

Killiney House

Killiney House is built on the site of a demolished 1950s residential dwelling and comprises a 500m², partial three storey reinforced concrete structure including part basement, knitted into the rocky granite site with a glazed, south facing front elevation overlooking Killiney Bay.

Downes Associates was involved as the Civil & Structural Engineering Consultants, Townlink Construction as the main contractor and O'Donnell Tuomey as the Architects on the project.

The superstructure consists of a cranked and folded reinforced concrete shell roof supported by 114mm diameter steel circular hollow sections along its south elevation and by reinforced concrete perimeter walls along all other elevations. Lateral stability is achieved via the roof diaphragm action through to the perimeter shear walls and the central reinforced concrete core, which houses the chimney flue.

A comprehensive finite element analysis was undertaken to determine the moments, shear stresses and deflections of the faceted three-dimensional reinforced concrete shell roof structure. Due to the nature and complexity of the roof structure, along with the architect's desired finish, it was found that a 225mm thick reinforced concrete slab was the optimum structural solution and provided an economical balance between slab thickness and reinforcement quantities. Due to the requirement of an exposed concrete ceiling it was vital that deflections and predicted crack widths were designed to an absolute minimum. Punching shear reinforcement at the steel CHS locations is provided in the form of parallel flange channels welded to the CHS' top plate which allows for the additional stresses associated with punching shear to be catered for without increasing the depth of the slab, a method which is commonly employed by the American Codes of Practice. A 115mm thick non-structural screed lies on top of the roof's weathering and rigid insulation to provide a solid concrete finish to the roof structure with a surface similar in nature to that of the exposed ceiling below to provide a continuity of expression throughout. The structure's first floor consists of 225mm thick reinforced, in-situ concrete slabs supported by reinforced concrete walls below. The external terraces and balconies that project



Killiney House: North West elevation of the completed structure.

from the building are constructed of reinforced concrete cantilevered beam and slab arrangements.

The walls, along with the underside of the roof and first floor, were to be left exposed and it was therefore imperative that a class A concrete finish was achieved. A bespoke concrete mix, which included the infusion of granite mica chippings, was used to add a lustrous finish to the concrete while Ecocem GGBS cement was also incorporated into the mix to provide a whiter appearance along with its greener credentials. Due to the geometry and required finish to the underside of the roof it was essential that a first-class formwork system was employed. The setting out of joints in the formwork was therefore crucial and it was this design, construction and attention to detail that paved the way for Killiney House to win the Irish Concrete Society's overall award for 2007. Prior to completion of the project, the exposed surfaces of the concrete walls and ceiling were sandblasted to achieve the architect's desired finish and a clear water-

proofing membrane was applied externally to counteract the effects of sandblasting on the concrete's permeability.

The partial basement comprises 250mm thick reinforced concrete walls designed with integral strip footings and grade 4 waterproofing was provided throughout.

Extensive geotechnical investigations were undertaken at an early stage to establish ground conditions and the extent of the granite outcrop which straddles the south east boundary of the site. This revealed mass granite underlying approximately 1.5 – 2m of topsoil/stiff brown boulder clay. As a result traditional strip footings were used to transfer the structure's loads down to suitable bearing stratum.

In April 2006, Townlink Construction Ltd. commenced construction of the concrete shell. In July 2007, they successfully completed the structure which has forever changed the landscape of Killiney in a unique and innovative way.

Ian Connolly, Downes Associates



Exposed concrete ceiling. Note carefully designed formwork joints.

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