

Conversions to Concrete

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There has been a growing trend in recent times for clients and their project teams to change the original design and opt for a re-design in concrete. This edition of Framework carries three recent high-profile projects where, for a variety of reasons, the client was convinced that he could obtain better value by using the concrete option. It is not a coincidence that, in all cases, the specialist concrete contractor was consulted at an early stage and included in the project team, thereby having the opportunity to utilise his experience and knowledge for the benefit of all. Nor is it a coincidence that the concrete contractors used are members of CONSTRUCT and are also SpeCC - registered, offering confidence that they are able to perform to the highest standards.

The massive hike in steel prices over the last two years, and the tragic events of 9/11, have ensured that clients more carefully consider all design options. Concrete has been shown to be a flexible, reliable and durable material over thousands of years and never have these qualities been more appreciated than now, when safety, economy and speed of erection are prime objectives for every designer. Typical examples of the current attitudes can be seen at the Beetham Tower in Manchester, where concrete's inherent fire resistance, acoustic performance and strength were major reasons for the choice of material. Safety was another element, as the use of tableform formwork provided a safer environment for workers. A similar story unfolds at Bridgewater Place in Leeds, where concrete turned out to be both the quicker and more economic option.

The following case studies go one step further as, following a re-assessment in conjunction with the specialist contractor, the client decided to change course.

Albion Riverside, Battersea

BBC White City Development

HM Treasury

Colin Cleverly, the Executive Secretary of CONSTRUCT for the past 12 years, is to retire on March 31st. He has been at the helm since the formation of CONSTRUCT in 1993 and has guided the organisation through a period of great change in the construction industry.

He will be succeeded by Robin Holdsworth (pictured below) who has had considerable experience in materials, both in the UK and overseas.



Conversion Projects from Steel to Concrete

1. Albion Riverside, Battersea

THE ARCHITECTURE

The development of Albion Riverside by the Client, Hutchinson Whampoa Property, reinforces a growing new community on the south bank of the Thames between Battersea and Albert Bridges.

The Architect, Foster and Partners, was challenged to design a mixed-use development; its ingredients designed to promote a lively urban quarter where people can live, work and enjoy city life.

The principal building on the waterfront is eleven storeys high. Its massing is designed to respect the heights of neighbouring buildings and to frame the view of the river from the opposite bank. The building arcs back from the river's edge in an asymmetrical crescent to create a public space alongside the river walk.

The apartments are elevated two storeys from the ground, supported on dramatically sloping 'V' columns constructed in high quality in-situ reinforced concrete.

The façades are principally of glass, used in a range of translucency to create elevations which vary in appearance and sparkle according to prevailing light conditions. On the river façade, in-situ concrete floors form complex curved balconies with clear glass balustrades.

The southern façade is expressed as a veil of aluminium rods, which forms a rain-screen in front of a metal and glass weathering layer. The roof continues the buildings curving form, appearing to wrap over and around in a single sweep.

THE STRUCTURAL DESIGN

An early decision was made to use reinforced concrete for the main frame, cores and flat slab floor system, as it:

- facilitated the shallowest floor construction, thus maximising floor to ceiling height
- possessed inherent fire protection
- provided the required acoustic insulation between the floors
- achieved maximum flexibility for services distribution
- could easily accommodate the required free-form curving shapes.

The flat slabs were supported on slender blade columns, "hidden" within the walls to help achieve the architecturally clean lines of these modern apartments.

A transfer deck at 2nd floor level was used to carry loads into a system of architecturally impressive but structurally complex 'V' columns. These were introduced to dramatically reduce the number of superstructure columns and thus:

- create an architectural transparency at ground level
 - greatly increase the number of basement parking spaces
 - further enhance the architectural statement
-

Concrete Frame Construction

Huge jumbo columns were formed in the basement to take the transferred loads from the V-columns above and it was here that the complex 3-dimensional modelling of rebar began. With 50mm rebar at specified 3-dimensional positioning there could be no bending and bashing of starter bars.

The development of the 'V' shaped columns, tapering in two planes, represented a major challenge. These columns were originally envisaged as smooth painted structural steel, filled with reinforced concrete. However, steelwork contractors proved unable to produce the required smoothness and accuracy of form.

At this point, John Doyle Construction, the specialist concrete contractor, took on the challenge of constructing these columns from reinforced concrete with a fair-faced finish. With columns varying from 75° to 41° rake angle and no repetition between the 3D geometry, a £60K development programme was created, with phases of:

- 3D modelling
- formwork design for loadings, surface finish and release agents
- concrete mix design
- full scale trials.

A range of trial mixes was produced, including self-compacting concrete, but the successful mix was arrived at as a superplasticised C60, with a minimum cement content 425kg, a water cement ratio of 0.38, 10mm limestone aggregate and 200mm slump. This was placed using a combination of internal and external high frequency vibration, monitored to the minimum to achieve the finish whilst avoiding sand runs and bleeding to the finish.



Completed raking V-column.



V-column complete at rear of building.



Completed Albion Wharf

2. The BBC White City Development

The BBC acquired the historic White City, site of the 1948 Olympics adjacent to the A40(M) in West London, to construct a six-storey Broadcast Centre, Central Office, Energy Centre, associated facilities and an underground car park.



The Client's engineer initially proposed a steel frame design for the superstructures but Byrne Bros, a leading specialist concrete contractor and a founder-member of CONSTRUCT, decided to produce an alternative concrete option in association with Walsh Associates and Bovis Lend Lease.

The objective was to offer the client a solution which would be both faster and cheaper and their full tender submission proved to be excitingly successful, ultimately saving the client a total of 9% of the original tender cost. Nobody can blame Byrne Bros and the project team if the TV licence fee rises!

The brief called for a flat soffit, to facilitate service distribution, provide mass for acoustic and vibration response and give flexibility for future change of use. A 400mm thick concrete flat slab met these requirements and highlighted the inefficiency of the equivalent 450mm thick floor proposed for the steel frame design, using precast planks plus in-situ concrete topping.

The adoption of a sway frame also offered a decisive advantage, as this eliminated the need for internal shear walls, thereby speeding construction and offering the client additional flexibility.

Downstand beams were abandoned, allowing the use of table formwork. These were fitted with leg extensions to enable easier removal and re-use on other floors. Bespoke steel formwork for columns was included to eliminate the need for painting, instead offering a high-quality, aesthetically-pleasing plain-formed finish.

The rationalisation of reinforcement, the use of hybrid elements, prefabrication and assembly are further examples of the innovative techniques employed and are testament to the professionalism adopted by Byrne Bros and the project team. The BBC reaped the rewards of the savings that accrued from getting the specialist concrete contractor on board early, allowing innovation to work in its favour.

3. HM Treasury

PROJECT DETAILS

The re-development of the Treasury site by Stanhope and Bovis Lend Lease was constructed in two phases to ensure that the building could remain occupied by HM Treasury throughout the course of this PFI project.

During the first phase, the refurbishment involved the demolition and re-construction of stair and toilet cores with composite steel structures. At the end of the first phase, a "lessons learned" workshop investigated options for the second phase to improve on the design and construction methodology. One of the main issues related to the number of interfaces between the concrete and steelwork trades for the reconstruction of small footprint cores. A method for the complete re-construction of the cores using a concrete structure was proposed and adopted at site, the main benefit being the programme certainty that resulted. This argument persuaded the client and professional team that concrete would be the more appropriate option.

CONSTRUCTION SEQUENCE

The construction sequence for the first phase was as follows.

- Demolition contractor completes demolition of existing structure, including the formation of padstones and installation of temporary works.
- The cleared core is handed over to the concrete contractor to construct walls and ring beam foundations.
- The steel erector completes structural works to splices.
- Metal decking contractor places decking to steel structure and hands works back
- Concrete contractor completes floors .

The construction sequence is simplified for concrete and the formation of padstones as demolition work proceeds is not required.

- Demolition contractor completes demolition of existing structure, including installation of temporary works.
- The cleared core is handed over to the concrete contractor to construct walls and ring beam foundations.
- From spreader beams, works to all other floors commence from basement to roof.

A comparison of the respective programmes demonstrated a clear 8 week saving on the original 23 week programme by using concrete.



ADVANTAGES AND DISADVANTAGES

The main advantages of concrete construction are as follows.

- Fewer interfaces between trade contractors.
- Less dependency on tower craneage.
- Greater flexibility in construction, especially at fourth floor set-back and padstones.
- Reduced overall programme period.
- Flat slab construction provides better access, flexibility and fixings for service contractors.
- Additional flexibility for service risers and openings in the slabs.
- Possible cost benefits.