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23.10.08

# SPAN TASTIC

HOW VOID FORMING PLASTIC BALLS ARE MAKING  
SUPER LONG CONCRETE SPANS POSSIBLE

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# Comment

Antony Oliver | PPA Editor of the Year

**"As a profession we have to use this difficult moment in economic history to our advantage"**

## Confirmed: infrastructure investment will drive recovery

As I wrote in this column just after the banking crisis started to emerge at the end of September "investment in quality, tangible infrastructure can and must be the driver for economic recovery".

One month, several bank collapses and a £37bn public cash injection later, I am pleased to see that Chancellor Alistair Darling at last agrees and has vowed to use public infrastructure investment to drive the UK's economic recovery.

"You will see us switching our spending priorities to areas that make a difference," he said, adding that areas that would make that difference included Crossrail, the 2012 Olympics, power stations and transport projects.

His list was not in fact dissimilar from that published by NCE last week.

This is all very good news for the industry. We must now wait of course for the flesh to be put on the bones. But with Gordon Brown's 40% of GDP public debt barrier has

been passed the forthcoming pre-Budget report should demonstrate that the government has finally twigged the long term value of decent modern infrastructure.

Darling's belief in Keynesian economic theory is crucial. When economist John Maynard Keynes proposed budget deficit-backed state spending as a solution to the economic downturn of the 1930s, there was a raft of railway legislation and construction that followed – witness the huge expansion in the London Underground at the time.

Darling's comment must surely reinforce civil engineering's place as a fundamental part of the UK's future growth plans. It is fundamental, as new business secretary Lord Mandelson described it this week, to the "new approach to business growth".

We have to believe it. We have to champion it. Decent modern transport, energy and water infrastructure is the backbone of the nation's economic prosperity.

And while banking and financial services are vitally important, they have been shown as simply a mechanism – not a substitute – for allowing the so-called "real" economy to grow.

As a profession we have to use this difficult moment in economic history to our advantage. We must hammer home to politicians that civil engineers must be at the heart of policy making. We have to reinforce ourselves as the solution and work with the new willing listeners in Whitehall to build the nation out of recession.

So when handed the keys to Crossrail, rail investment and renewable and nuclear power supply cash we must make absolutely sure we can deliver early and under-budget.

But with this firmly in mind, now is the time for us to grab the ball thrown to us by Darling and run as hard as we can. For as long as we can.

■ Antony Oliver is NCE's editor

## STRUCTURES: COBIAXDECK

# BOWLING ALONG

Big spans – really big spans – used to be the preserve of post-tensioned concrete. But thanks to plastic balls this is changing fast and supermarket giant Tesco is one of the first benefactors. **Mark Hansford** sees for himself as he reports from the Kentish commuter town of Orpington.

**A** 7,500m<sup>2</sup> floor plate, columns on a 16m grid, seven suspended floor slabs – two for a supermarket, two for the supermarket's heavily loaded car park, two for roof-top residential housing and one more for the residents' car park – and a location smack-bang in the town centre.

Those were the requirements of Tesco for its new superstore in Orpington, Kent. They add up to a fairly hefty challenge for any builder. But BAM Construction met them through a pioneering use of Hanson's Cobiaxdeck semi-precast concrete panels.

The system, developed in Switzerland, uses a precast concrete base, or "biscuit" with the reinforcement arranged around plastic balls. The slab is lifted into place and insitu concrete poured to complete the slab. The effect of the balls is to displace concrete in the section of the slab where it has no structural effect but simply adds dead weight. As a result slabs can span longer distances without undue deflection (see box).

"Cobiaxdeck has been ideal," says BAM Construction project manager Mick Kelly. "Tesco wanted to max the car park, max the retail space, so wanted a 16m grid. Over a 7,500m<sup>2</sup> floor plate the number of columns is greatly reduced."

These long spans are breaking new ground. "I've only used post-tensioning up to 10m. I've had experience of Cobiaxdeck

but nothing on this scale. This has never been done before, and it's going well," says Kelly.

Contractually, Hanson is working in joint venture with contractor Stephenson Shell & Core to provide frame and floor for a lump sum fixed price – and in just 48 weeks. "It's very clean and tidy for us and takes away the risk on a £10M-plus frame. Overall, the project is worth £42M to BAM," says Kelly.

Formwork on the job is minimal and speed of erection is high: "In the straightforward areas we are doing up to 1,500m<sup>2</sup> comfortably a week," says Kelly. Typically 1,000m<sup>2</sup> is being achieved.

"On a traditional insitu concrete job we would be looking at doing 500m<sup>2</sup> a week. We are doubling that output here and have had 150 men on the job from week 10," adds Stephenson senior project manager Mike Lockwood.

"And we are well ahead of programme," adds Lockwood. "Even though 48 weeks is a very short programme for seven storeys of 7,500m<sup>2</sup> suspended floor slab."

In total 18,000m<sup>3</sup> of concrete and 2,100t of steel are being used to create the structure – a completely unique hybrid, with the seven suspended Cobiaxdeck floors – ranging from 450mm in the basement car parks, to 600mm at store level to a whopping 800mm deep transfer slab at residential level – spanning two-ways onto largely (but not



exclusively) steel columns.

"Reinforced concrete columns were coming in at 1m-plus in cross-section and were starting to encroach on car parking, so we did a bit of engineering work with consultant Pinnacle who

came up with steel columns. There was also a programme advantage as the columns are three storeys high and are lifted in one piece." The frame sits on a variety of piles – essential because of a very high water table. But the lightweight Cobiaxdeck enabled BAM to cut £50,000 out of the foundations.

In addition there are six concrete stair cores and six lift shafts, constructed in advance of the frame to provide lateral stability and remove the need for bracing. The final structural elements are five ramps for the car parks – two each for access to the upper and lower basements and one, 150m-long giant for the residential housing on the roof.

"This ramp is key to the job," says Lockwood. "We looked at the precast option, but the biggest concern was tower crane time."

Three tower cranes are in use on the site, which highlights one of the few drawbacks of the system – there is a lot of lifting. "It is very crane dependent and high winds can hit the programme." Concrete used



**"On a traditional insitu concrete job we would be looking at doing 500m<sup>2</sup> a week. We are doubling that output here"**

Mike Lockwood,  
Stephenson Shell  
& Core



is predominantly C32/40 with some C50/60 and some C75/80 where steel columns are occasionally replaced with concrete.

Work began on site in January last year and the Stephenson/Hanson JV is currently erecting the final two storeys for residential housing set on top of the supermarket. With this sitting on a different grid to the main store and also coming with heavy loads from car park, level three provided the biggest engineering challenge – the massive Cobiaxdeck transfer slab.

"Originally the plan was to combine Cobiaxdeck with steel beams, with the services hung underneath the Cobiaxdeck slabs. But the whole series was so drawn out it would have added six weeks to the programme.

"The challenge was turning Cobiaxdeck into a transfer structure – it's an 800mm thick slab and we did have to keep the props in the floor area below for a long time," says Kelly. Pours for the insitu component are large – up to 1,000m<sup>2</sup> in one hit, with the slabs supported by

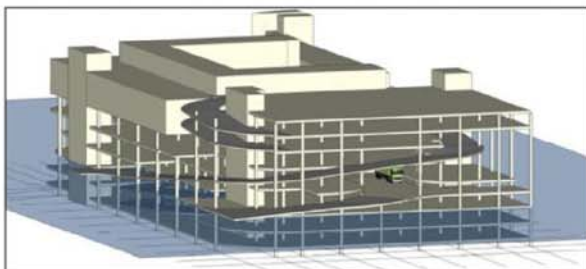
static props. These were needed at every level right down to the lower basement, such as the weight of the slab. But the advantage was that we could pour in stages, level, and start the residential," says Kelly.

This ability to work in stages across the site was vital, after work was initially held up by a rogue Thames Water sewer which ran the length of one elevation.

"Until week 18 we only had 60% of the site to work in. So we worked across as far as we could, then went up. By week 15 we were working on three floors and seven different work fronts," says Lockwood.

Logistics are a major challenge. Every 10.4m long, 2.4m wide slab is bespoke.

"We had an 80-week programme, and everyone thought that was undeliverable," says Kelly. And so, thanks to the sewer, it has proved. But that 28 week delay has been cut to 23 and fit out of the supermarket is now scheduled for January with the residential due for completion in May.



**Ramp it up:** A 3D model of the new supermarket shows the long ramp to residential spaces, which is key to the job



**Heavy lifting:** The precast concrete "biscuit" base

#### COBIAXDECK: HOW IT WORKS

These precast panels offer several advantages in projects demanding large spans, without beams and with a reduced number and size of vertical bearing elements.

Slab thicknesses range from 240mm to more than 600mm.

The system has been designed to remove the non-working, dead load in concrete slabs while maintaining biaxial strength. This is achieved by placing hollow plastic spheres between the upper and lower static reinforcement of the concrete slab, displacing concrete where it has no structural

benefit. The effect is to decrease the overall weight by up to 35% when compared to a solid slab of the same bearing capacity.

The reduced weight allows the quantity and dimensions of vertical bearing elements, such as columns, to be reduced. Yet the slabs offer very high load carrying capacity and flexibility.

The flat slab produces flat unobstructed soffits because it does not require beams and the costs of installing services in a building are also substantially reduced.

