SPANEWS
STRUCTURAL PRECAST ASSOCIATION
AUTUMN 2001

PRECAST CONCRETE STANDS UP TO SCRUTINY

Mike Downing, chairman of the Structural Precast Association, reports on the contribution precast concrete is making to the construction industry.

Sustainability is a major issue receiving worldwide attention. Following the Kyoto Conference in 1992, the UK Government made a commitment to reduce CO_2 emissions from the 1990 levels by 12% by 2012. The concrete industry is playing a significant role in this and an initiative launched by the British Cement Association is aimed at beating the Kyoto commitment.

However, sustainability is a much bigger subject than simply reducing CO_2 emissions, important though that is. Sustainability is broadly described as 'ensuring that development meets the needs of the present without compromising the ability of future generations to meet their own needs'.

Prefabrication, and precast concrete in particular, meets the criteria for sustainability very well. Factory manufacture is much more efficient in its use of labour and offers a much safer and more acceptable environment. It generates virtually no waste, since materials are ordered in strict quantities and are stored and processed in controlled conditions. The construction process is planned in detail to minimise the number of traffic movements. Erection is carried out by a team of just four or five men on a just-in-time basis and the resultant speed of construction is several times faster than traditional construction. Safety is greatly enhanced and dust, noise and waste are much reduced.

Concrete is noted for its high thermal capacity. Precast concrete adds a further dimension in its ability to

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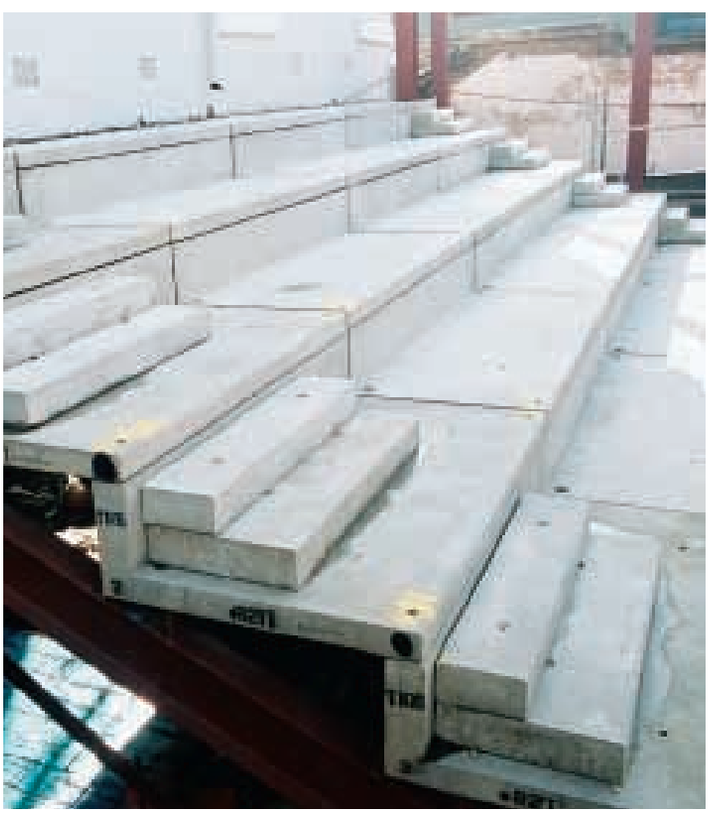
SOUTH COAST LOCATION

Portman House in Bournemouth is the recently completed headquarters of the Portman Building Society.
The design employs a high degree of prefabrication by Trent Concrete including precast brick faced spandrel panels, with integral reconstructed stone window heads and cills. The vertical fin features are cast in the same mix as the main columns and spandrels.

Client:
Portman Building Society
Architect: *Fitzroy Robinson*
Engineer:
Ove Arup & Partners
Q.S: *M D A*
Contractor: *Skanska UK*
Precaster: *Trent Concrete Ltd*

Main feature at local cinema

The new eight-screen cinema under construction at Kingston on Thames is a cross between the old and the new. The planners wanted to retain the old frontage of the furniture depository, which formerly occupied the site. Grantham based Bell & Webster Concrete is supplying contract specialists Costain Construction with terrace and step units suitable to accept the seating. Yet another example of precast units being used to create the terracing in new multiscreen cinemas. The units are a derivative of the tried and tested stadia components, which have been successfully supplied to many prestige sporting arenas over a number of years.



Vertical precast formwork for luxury dwelling

Precast concrete lattice girder panels are often used as permanent formwork, usually in floor slabs or bridge decks for civil and building applications. Most designs take advantage of the ability of the precast units to contribute structurally to give an efficient composite slab with obvious economic benefits. This has frequently been extended to vertical applications, such as precast linings to tunnels, infill wall panels to structures to resist blast loads and, recently, to the construction of vertical load-bearing walls.

At Farm Street in London, Mayfair, Kier London is redeveloping a restricted site for the ultimate in luxury living. The extensive dwelling includes a number of design features to isolate the substructure from ground-borne noise and vibration. There is a particular requirement to isolate the structure from adjoining buildings.

With the assistance of project manager Mike Perera, a system of permanent precast concrete vertical formwork was designed by Hanson Concrete Products to permit a single pour height of 3.5m. and at the same time maintain a 50mm gap between party walls. Being precast, the panels can be designed and manufactured to suit the requirements of each position along the perimeter. The arrangement of formwork tie positions and a two-way lattice configuration can also take account of the various heights of wall. Kier is so pleased with the speed and performance of the system that similar applications of the same construction technique are being considered.

Main Contractor: *Kier London*
Precaster: *Hanson Concrete Products*

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achieve consistent high-quality surface finishes. Dr Jacqueline Glass of Oxford Brookes University has written numerous influential papers on what she terms 'fabric energy storage', FES. She has demonstrated that the use of exposed concrete structures, particularly the floor slabs, can reduce peak daytime temperatures by 4 to 5°C and will move the time of the temperature peak back by several hours. This can eliminate or at least significantly reduce the need for mechanical cooling.

Talking of energy, it is worth remembering that concrete stands up well in comparisons. For example, 1475kWh are required to make a tonne of concrete, compared with 8684kWh for steel and 91,000kWh for aluminium.

There is a growing realisation of how much concrete can help in reducing a building's energy demands along with an appreciation of life-cycle costing. Dr Glass points out that, as a minimum, a building has costs in the ratio 1:4:10, where 1 is the building cost, 4 is the operating cost and 10 is the employee cost. An understanding of life-cycle cost is also well developed in the PFI sector, where the contractor has the responsibility to operate the building for 25 years or more. In these circumstances the motivation for buying decisions changes from lowest initial cost to best value and from lowest specification to energy-efficient construction. More and more the concept of the best value is being given a thorough analysis, taking account of the downstream benefits and cost reductions. This principle applies to all prefabrication work. Initial cost will seldom give the true best value at the buying stage.

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Composite Beam Design Proving A Success

Peter Kelly, technical director Bison Concrete Products highlights some of the reasons

Composite Beam Design is defined as the use of precast concrete hollow core and solid slabs with in situ infill in conjunction with welded studs onto steel beams to enable the slabs and steel beams to act compositely together enhancing the load capacity of the steel beams. The design has been successfully employed on a number of major projects, the Millennium Stadium, Cardiff where 45,000m² of 200 mm and 250 mm deep hollowcore units were installed, 38,000m² were supplied for the St James Park Stadium, Newcastle and 80,000m² of prestressed hollowcore is going into the Basingstoke Town Centre development.

The system offers many advantages, speed of erection, reduced site operations including a minimum of in situ concrete work, factory welded shear studs, reduction in steel components and quality assured factory produced precast components. Additionally the design allows the optimisation of shear stud design together with the elimination of local deflections. Other benefits worth noting are that once a precast floor is erected it becomes available as a working platform, propping is not required with hollowcore slabs designed compositely into a steel framed building and precast floors can be supplied with a fire resistance of up to two hours.

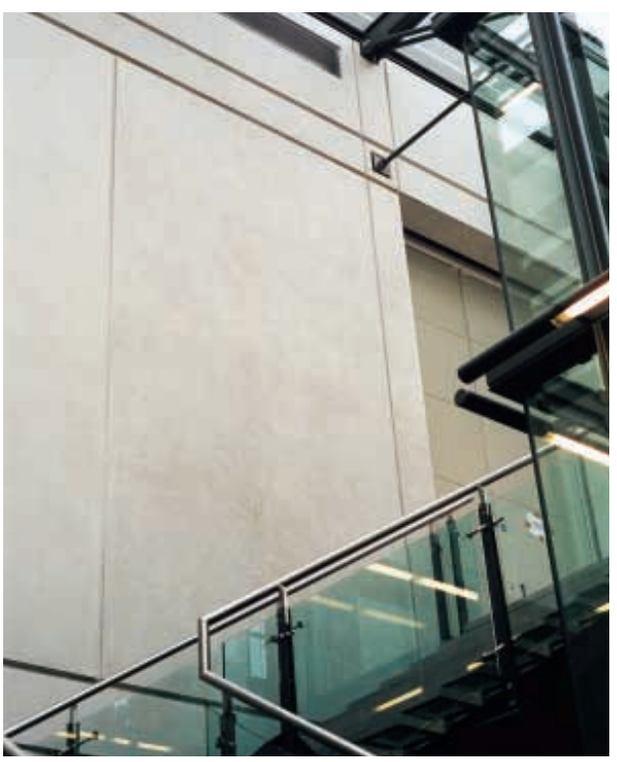
The concept has been subjected to a combination of experimental testing and finite element modelling. Testing consisted of a parametric study demonstrating the viability of this method of design and a further series of tests to provide the statistical basis. The development of the application of precast hollowcore and solid slabs to the design of composite steel beams is the result of several research projects undertaken since 1993 supported by the Engineering and Physical Sciences Research Council, the Precast Flooring Federation and Bison Concrete Products Ltd. The company acknowledges the research and development conducted by Dr D Lam of Leeds University, Dr K S Elliott of Nottingham University and Prof D A Nethercot of Imperial College.

Bison have embarked on a programme of technical presentations to structural engineers, design and build contractors and fabricators demonstrating the advantages and ease of design using their composite beam software. **For details of the presentations, copies of the technical brochure or the new software relevant to the revised BS5950 Part 1 incorporated into the Composite Beam Design programme email: composite@bison.co.uk**

Pfizer contract for Tarmac

Tarmac Precast Concrete has secured a multi million pound order for the design and manufacture of the precast frame and structural flooring on Pfizer's Building 530 to be erected in 2002 on their campus at Sandwich in Kent.

Manufacture will take place at the company's Tallington factory running from October 2001 to May 2002. The order includes 20,000m² of double tee flooring for the laboratory areas.



ARTISTIC FINISH

Precast concrete features prominently in the £25 million extension to the 1823 Manchester City Art Gallery. Picture shows main feature wall in the staircore and lift areas comprising nine individual wall panels, two intermediate floor beams capped by a roof beam weighing 19½ tonnes. SCC Ltd, the precast concrete contractor, achieved the appearance by using antique white cement, mica sand with a light acid etched finish.

Architect:
Michael Hopkins & Partners
Engineer: *Ove Arup & Partners*
Precast consultant: *Deakin Walton*
Main Contractor:
Bovis Lend Lease
Precaster: *SCC Ltd*

Up for the games

Recent completion of precast erection at the Commonwealth Games Stadium in Manchester, England, has signalled the temporary end of C.V. Buchan Ltd's involvement – namely to design, manufacture and supply precast elements to main contractor Laing Construction Ltd – in the project.

In was in March 2000 that Laing awarded C.V. Buchan the design/manufacture/supply contract for the precast units. In the absence of final detailed drawings, moulds were designed using architectural and schematic drawings – a risky procedure dictated by the tight programme. Top of the priority list were the intricate moulds for the terracing, which required four to six weeks for manufacture and a further three weeks before all of them would be at the factory. This hiatus allowed C.V. Buchan's design team to do some initial design and detailing so that construction details were in place and manufacturing could start as soon as the moulds arrived.

Owing to the prestigious nature of the project, the quality of precast concrete was vital. Of the many types of precast element, the terrace units – constituting over 50% of the total – dominated. The standard units were split into just two geometrical sections, one at the middle tier and the other at the upper tier. As the middle tier had a rake of about 1:2 and the upper tier 1:15, two sections were required.

A further complication was that the bowl shape had to be incorporated into the terrace units, the plan diameters being 840.68m for the sides, 413.67m for the ends and 59.23m for the corners. The ends of the terrace units were therefore bevelled so that terracing could be faceted, giving the illusion of a curve. This led to a variation between the front edge and back edge of the terrace units ranging from 18mm to 216mm. Coupled with variations in the length of terracing from 2923mm to 8008mm, the result was extensive variation in the geometry of the terracing units. In short, this portion of the precast package proved extremely challenging.

Among features involved were strip recesses to allow a slip-resistant strip to be post-filled, radiused nosing to remove any sharp edges or lines, toggle joints with a drip detail to enable a natural shear connection, and a waterproofing feature. Shear connection from terrace to terrace, and from terrace to rake beam, was achieved by a dowel-to-pocket design. Also incorporated into the table of the unit was a 1:80 fall to combat ponding in rain.

Perimeter beams were 250mm thick quadrilateral units spanning from column to column on each gridline, sitting in formed rebates in the capitols. The top edge of the beam featured an angled detail to break the sight line and improve appearance. Walls were cast horizontally on steel moulds with the vomitory side of the wall receiving a power float finish, all formers and details being made by C.V. Buchan's joinery team. Other precast items included step blocks, staircases, and specialised terracing with non-standard sections.

The company has also produced – and is storing outside so that weathering will match what has been erected – precast units for the final section of the stadium. This represents some 16% of the total.

***Client**: Manchester City Council Special Projects Office*
***Main Contractor:** Laing*
***Structural Engineer:** Ove Arup & Partners*
***Architect:** Arup Associates*
***Precaster:** CV Buchan*

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