

# interface

at the forefront of architectural precast concrete solutions

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benefits from  
Hardwall®  
construction**

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refurbishment  
in London  
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area**

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construction**

*Trent*

CONCRETE  
LIMITED



# Fosters design benefits from **hardwall** construction

Hardwall® is an insulated precast concrete sandwich panel system, which has been used extensively in the US for the last two decades. Trent Concrete is now bringing the benefits of this unique construction method to the UK market, having completed the warehouse at the new headquarters for JC Decaux in Brentford (which won two accolades at the recent Concrete Society Awards) and currently working on the Ocean Terminal project at Leith. For a detailed explanation of the Hardwall® concept, please refer to the Practically Speaking section of this newsletter.

## **The JC Decaux project**

Hardwall® was specified for the new warehouse building at the recently completed European headquarters for JC Decaux, designed by architects Foster & Partners, on the Great West Road in Brentford. This project was recognised with The Concrete Society & BPCF Award for Excellence in Precast Concrete and a Concrete Society Certificate of Excellence.

The headquarters has three distinct parts – a refurbished grade 2 listed 1930s office building, a new warehouse and a covered street linking the two. As the existing listed office building had to

retain its white render, a material was sought for the warehouse that would respect its predecessor whilst expressing its own originality and create a clean, light and efficient image. The client and architect selected precast concrete based on its high aesthetic quality, accuracy of finish and ease of installation.

Trent Concrete was responsible for the precast reinforced concrete frame with a grid of 15 metres span by 9 metres bay centres, as well as the 1530m<sup>2</sup> of Hardwall® cladding. The design was optimised so that the smallest number of large

units could be used. The cladding panels measured 9 x 3 metres; the main roof beams 900 x 400mm, external columns 600 x 400mm and internal columns 400mm square. This enabled rapid construction of the 63m long, 45m wide and 9.65m high warehouse, with the entire frame and cladding to the two long elevations being erected in just 12 days.

The panels are self-finished, and since the structure was to have no internal lining, all fixings also had to be hidden from view. Trent Concrete produced a white reconstructed stone mix incorporating Spanish dolomite for additional "sparkle". The interior walls have a superior trowelled architectural finish, whilst the exterior seen surfaces were treated with a light acid etch and a rubbed finish. These quality finishes are an important aspect of the project since JC Decaux, a leading supplier of street furniture and advertising space, regularly tours the warehouse with clients.

The absence of sheeting rails and sag rods also keep the inner face clear and easy to clean. The cladding fixings were made as small as possible and recessed into the inner leaf of the sandwich, directly behind the columns. Similarly, column and roof beam connections were designed to fit into the top of the beams keeping them out of sight. Computer simulations were set up to ensure that all the fixings were outside any possible lines of sight. A clean appearance was also achieved

externally, by, for instance, casting the rain water pipes into the columns. This further enhances the crisp lines of the warehouse's simple rectangular design and makes it a fitting partner for the refurbished office building.

From a structural viewpoint, the building is designed to be braced in the longitudinal direction using the precast sandwich panels as the structure. The panels were dowelled at the horizontal joints to transfer the shear forces, and robust mechanical connections were installed to bolt the panels to the columns. The roof structure and cladding act as a diaphragm to transfer wind forces into the braced frame. In the transverse direction the structure is designed as a sway frame taking advantage of the 11.35 metre high cantilever columns.

The result is an aesthetically pleasing, structurally sophisticated, and thermally efficient building.



**Cover:** Linking the new warehouse and the refurbished office building is a vaulted glazed canopy, which shelters a broad street acting as a 'showroom' for JC Decaux's street furniture. Trent Concrete also supplied the paving for this street, matching the cladding in colour and finish, and designed to withstand loads imposed by a 35 tonne crane.

## Professional teams

client  
JC Decaux UK Limited  
architect  
Foster & Partners  
construction manager  
Heery International Limited  
structural engineer  
Anthony Hunt Associates

client  
Ocean Terminal Ltd  
contractor  
Bovis Lend Lease  
architect  
Keppie Architects in association with Conran & Partners  
engineer  
Bingham Cotterell



◀ **Ocean Terminal** - Trent Concrete has also recently erected a Hardwall® cladding system at the Ocean Terminal retail and leisure development in Leith, Edinburgh. Once again, the relatively small number of large units, 74 8 by 3 metre panels, meant a short build time could be achieved. In addition to the speed and ease of installation, Hardwall® cladding was specified for its ability to insulate airborne sound and its aesthetic qualities.

# Reconstructed stone refurbishment in London conservation area

The recent refurbishment of a seven-storey office building on Dacre Street in London SW1 featured a reconstructed stone façade. Westminster City Council's planners accepted a reconstructed rather than natural stone façade, even though the building is situated in a sensitive conservation area close to the Houses of Parliament, based on samples provided by Trent Concrete.

The existing façade was stripped back on the two main elevations to the original reinforced concrete frame - resulting in a challenging design development task for Trent's in-house design team. The new reconstructed Portland stone cladding, treated with an acid-etch and ground finish, was then fixed to this exposed frame. The panels included spandrel and mullion units which form integral window openings, a cornice detail at fourth floor and parapet level, shear walls and complex fascia and soffit units to the main entrance. Mullions on the ground to first floor level feature alternating bands of smooth and textured finishes, producing a striking visual appearance.



## Professional team

client

Lloyds Bank Pension Trust Corporation Limited

contractor

Bowmer & Kirkland

architect

LDA Limited

engineer

Michael Bradbrook Consultants

## Online resource

Copies of the current and previous issues of Trent's Interface newsletter, along with detailed product definitions and applications, case studies illustrating how the products are used in practice, in-depth technical information and advice, sections on procurement and sustainability issues, a samples library and all the latest news, are available at Trent's web site: [www.trentconcrete.co.uk](http://www.trentconcrete.co.uk)

# practically speaking

a regular source of information and advice for the design team

## Sandwich panel construction

By Cliff Billington, Trent's Chief Engineer



Most precast concrete cladding forms only part of a wall construction. To provide the overall functions of a wall, it is usual to add additional layers providing insulation and inner lining. This is also the case with 'traditional' cavity wall construction of brick/block.

For some time now, it has been possible to provide a precast element that incorporates all the individual functions in one piece. In the precast industry, such a product is a sandwich panel, also termed Hardwall®. A sandwich panel not only gives the required structural and thermal properties, but also gives several spin-off advantages as well.

In simple terms, a sandwich panel consists of two layers of concrete fastened together

with insulation in-between. The fastening together of the two layers is the critical aspect that requires careful consideration. It is possible to use reinforcing bars to stitch the layers together, and Trent did this in the mid 1980s for projects at Tetrapak and the Manchester Royal Infirmary. However since those early days, various proprietary systems have been developed which are more efficient as well as being easier to use.

These systems fall into two distinct types, one using metal connectors and the other using non-metallic. Metallic connectors are generally sourced from the continent, where they are still widely used. However, they have several serious drawbacks. The stainless steel connectors are very rigid, and thus they do not allow independent thermal movement of the outer layer relative to the inner. This in turn puts a limit on the size of panel that can be made without having expansion joints in the outer layer. For one leading system this is as low as 5m! Another major problem with metal connectors is the localised heat flow permitted along the connectors, which can produce cold spots with local condensation being a risk. To overcome these problems, a new generation of connector

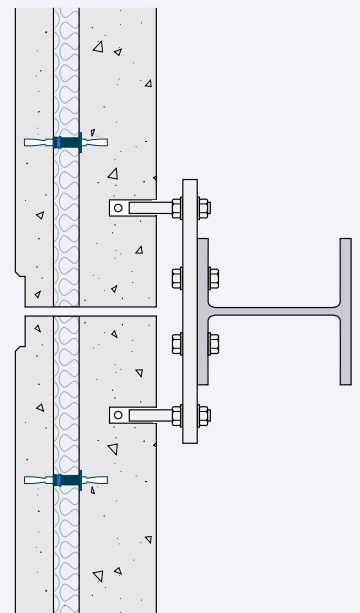
was evolved in USA in the late 1970s. These connectors are flexible enough in bending to allow relative movement of the two concrete layers, whilst using modern high-tech materials to provide the structural integrity to support the outer layer. The first of these, and the one used by Trent, is the Thermomass® system. This uses connectors of high strength fibre composite, with a tensile strength of over 800 N/mm<sup>2</sup> which is about four times as strong as stainless steel. This is used in conjunction with blue Styrofoam\* insulation to give a composite sandwich panel in which each element has a proven track record. Over 6 million m<sup>2</sup> of Thermomass® walling is now in use.



connectors are inserted through the insulation into the 'wet' concrete on a 400 x 400 grid and securely bonded. The upper layer of concrete, again incorporating reinforcement, is then poured around the protruding connectors. The connectors thus stitch the two layers together. Once hardened, the complete unit is then taken from the mould and finished in the same way as a solid cladding panel would be.

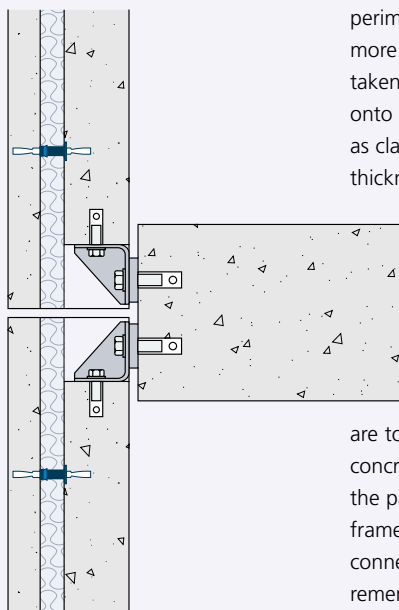
As mentioned above, combining the various elements together has many advantages. All aspects of production are carried out in a factory

### Typical fixings to steel structure





**Typical fixings to concrete structure**



environment where quality control is carefully monitored. Several trades are removed completely from site. Site erection is fast, with a 30m<sup>2</sup> panel being placed in half an hour. Once fixed, the joints are sealed, giving an immediate weatherproof envelope.

A Hardwall® system can be used not only as cladding, but also as an integral part of the structure. By using the roof as a diaphragm, the stability of the building can be provided by the panels acting as shear walls. Thus heavy/stiff columns can be reduced, and in many cases done away with

altogether, with the panels carrying the roof at the perimeter of the building. If a more traditional approach is taken, the panels can be fixed onto a steel or concrete frame as cladding. Since the overall thickness is more than a single outer skin of concrete, this allows more scope to make fixings non-visible from the inside, providing a 'clean' appearance especially if no further finishes

are to be applied to the concrete. Even when hidden, the panels are usually fixed to a frame using simple bolted connections. It must be remembered, however, that it is only the inner layer that is connected/supported, as the outer layer hangs off the inner by means of the connectors. Since the area supported is only 0.16m<sup>2</sup> per connector, the factor of safety is in the region of 12 to 20. Thermal movement can take place freely since there are no rigid fixed points. When detailing, it is important that the joint details can accommodate movement, which could be in the order of 13mm.

Being a reinforced concrete member, Hardwall® gives excellent resistance to many types of forces, including blast, impact from vehicles such as fork trucks, and vandalism. This

makes it especially useful for buildings requiring a high degree of security such as data storage. (In USA the system is particularly popular for prison construction).

The thermal insulation afforded by the Styrofoam\* easily meets current building regulations with a typical construction of 75 outer layer/52 insulation/150 inner layer giving a U value better than 0.45. Adjusting the thickness of Styrofoam\* will also accommodate the proposed tightening of the regulations, and in fact the system is ideal for cold storage where very high standards of insulation are necessary. Another aspect of thermal behaviour is the thermal mass afforded by the inner layer inside the insulation. This means that as the building is heated, heat is stored in the relatively massive inner layer. When the heat is turned off, the heat is released back into the building. This fabric energy storage evens out the thermal peaks and troughs, and the avoidance of such temperature swings not only means a more comfortable environment, but considerable cost savings.

Styrofoam\* is a registered Trademark of the Dow Chemical Company

Thermomass® is a registered Trademark Composite Technologies Corporation

Interface is the newsletter of Trent Concrete Limited.

The back page, "Practically Speaking", will tackle different subjects and provide technical advice for the design team based on Trent's many years of experience. Each project requires several teams with differing priorities to reach fruition - we hope to improve the interaction between them, as well as between building components, and so overcome potential problems before they arise. If you have any suggestions for future topics, or would like to discuss this issue's feature with Cliff, please do get in touch.

For further information regarding any of the topics raised in this issue please contact

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