

Fibre-only suspended ground-floor slabs – do they work?

“Using a fibre-only solution for a suspended ground-floor slab can... reduce slab thickness, save on excavation and cart-away costs and reduce the demand for cement and aggregates needed for the concrete.”

To produce high-quality floors using the safest site techniques and the minimum of risk, slabs reinforced with steel fibres only are the most suited to suspended ground-floor slabs.

DARRYL EDDY, TWINTEC

Concrete Society Technical Report 63⁽¹⁾ highlights the general acceptance of this technology and its potential application. While the technical committee was led by academia, and although unfortunately there was an absence of flooring contractors on the committee, it is nonetheless a good base document and no doubt will be subject to future revision.

Fibre-only designs as put forward by Twintec and steel-fibre suppliers are in accordance with TR63 in that they are based on the ‘design assisted by testing’ route (TR63 section 5.3). This testing, carried out by a broad spectrum of participants across the industry, has included:

- circular plate tests to determine yield patterns
- full-scale testing to verify moment capacities
- full-scale testing to verify shear capacity
- beam tests to establish $R_{e,3}$ values.

It could also be suggested that fibre-only slabs have also been verified by ‘proof testing’ (TR63 section 5.4). Twintec has a UK track record of 130 projects (2 million m²) and an international track record of 400 projects (5.5 million m²). Every project used AFT +1/60 steel fibre at 40 or 45kg/m³ and concrete produced to match a very similar mix design and grading curve (C28/35 or C32/40). Each project also used the same detailing.

This experience amounts to several thousand individual panels of concrete. While TR63 section 5.4 refers mainly to the mass production of identical precast units, each one designed, detailed and produced in the same way, the same could also be said of fibre-only floor slabs.

Figure 1: Load testing of a steel-fibre-reinforced concrete slab at Greenwich University.



Industry acceptance

This technology is widely accepted in the industry, as evident when reviewing the track record referred to earlier. Many of the design practices working on the largest, most prestigious industrial buildings in the UK recognise the suitability of fibre-only slabs for such an application. The largest developers in the UK, indeed the world, have constructed many buildings both speculative and tenant-led, which have used fibre-only floor slabs.

This increasing acceptance was highlighted when Twintec became inaugural winner of The Concrete Society’s 2007 ‘Concrete Performance Award’ for outstanding merit in the use of concrete. The judges’ comments appeared in *CONCRETE* November 2007⁽²⁾, which said, in part:

“What makes the project special is the use of steel-fibre concrete in a suspended slab design, with significant savings from the avoidance of conventional steel fixing. The benefits of steel-fibre-reinforced slabs have been proven in ground-bearing situations, offering rapid, low-cost construction. This application in suspended slab design proves the technology can also be applied successfully.”

Fibre with bar designs are evolving

Fibre and reinforcement bar alternative to fibre-only has changed markedly over the last 20 years. The fibre dosage appears to have remained fairly constant but the reinforcement content has been gradually reducing, even for schemes where the loads and pile conditions have been similar. In the 1990s, the weight of steel reinforcement in the reinforced area was in the order of 25–35kg/m³ consisting of T12 or T16, top and bottom bar, installed as orthogonal beams between piles. By the early 2000s, the weight of steel reinforcement was down to 15–25kg/m³ consisting still of T12 or T16, top and bottom bar, installed as orthogonal beams between piles.

However, in line with TR63 (according to March 2007 *CONCRETE* worked example⁽³⁾), the weight of steel reinforcement is now <2kg/m³, consisting of T8s at 300mm c-c in corners only. According to the worked example, no shear reinforcement over internal piles is required.

This interesting change, along with the fact that all manufacturers now sell fibres for ‘fibre-only’ floor slabs, strongly suggests that even manufacturers who at one time contended that fibre-only did not work may have at last recognised that this is simply not the case.

Practical benefits

It must also be pointed out that there are other, very powerful reasons behind the choice of fibre-only for suspended ground-floor slabs. Adopting this system completely eliminates the need for detailing, procurement, site storage, fixing and checking of steel bar (or custom fabric) – more than halving the programme time that would normally be needed for a traditionally reinforced-concrete floor slab. It also eliminates a major risk to the health and safety of the workforce as well as the risk associated with the possible misplacement of steel bar.

Using fibre-only also more readily allows the use of one of the most important and revolutionary developments in concrete flooring in modern times – the laser screed – dramatically improving output and quality. Using a fibre-only



Figure 2: Award-winning completed slab for ProLogis, Peterborough.

solution for a suspended ground-floor slab can also reduce slab thickness, save on excavation and cart-away costs and reduce the demand for cement and aggregates needed for the concrete.

Concluding remarks

Fibre-only suspended ground-floor slabs offer a range of benefits and this is recognised across the flooring industry by all of the major contractors and their trade association, the Association of Concrete Industrial Flooring Contractors. There is still more that the industry can do to highlight all of the options to clients and designers and we trust that TR63 and TR34(4) will both be reviewed to explain more accurately the options, as well as the means, available for clients and consultants to properly interrogate them. ■

Figure 3 right: The Concrete Society Awards 2007 certificate.



References:

1. THE CONCRETE SOCIETY. *Guidance for the design of steel-fibre-reinforced concrete*. Technical Report 63, The Concrete Society, Camberley, 2007.
2. ProLogis Distribution Centre, Peterborough. *CONCRETE*, Vol.41, No.10, November 2007, pp.16, 18.
3. VOLLUM, R., Design of steel-fibre-reinforced pile-supported slabs. *CONCRETE*, Vol.41, No.2, March 2007, pp.12, 14-15.
4. THE CONCRETE SOCIETY. *Concrete industrial ground floors*. Technical Report 34, Third edition, The Concrete Society, Camberley, 2003.

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