SPAN NEWS
STRUCTURAL PRECAST ASSOCIATION
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SUSTAINABLE CONSTRUCTION


Mike Downing is Managing Director of Trent Concrete Ltd.

Mike Downing, chairman of the Structural Precast Association, examines the role of the precast concrete industry.

In 1998 the government published a paper "Sustainable construction – opportunities for change" and it is perhaps appropriate two years on to assess the contribution the precast industry is making to sustainability in construction.

Reports from the DETR identify specific targets including quality and durability of construction; re-use of materials; improved efficiency; reduction of waste and pollution and improved energy efficiency. I believe that many of these issues have been addressed but there is no room for complacency and the industry should continue to set itself targets and monitor progress.

- ***Procurement process:*** New procurement routes, such as partnering and strategic alliancing, have an important role to play in sustainable construction. By bringing the interfacing specialist contractors together with the design teams early in the process, considerable time and cost savings can be made along with major reductions in duplication and waste.
- ***During manufacture:*** Manufacturing buildings in factory conditions with permanent employees means that skills and knowledge are continuously applied, resulting in much more efficient use of labour and improved quality.

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Moreton Lane Prison an example of fast construction

CV Buchan are coming to the end of their on-site activities in connection with the detailed design, supply and erection of Moreton Lane Prison for their customer, Kvaemer Construction Limited.

The Prison is situated near the village of Marchington in Staffordshire and is a Category B establishment, designed for a population of 800.

The complex comprises 11 major structures, the two largest being multi-wing houseblocks containing the main prisoner accommodation areas. Segregation areas, training, works and hospital facilities are also included as precast structures.

Buchan secured the contract in September 1999. A dedicated design team liaised closely with the project architect and other major sub-contractors to produce a fast-track design programme, the aim of which was to satisfy the end-user requirements and optimise the design for the benefit of precast manufacturer.

Precast concrete was selected for the structure for its durability, robustness, and because Buchan's "factory engineered concrete" system of build was one of the few methods available which would achieve the overall project programme.

Erection commenced after the Christmas break with typically 1000 tonnes of precast concrete being erected each day at peak times.

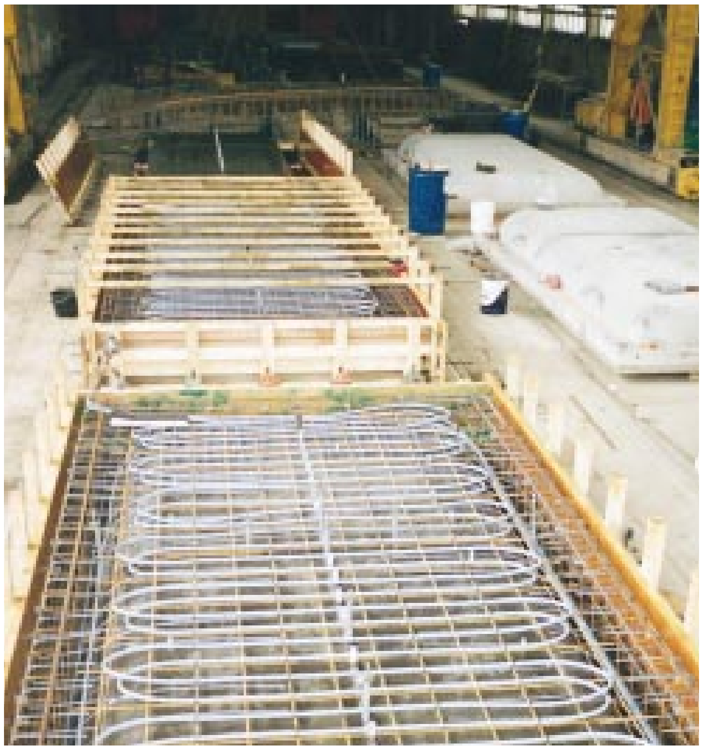
In total over 11000 units and the roof structure were erected in just 142 working days, involving up to 9 mobile cranes.

Another advantage of the system was that following trades were able to occupy the buildings immediately.

Controlling the Building Environment

Norman Brown, Structures Director at Tarmac Precast Concrete, reports on embedded coil technology.

Within the next few years, embedded coil technology will become the most common form of heating and cooling of buildings driven principally by the ever increasing need to reduce CO_2 and refrigerator gas emissions.



Underfloor heating specialists Warmafloor have pioneered the use of embedded coil technology and created a separate company, Structural Conditioning, to develop a patented system for environmentally conditioning buildings using precast concrete components.

After proving the system, which included extensive testing by the Building Services Research and Information Association, Structural Conditioning has joined forces with Tarmac Precast Concrete to bring the concept to market under the name of Thermocast.

Tarmac Precast Concrete has a proven track record in the supply of both prefabricated flooring and structural components which make up the Thermocast concept. These components can be incorporated into steel, in-situ, precast and composite frame systems and either just supplied or supplied and fixed.

Each project is considered by the Thermocast team individually to enable the project specification to be developed alongside detailed designs, heat transfer requirements, control packs and all other necessary interfaces.

The system can be driven by renewable energy resources, such as lakes and rivers, ground water or by chillers or conventional boilers. It can be used as a direct form of cooling or heating or used as a storage element to condition the building space during occupied periods. Differential mean radiant temperatures between the concrete, (which is a highly efficient thermal store), and the occupied space provide passive heating or cooling resulting in excellent comfort levels. In the cooling mode, the system will absorb internal gains from people, lighting and equipment as well as solar gain.

By using Thermocast, it is possible for clients to be provided with an optimal solution for controlling their building environment using factory engineered components that facilitate energy savings and reduce carbon dioxide emissions during the lifetime of the building. The use of off-site fabrication and the installation of embedded coil technology is at the forefront of modern construction practice advocated by the Egan Report.

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The modern precast factory has full environment management, with the small amount of discharge being carefully monitored and controlled. Unlike construction in general, there is very little waste as materials are ordered in strict quantities from sustainable sources. The factory environment also means that materials can be properly stored, handled, consumed and recycled. Precast production also uses less energy than that required for either structural steel frame components or system curtain walling.

- ***On site:*** By prefabricating the whole of or a major part of a building, site activity can be minimised. Components are delivered to site, just-in-time in a carefully planned sequence, so that a single crane movement takes the component from the delivery vehicle to its final position in the building. Construction is faster, there is less pollution from dust and noise and there are fewer traffic movements. In addition, fewer people are needed on site, which in turn increases safety and simplifies construction management. A development of this strategy is to make units as large as practical to reduce the number of components to be erected, minimise the amount of joints and fixing components and speed up construction.
- ***Lifetime considerations:*** The high-quality finish of precast concrete means that it can be left untreated and exposed to maximise concrete's thermal capacity and contribute to green energy-management solutions.
- ***Continuous improvement:*** Most precasters have now introduced procedures fully in line with the ISO 14001 Specification for Environmental Management Systems – and members of the precast product associations are establishing Key Performance Indicators adapted from those used by the Movement for Innovation. These KPIs will provide a useful measure of how continuous improvement is being achieved.

Factory prefabrication of precast buildings and building components has a very beneficial impact on construction efficiency, safety and sustainability.

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FABRIC ENERGY STORAGE

– the hidden genius of precast concrete

Dr Jacqueline Glass, Oxford Centre for Sustainable Development, Oxford Brookes University

Concrete can make a useful contribution to energy efficiency in buildings. The thermal capacity of concrete, sometimes called thermal mass or fabric energy storage (FES), enables it to store and re-radiate heat provided it is 'exposed' to the heat source. With thermal mass, the onset of peak temperatures can be delayed by up to 6 hours and reduced by 3-4°C. In commercial buildings, the impact of internal heat gains is so great that FES makes a more meaningful contribution to occupant comfort than either insulation or solar shading.

Many blue chip UK clients have already used precast FES concrete including BRE, BT, Toyota and the Inland Revenue. Although any part of a concrete structure can be used for FES, floor slabs (soffits) are particularly suitable because they form the largest volume and surface area and are evenly distributed throughout the building. A concrete thickness of anything from 100mm to 300mm thick can be effective; any extra mass provides the client with free 'heatwave insurance'.

Above: Toyota's HQ in Epsom uses 'passive' exposed precast concrete soffit units throughout the office areas as part of a hybrid concrete frame. A precast floor unit being lowered onto falsework, Trent Concrete Ltd manufactured the precast columns and floor slabs.

Left: BRE's Environmental building and uses 'active' sculpted precast units to good thermal and aesthetic effect. SCC Ltd manufactured the columns with an RSJ cast through projecting top & bottom to take the beams which have an S shaped seating ledge.

Simply exposed slabs using flat, coffered or troughed surfaces (with a raised floor system above) can absorb heat gains from occupants and equipment. These 'passive' systems have up to 25W/m^2 cooling capacity. An 'active' FES solution achieves enhanced heat transfer by forced ventilation through a precast hollowcore slab, or across the slab surface. This gives up to 40W/m^2 of free cooling and results in a 50% reduction in CO_2 emissions (compared to air conditioning). Thermodeck and hollowcore floor panels are examples of active FES systems. Bespoke floor systems using curved or serpentine-section precast concrete units can be particularly effective.

If a significant area of concrete is to be exposed, then consideration should be given to the attainment of an appropriate surface consistency and colour consistency for the concrete. To attain an acceptable surface consistency, the designer should include a clause in the concrete specification stating the number and size of acceptable imperfections per unit of surface area. FES soffits in particular are most effective (for daylighting and lighting) if they have a white or pale finish that helps to reflect or 'bounce' light onto workspaces. Both white architectural concrete and painted structural 'grey' concrete have been used in FES buildings.

TRANSFER OF WASTE MADE EASY

Elevated access to enable private vehicles to park adjacent to and above transfer skips is being installed at the Leominster Waste transfer station for Mercia Waste Management Limited.

The scheme called for a ramp, up to and down from, an elevated section from which spurs would be created to allow parking for the transfer of refuse directly into the skips. The design had to make allowances for the unrestricted movement of skips to and from the various bays and at the same time for a structure to be erected to carry the elevated roadways.

The solution was to use Tee walls produced by Bell & Webster Concrete Limited. The units are manufactured with stainless steel or T20 dowels projecting from the top to form a connection to the slab reinforcements. Special L shaped walls were manufactured to form the bay ends with similar dowels incorporated. Once everything is in place, the slab is cast to form the spur roads using the Tee walls as the structural element.

The Leominster project is just one of a number under construction in the region.

Client:	*Mercia Waste Management Limited*
Contractor:	*Dean & Dyball Construction Limited*
Engineer:	*Halcrow Group*
Precaster:	*Bell & Webster Concrete Limited*

LITERATURE UPDATE

Ebor Concretes' the market leader in the design and manufacture of dock leveller pits, has published a brochure highlighting the advantages precast concrete has over competing materials. The company, in conjunction with a major dock leveller manufacturer, has created a design and build team specialising in distribution centres to meet the following criteria.

- *Quicker site completion.*
- *Phased deliveries of components to optimise vital site space.*
- *Accelerated progress of following trades.*
- *Factory engineered tolerances to ensure final fit of the dock leveller equipment.*

The brochure details the package available, with particular emphasis on the most economical solution best suited to the layout with typical examples illustrated. The section on open dock leveller pits includes an assembly sequence supported by drawings making it a useful working document.

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Picture shows tailgate pits

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