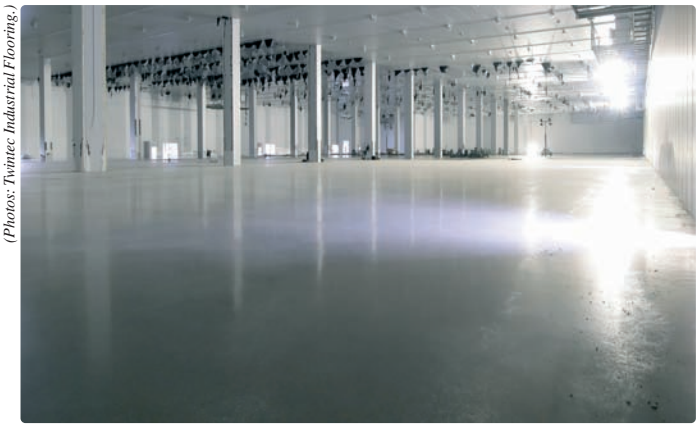
A far cry from nominally reinforced floors with jointed floor slabs cast using long strip methods, Twintec always propose SFRC 'jointless' floor slabs. SFRC proprietary design software allows the plastic moment redistribution effect to be taken into account while still using an elastic method of design. This is now a well-established design methodology and with a track record of several million m^2. The solution specified by Twintec was a jointless design, 200mm thick, using C40 concrete reinforced with steel fibres at 40kg/m^3.

Daily output

The size of the building lent itself to jointless panel sizes 30 × 30m with no sawn contraction joints at all; this has dramatically reduced the number of joints in the whole building and improved the versatility of the working surface. The whole slab was cast in just four days. The placement conditions were particularly challenging as the floor slab

Figures 1 and 2: The size of the Distribution Centre in Corby lent itself to jointless panel sizes 30 × 30m with no sawn contraction joints at all.

(Photos: Twintec Industrial Flooring.)



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was cast on top of heavy-duty insulation and within the confines of insulated wall panels, which prevented direct discharge of the concrete from mixer trucks and necessitated concrete pumping. This also ruled out the use of the laser screed and topping spreader and required extremely high levels of skill and experience with flood pour techniques to achieve the quality demanded by the client.

Added to these challenges, a tight programme required the use of two production teams working side by side; a total of 34 experienced, skilled Twintec production staff worked simultaneously on the project using up to 630m^3/day of concrete to cast jointless panels up to 3300m^2.

Concrete

The size of the panels meant that a concrete volume of 630m^3 was required on a daily basis. The quality and consistency of the concrete was of prime importance and Twintec's in-house technicians, together with Hanson, developed the most appropriate mix design. Hanson displayed outstanding commitment to the project to ensure that they delivered the goods and the concrete pumping was carried out by ASCUS.

Steel-fibre reinforcement

High-tensile, undulated steel fibres (50mm long and 1mm diameter) were used to reinforce the concrete and were supplied by Synthetic Industries; proper mixing of the fibres is essential, ensuring that a uniform distribution takes place throughout the batch. It is believed that the most effective way of incorporating the steel fibres is with a pneumatic integration machine.

Skilled workers

Twintec's directly employed workforce produced a floor laid to FM2 special tolerance, a very high standard of flatness in large-area jointless pours without laser screed and with no remedial grinding. While the company has developed a few special tools and some unique techniques, it is essentially a question of the attitude and commitment of the workforce.

The floor slab was produced in just four casting days using 2400m^3 of concrete, 100 tonnes of steel fibres, 50 tonnes of 'Twintop' dry-shake topping and 1200 litres of 'Twinseal 90' curing agent/sealer. The surface of the floor slab is virtually fibre-free and the survey results for flatness are outstanding.

Concluding remarks

As the case study above demonstrates, today's flooring contractor has at its disposal exceptional advantages when compared with the small bands of workers who were laying a few hundred square metres a day 40 years ago. These design methods, materials, machines and equipment complement skilled workers and offer outstanding benefits to both client and main contractor alike. I wonder what will be different 40 years from now? ■

Reference:

1. THE CONCRETE SOCIETY. Technical Report 34, *Concrete industrial ground floors – a guide to their design and construction.* Third edition, Camberley. 2003.