

Projects in Belfast and Dublin

Paul Halpin (M) and Alan Mannis (M) describe schemes being undertaken by Albert Fry Associates

Adelaide Exchange Development, Belfast City Centre

The area directly south of the City Hall in Belfast City centre, known as the Linen Quarter, has been undergoing major development over the past 15 years. One of the larger developments to be completed is the 25 000m² Adelaide Exchange Development between Alfred Street and Adelaide Street. The nine storey mixed use development is already home to US company Liberty's IT staff, Belfast City Council offices and a 170 bedroom Premier Travel Inn, as well as 183 underground car parking spaces serving the development above.

The linen quarter was historically home to many of the large linen warehouses of the Victorian era, and before this, the area was occupied with industries such as the old gasworks and brickworks. The site itself was previously a car workshop and showroom, and before that, part of the old gasworks on the banks of the Blackstaff River. The Blackstaff had been culverted and re-routed many decades previously and the original route infilled to reclaim extra land in the 1920s and '30s. With the many and varied previous land uses the ground was contaminated with a mixture of gasworks spoil and oil, which in any case had to be removed from site to allow construction of the basement.

The development has a total frontage onto Adelaide and Alfred Streets of 130m and is bounded on the other sides by adjacent buildings. Extensive desk studies were carried out on the surrounding buildings which varied from early 19th Century, five storey warehouses founded on shallow timber piles to modern, piled seven storey apartments and offices. The ground underlying most of Belfast City centre consists of soft estuarine alluvium and clay over bedrock, which can vary in depth from approximately 15m to more than 30m below surface. Lenses of sand can harbour perched water tables.

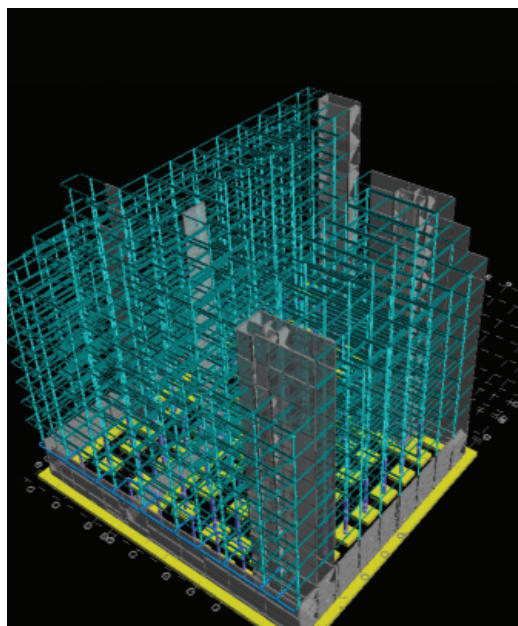
The close proximity of the adjacent buildings and streets to the

8m basement excavation was carefully considered and CFA piling with a propped perimeter capping beam anchoring the tops of the CFA piled wall was adopted as the least risk option. Extensive 3D monitoring of the adjacent properties and capping beam was also put in place and continued throughout basement construction works. In the double storey basement construction alone, some 26 000m³ of material was excavated and 279, 750mm diameter CFA perimeter piles along with 891, 600mm diameter CFA bearing piles were installed by Cementation Foundations (Skanska), which also took care of the bulk excavation and coordination of the propping. Bearing piles typically extended to 23m depth below surface and were required to carry both an 80t safe working load and a 30t tension capacity to anchor the basement floor in both the temporary and permanent conditions. Due to the perched water tables and the proximity to the main water table, continuous pumping from well-points was utilised to minimise water ingress into the excavation. A Caltite waterproof concrete by Cementaid was chosen for the lower basement floor slab, designed against hydrostatic uplift, and for the facing internally to the perimeter piled wall, also under hydrostatic head of water. The upper split-level basement slabs were constructed from *in situ* flat slabs, the main contractor, Patton Construction, opted for 'roll-out' type reinforcement mats which minimised fixing time on site. The grid of columns was set typically at 5m, which suited the car parking within the basement and the office grid above, avoiding the need for a deep transfer structure over most of the site. The optimal hotel layout however did not correspond to the basement grid and therefore a transfer structure incorporating 1200mm deep *in situ* concrete beams was adopted at first floor level within the hotel.

RPP Architects arranged the buildings above basement level around a central, ground level public piazza to maximise natural light. The superstructure of the hotel above first floor level,



1 Adelaide Street Elevation to Offices (Courtesy RPP Architects)



2 Building Superstructure Model from RAM Structural System

3 Internal Courtyard Elevation showing the rear of the Premier Travel Inn



comprises of a grillage of composite steel beams supported on steel columns. External walls are finished in a mixture of rendered blockwork and red brick in standard cavity construction. The superstructure for the offices uses a mixture of composite long span cellular beams, by Westok and shallow Slimfor beams, by Corus, this allowed for extensive options for service runs to be planned after construction had commenced on site. External finishes to the offices vary from curtain wall glazing, to solid limestone and traditional cavity block wall on the first phase, with extensive secondary steelwork required to stabilise the external walls against the high wind suctions encountered. The second phase offices also use Kingframe insulated cladding panels for the external walls to cut down programme time and site, wet trades. Stability to both the hotel and offices was gained by five separate concrete lift and stair cores rising from foundations to roof level. Patton Construction opted to form the cores using a bespoke climbing formwork to full height prior to erection of the structural steelwork.

The demolition works started in summer 2004 and the development was completed in phased handovers during 2007.

Merrion Road, Dublin

The half acre site on the Merrion Road in Dublin was for many years a petrol filling station prior to its purchase in 2005. The new development was for high end landmark residential seafront homes with spectacular views out across Dublin Bay and to the Dublin Mountains.

Having all but reached the final design stage and awaiting client notice to proceed to site commencement, this dual aspect 42 apartment residential scheme designed by Dublin Architectural practice DTA comprises a 13-storey structure to include two levels of below ground basement car parking. The architectural design concept behind the predominantly glazed and aluminium clad facades will emphasise the reflective qualities of the finish which will catch and reflect sunlight and create a shimmering effect of the building massing and form.

Having gone through a lengthy planning process before receiving a full grant of permission the project was made even more complex from a planning perspective considering the half

acre site footprint straddles the demarcation border of two Local Authorities – Dublin City Council (DCC) and Dun Laoghaire Rathdown County Council (DLRCC).

After numerous structural design options being explored and subsequent review with the client, it was decided to proceed with the design of an 11-storey steel framed solution, modelled on RAM structural software, with the provision of precast floor plates at each level all supported from a 1m deep reinforced concrete transfer slab at ground level.

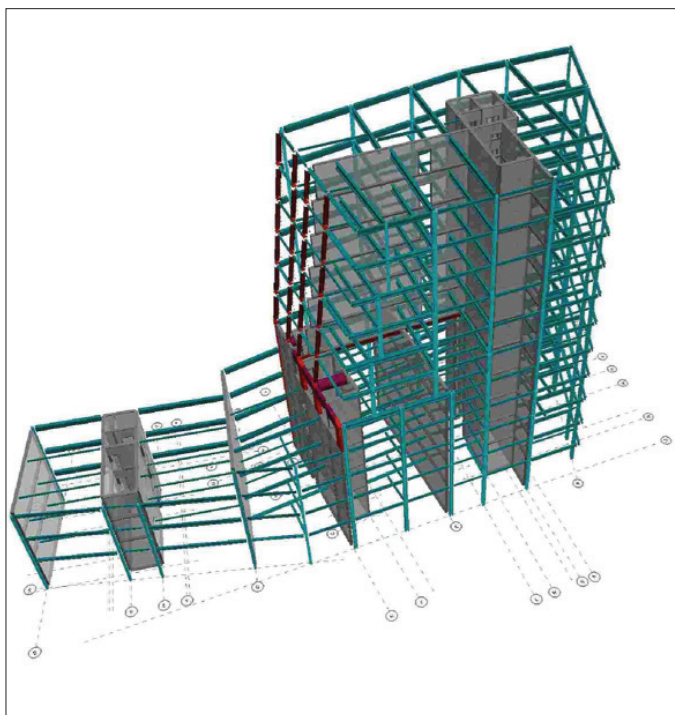
Due to architectural constraints regarding permissible structural floor zones the design of heavy ultra shallow floor beams (USFB) in consultation with Westok overcame the design issue. Basement construction comprises a two -storey deep reinforced concrete 'watertight box' up to ground level transfer slab with steel superstructure 'springing' from ground level upwards.

Overall building stability is achieved via diaphragm action of floor plates into reinforced concrete stair and lift cores at specific locations throughout the building footprint. With extensive areas of the façades almost entirely glazed, careful attention to deflection limits of the frame was considered during the design process with particular attention to a fully enclosed glazed cantilevered winter garden on the southern elevation.

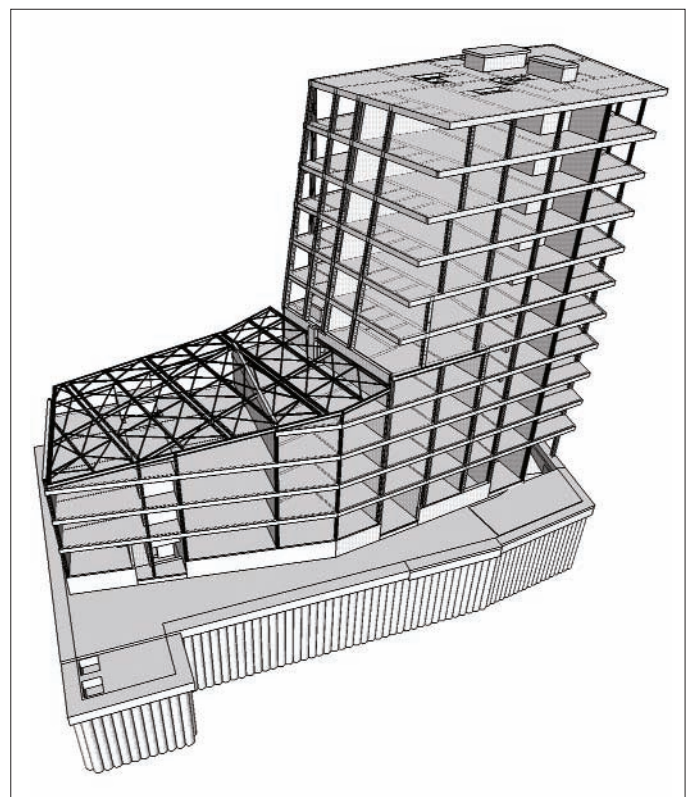
The site investigation contract identified fill material overlying moderately strong jointed limestone bedrock coupled with a high water table within the overburden. After exploring numerous basement design options in consultation with the client with particular attention to programme and cost related issues, the end result was the construction of a 600mm and 900mm diameter secant piled basement wall with embedment into the bedrock below dredge level. Pump tests were carried out on site to predict projected ground water flows as part of the basement de-watering design process.

Temporary works to facilitate bulk excavation and ease of basement construction within a confined site footprint resulted in the design of proprietary temporary props at the top of the secant wall spanning the full basement width and tied back into capping beams. To prevent hydrostatic uplift the lower basement slab has been designed for 12m long anti-flotation anchors each with a working load of 2500kn on a 6m x 6m grid.

4 & 5 MRB 3D working models of the Merrion Road residential development



4



5