Waterman Moylan
Engineering Consultants

# Planning Stage Structural Report

## SHD at Holybanks, Swords

March 2022

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**Client Name:** Cairn Homes Properties Ltd.
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## Quality Assurance – Approval Status

This document has been prepared and checked in accordance with
Waterman Group's IMS (BS EN ISO 9001: 2015 and BS EN ISO 14001: 2015)

| Issue | Date | Prepared by | Checked by | Approved by |
|---|---|---|---|---|
| No. 1 | 23 March 2022 | Damien Kelly | Richard Osborne | Richard Osborne |

**Comments**

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# Contents

# 1. Introduction

## 1.1 Scope

Waterman Moylan has been appointed by Cairn Homes Properties Ltd. to provide Structural Consultancy Services for the proposed residential development at Holybanks, Swords, Co. Dublin and to develop the scheme to Planning Stage.

The subject site will consist of construction of 621 no. units (145 no. 1-bed units, 278 no. 2-bed units, 187 no. 3-bed units and 11 no. 4-bed units) comprising 349 no. apartments, 118 no. houses and 154 no. duplex units. Building heights range from 1 no. to 7 no. storeys (over basement level).

- Block A five to seven storeys with ground floor level undercroft.
- Block B six to seven storeys over single level basement.
- Duplex Blocks
- Detached, semi-detached and terraced residential units.

The main structural issues covered are as follows:-

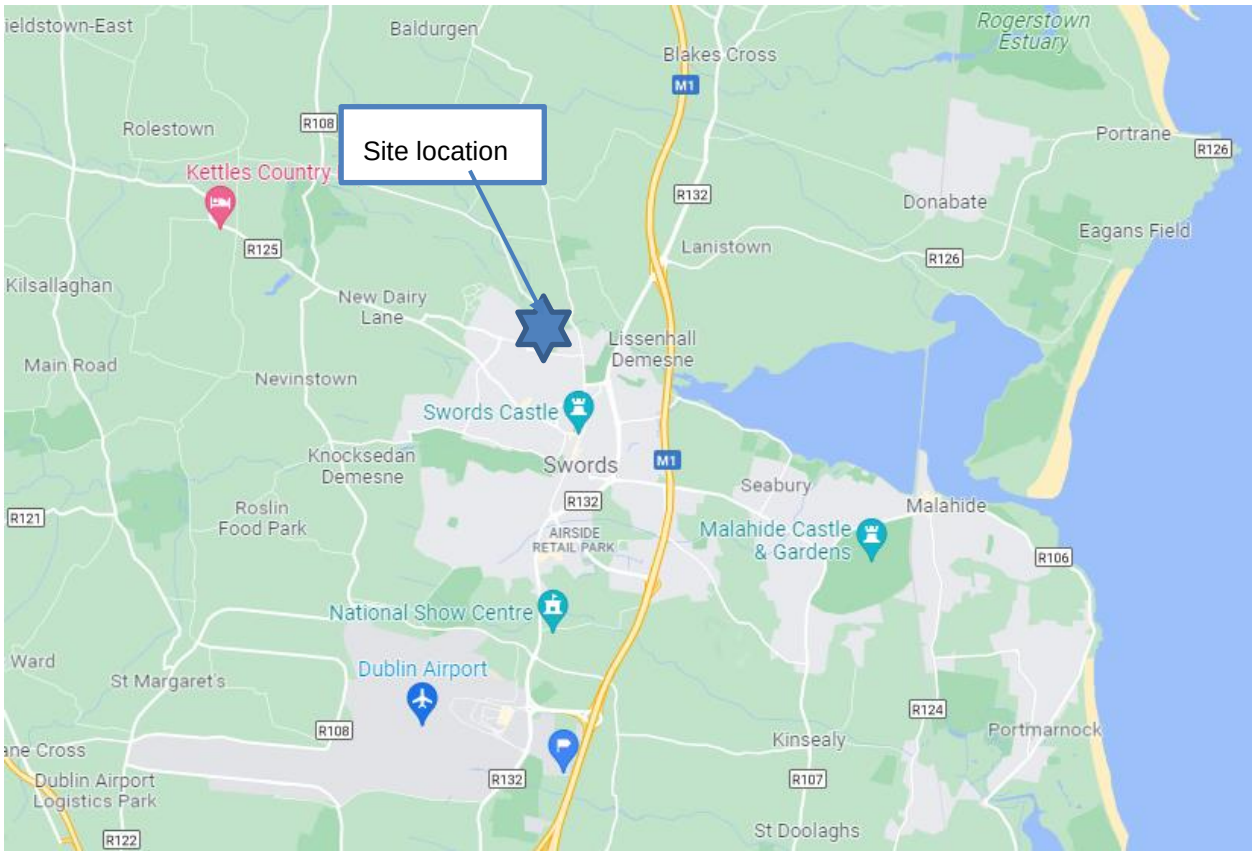
- Develop an understanding of site constraints.
- Form of the new structures.
- Advise structural dimensions.
- Review of construction methodology in relation to the site constraints

## 2. Site Constraints

The site is in Swords, Co. Dublin. The site is bound by Glen Ellan Road to the south, Jugback Lane/Terrace to the west, the former Celestica factory site to the east and the Broadmeadow River to the north.

Swords Celtic Football Club and its associated sports grounds are located to the north, on the opposite side of the Broadmeadow River. The Swords Business Campus is also located to the east of the site on the opposite side of Balheary Road. The site location is indicated in Figure 1 below.

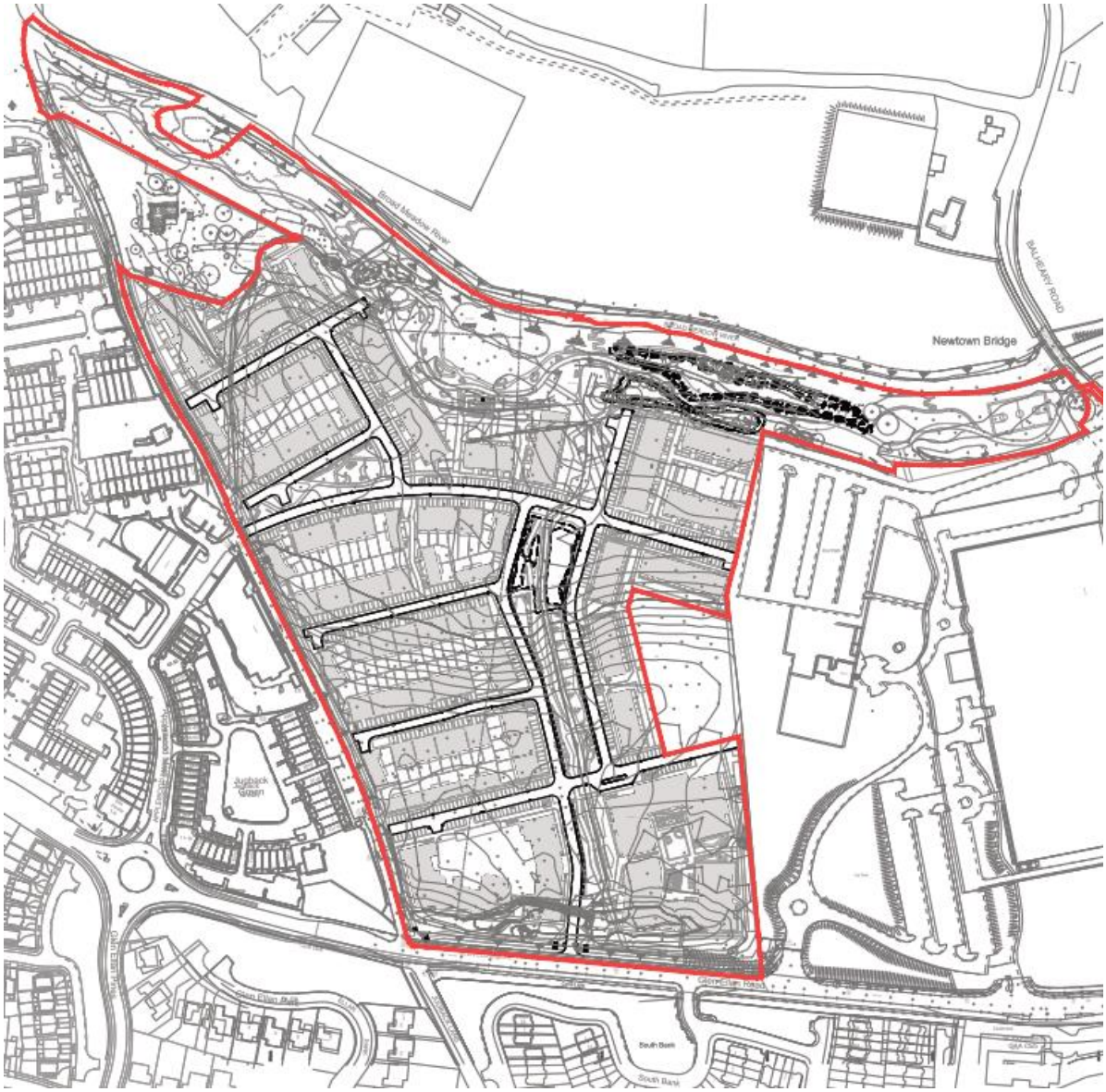
***Figure 1*** | *Site Location (Source: Google Maps)*




The subject site is a greenfield site. The site generally falls from south to north towards the Broadmeadow River. The ground levels to the southwest are in the order of 14.0m falling to 5.6m at the northeast.

A proposed site plan is shown in Figure 2.

***Figure 2*** | *Proposed site plan (source MCORM Architects & Waterman Moylan)*




## 2.1 Site Access

The site will be primarily accessed by via entrances on Glen Ellan Road, with an additional new secondary site entrance provided from Jugback Lane/Terrace

## 2.2 Traffic Management

Construction timings and methods, protection and potential temporary detours for both pedestrians and vehicles shall be studied prior to the commencement of construction activities. The Contractor shall agree and submit proposals to Fingal County Council for approval.

## 2.3 Adjacent residential Properties

The site is adjacent to several residential properties. Dilapidation surveys will need to be undertaken to these properties ahead of the works commencing, in addition to monitoring of noise and vibration during demolition and construction.

## 2.4 Site Gradient

In order to provide a rationalised layout for the site, material cut and fill of the existing levels will be required underneath the roads and structures. Where possible the vast majority of this material will remain on site. Should excess cut be produced this will be removed off site. Similarly, if additional fill is required this material will be imported to site.

# 3. Structural Concept

The structural scheme has been developed following review of the architectural planning drawings and analysis of floor spans and structural zones.

The structural concept varies between the different building typologies proposed for the development. Below is a table summarising the structures across the development.

| Building | Code | Description |
|---|---|---|
| Block A | BLKA | Five to Seven Storeys with Ground Level undercroft and podium slab. |
| Block B | BLKB | Six to Seven Storeys over basement with podium slab. |
| Duplex Blocks | DUPX | Three storey terrace blocks. |
| Housing | --- | Detached, semi-detached and terraced units. |

***Table 1*** | *Proposed buildings*

## 3.1 Substructures

From an analysis of the anticipated building loads and the soil conditions described in the preliminary site investigation report, and in consideration of the cut and fill works required on the site, the proposed buildings have been divided into four different substructure typologies.

| Building | Description | Substructure Typology | Description |
|---|---|---|---|
| Block A | Five to Seven Storeys with Ground Level undercroft and podium slab. | Type 1 | Pilecaps, piles and ground beams under load-bearing walls and columns. |
| Block B | Six to Seven Storeys over basement with podium slab. | Type 2 | Pilecaps, piles and ground beams under load-bearing walls and columns. |
| Duplex Blocks | Three storey terrace blocks. | Type 3 | Reinforced Concrete Strip Footings under load bearing walls. |
| Housing | Detached, semi-detached and terraced units. | Type 3 | Reinforced Concrete Strip Footings under load bearing walls. |

***Table 2*** | *Proposed Substructures*

### 3.1.1 Foundations for typology 1 & 2

The soil conditions and anticipated building loads would require piled foundations. The proposed piles are to be conventional continuous flight auger (CFA) or rotary bored piles of 600-750mm diameter, subject to a site investigation, and will be designed to resist the vertical and horizontal loads from the structure above.

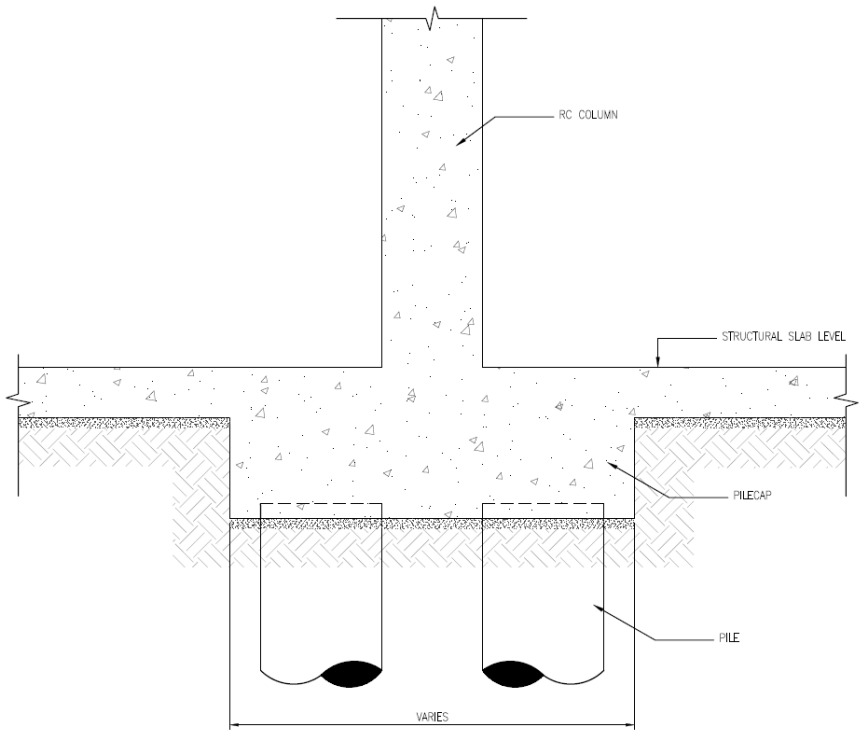
Rectangular reinforced concrete beams (Ground Beams) will span between pilecaps to support load bearing walls.

Type 1 is differentiated from Type 2 due to the additional need for basement/retaining walls. Typical basement wall details are provided in section 3.1.2.

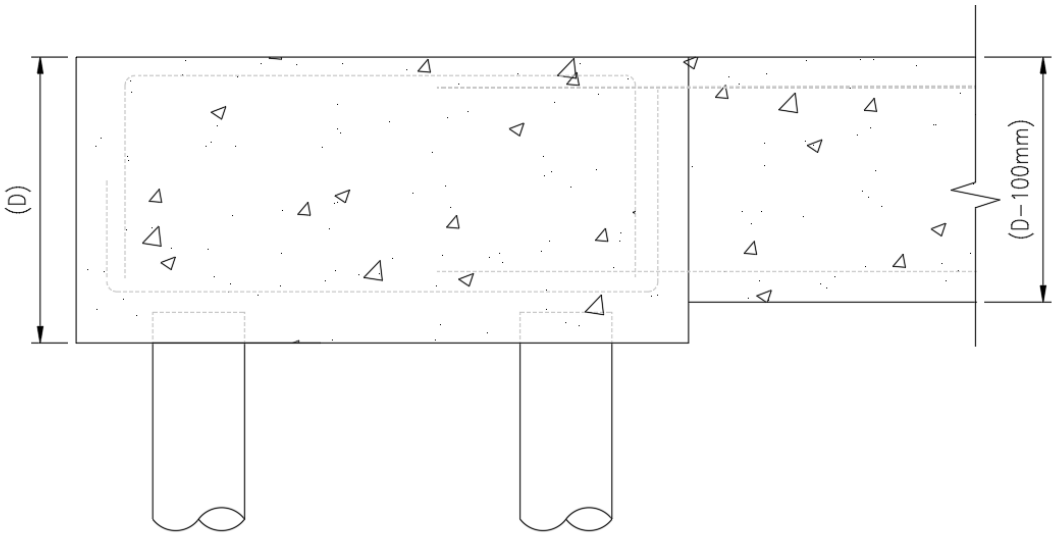
Pile caps will be reinforced concrete cast in-situ elements designed to spread the building loads into the piles. The pile caps are typically 1000 to 1800m deep for 600-750mm diameter piles

- Typical Pile Cap dimension*****: 3000x3000x1800mm deep square pilecap under columns.
- Typical Ground Beam dimension*****: 700x900mm deep spanning between pilecaps.

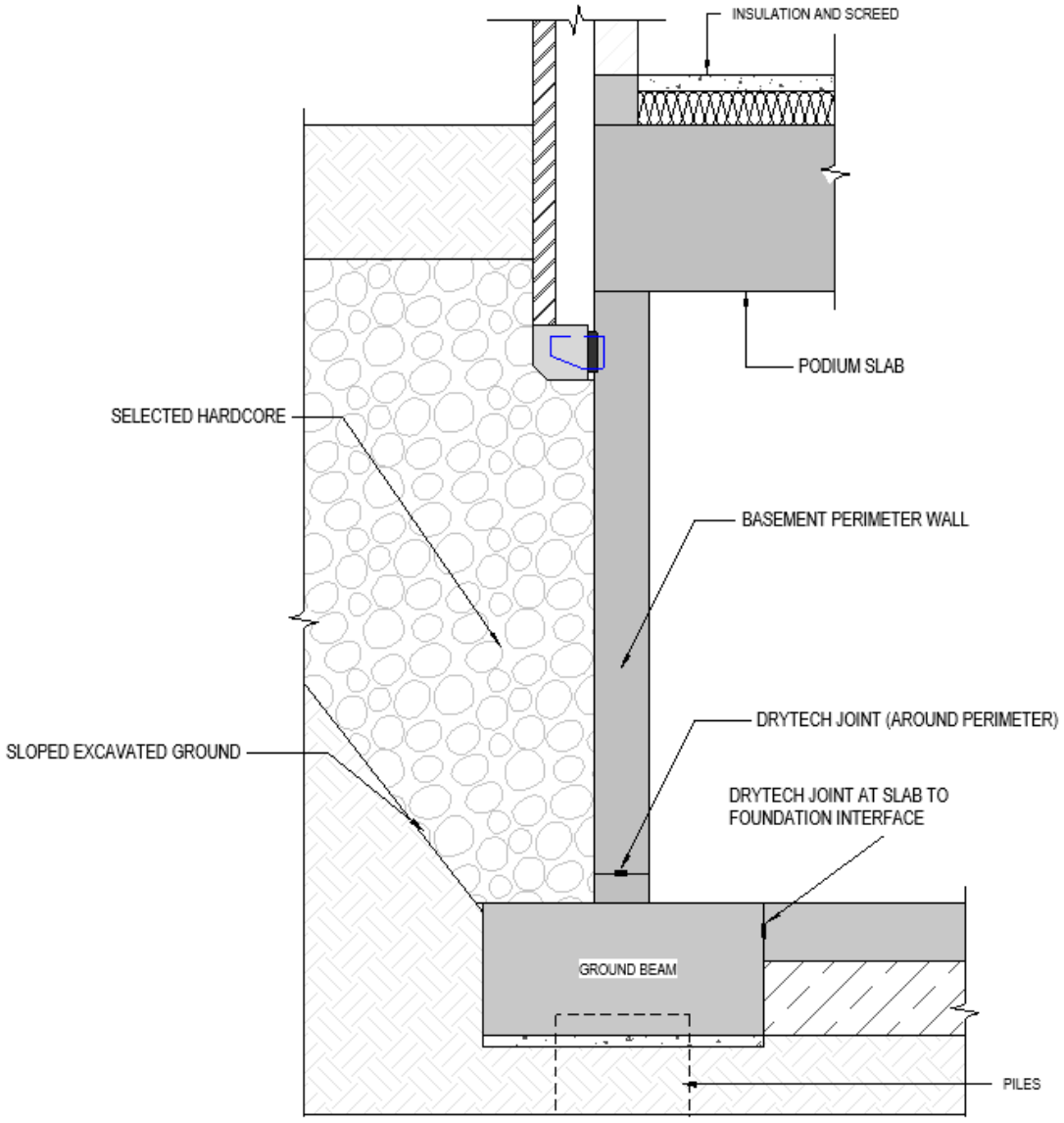
***Note**: Dimensions shown above are typical of what will be required but may be subject to change when more detailed Ground Investigation information or other information on site conditions becomes available.




Typical Foundation Type 1 and 2




Typical Pilecap-Groud Beam Interface




Typical Basement Perimeter (w/piling)

### 3.1.2 Basement Structure for typology 2

The perimeter of the basement will be constructed using reinforced concrete walls, 250-300mm thick.

Note: The basement footprint will not encroach on any tree root protection area.

### 3.1.3 Basement/Undercroft Waterproofing for typology 2

Requirement and details for basement waterproofing are shown by the Architect.

Table 2 **Grades of waterproofing protection**

| Grade | Example of use of structure[A)] | Performance level |
|---|---|---|
| 1 | Car parking; plant rooms (excluding electrical equipment); workshops | Some seepage and damp areas tolerable, dependent on the intended use[B)]<br>Local drainage might be necessary to deal with seepage |
| 2 | Plant rooms and workshops requiring a drier environment (than Grade 1); storage areas | No water penetration acceptable<br>Damp areas tolerable; ventilation might be required |
| 3 | Ventilated residential and commercial areas, including offices, restaurants etc.; leisure centres | No water penetration acceptable<br>Ventilation, dehumidification or air conditioning necessary, appropriate to the intended use |

A) The previous edition of this standard referred to Grade 4 environments. However, this grade has not been retained as its only difference from Grade 3 is the performance level related to ventilation, dehumidification or air conditioning (see BS 5454 for recommendations for the storage and exhibition of archival documents). The structural form for Grade 4 could be the same or similar to Grade 3.

B) Seepage and damp areas for some forms of construction can be quantified by reference to industry standards, such as the ICE's *Specification for piling and embedded retaining walls* [1].

Grades of Waterproofing Protection (extract from BS8102:2009)

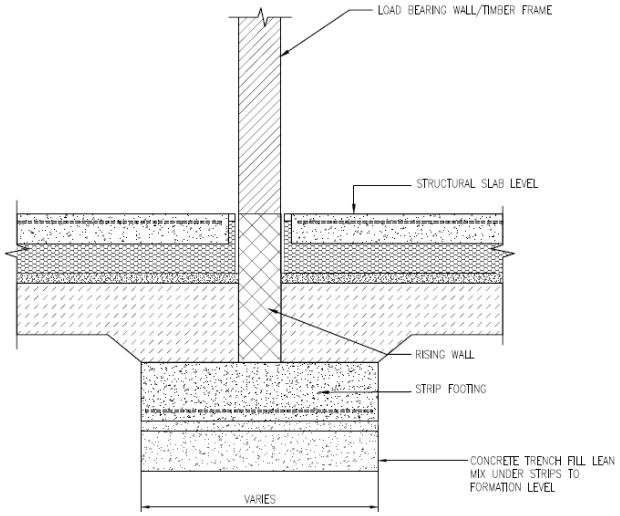
In basement habitable areas, core lobbies, electrical rooms and lift-pits, the basement waterproofing performance will need to be BS 8102:2009 Grade 3. Elsewhere the basement will be designed for Grade 2.

Current proposals to achieve this required environment will be developed over the next stage. At this stage and for any preliminary cost plans we would suggest that a “white tank” system by Rascor or Drytech is considered.

### 3.1.4 Foundations for typology 3

From the anticipated soil conditions, it is expected that the structure will be supported on shallow foundations. This will comprise in reinforced concrete strip footings on mass concrete (leanmix) extending to the stiffer ground layers where necessary.

The ground floor slabs are 150mm thick reinforced concrete and ground bearing. The slabs are formed on 50mm T3 Blinding with minimum 225mm T2 hardcore to SR:21 requirements.




Typical Foundation Type 3

- Housing Blocks
    - Typical Strip Footings: 750 to 1200mm wide by 300mm deep*****.
- Duplex Blocks
    - Typical Strip Footings: 900 to 1800mm by 300mm deep*****.

***Note**: Dimensions shown above are typical of what will be requires but may be subject to change when more detailed Ground Investigation information or other information on site conditions becomes available.

## 3.2 Superstructures

A material options study for the super-structure was undertaken for all the proposed building typologies and can be summarised as follows.

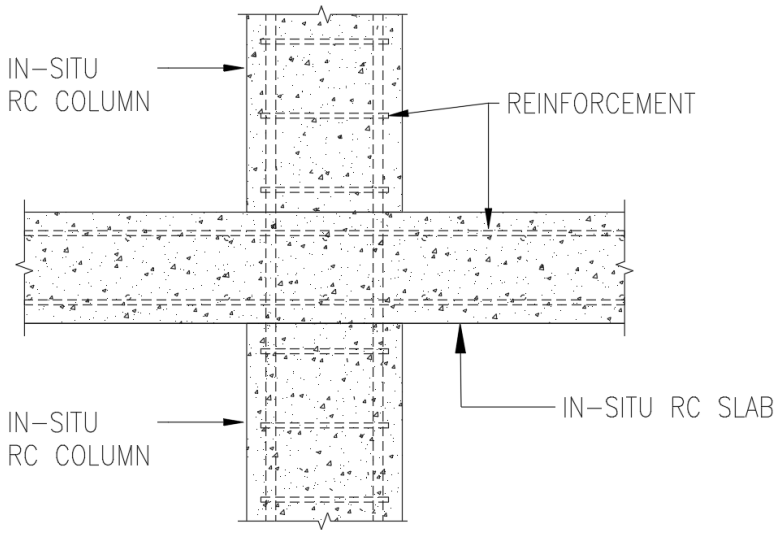
| Houses and Duplex Blocks | | | | | |
|---|---|---|---|---|---|
| | Framing Layout | Speed-of-Construction | Fire Resistance | Acoustic Performance | Vibration Performance |
| **Masonry Walls & Precast Concrete** | Average | Average | Good | Good-Average | Good |
| **Timber Frame** | Good | Good | Average | Average | Average |
| **Masonry Walls & Timber Floors** | Good | Average | Average | Average | Average |
| **Light Gauge Steel (LGS Frame)** | Good | Good | Good | Average | Average |

For the houses it is proposed to use timber frame construction.

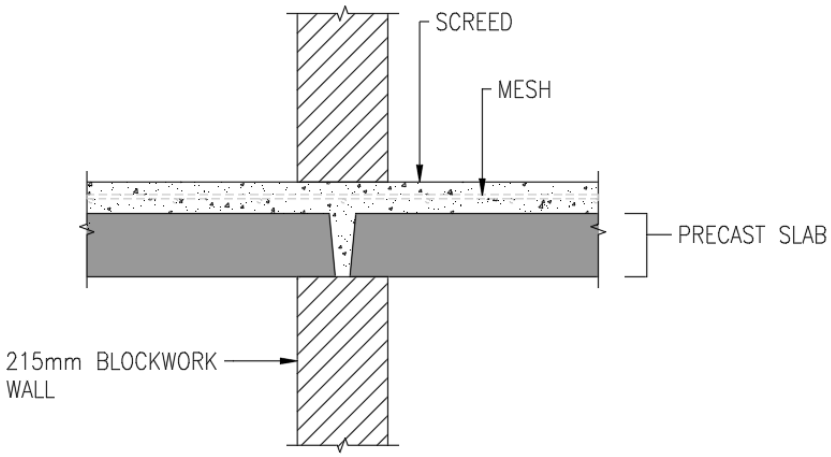
For the duplex apartment blocks, it is proposed to use either a LGS system or Hybrid Masonry and Precast Ground Floor Unit with Timber Frame on top.

| Apartment Block A and B | | | | | |
|---|---|---|---|---|---|
| | Framing Layout | Speed-of-Construction | Fire Resistance | Acoustic Performance | Vibration Performance |
| **Hybrid Precast Hollowcore & Crosswalls** | Good | Good | Good | Good-Average | Good |
| **In-situ Concrete Frame** | Good | Poor | Good | Good | Good |
| **Steel Frame & Precast Concrete** | Good | Good | Average | Good-Average | Average |
| **Masonry Walls & Precast Concrete** | Poor | Poor | Good | Good-Average | Good |

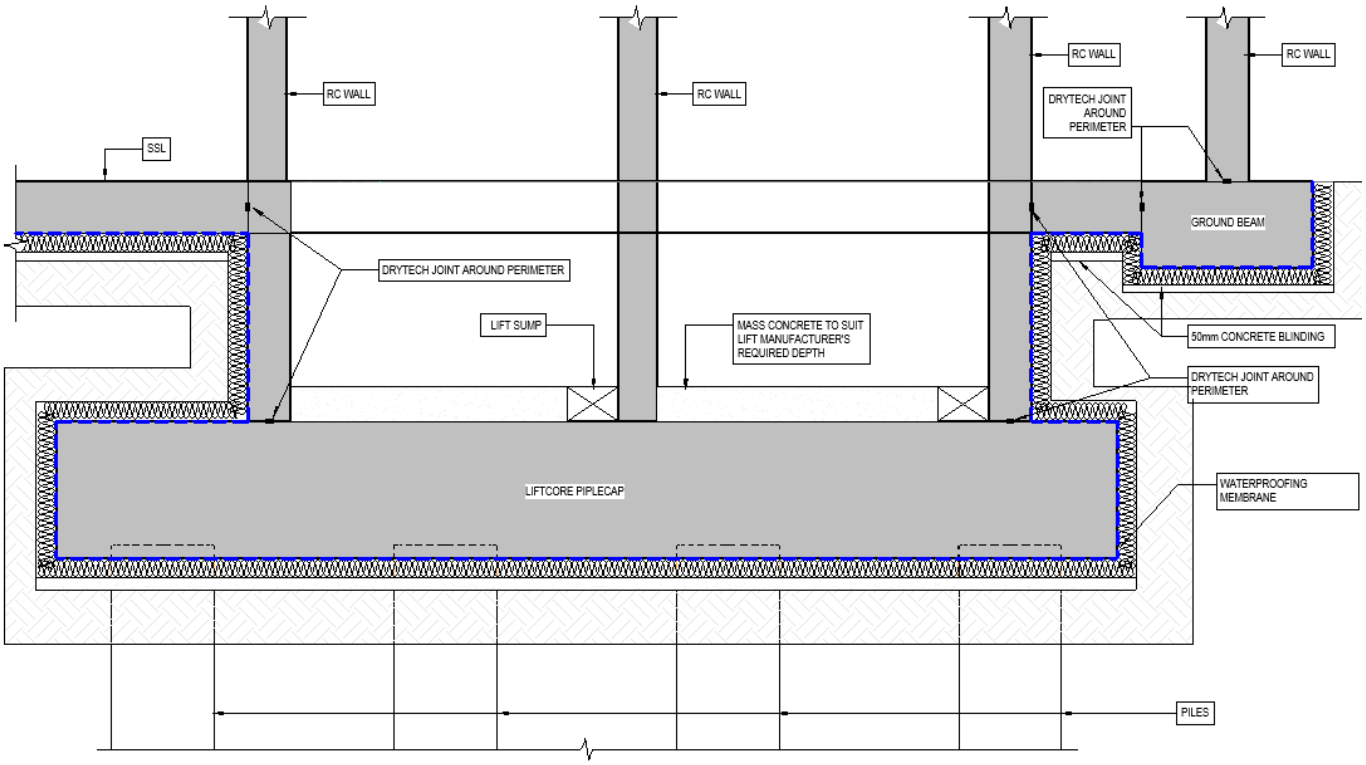
**Blocks A and B:** The proposed structure is to be an in-situ reinforced concrete frame due to the size and geometry of the blocks. This structure type will be overall lighter compared to precast wall or masonry wall structure and provides greater flexibility in reducing areas of transfer and to achieve the architectural intent.




Typical In-Situ Reinforced Concrete Floor Structural Build-up




Typical Masonry Walls & Precast Concrete Floor Structural Build-up

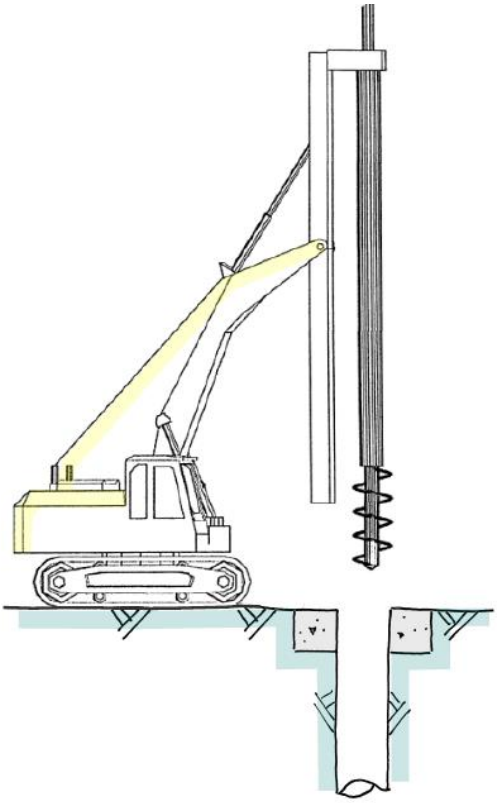



Typical Lift Pit
(In-Situ RC Frame Superstructure)

# 4. Construction Methodology

## 4.1 Foundations Type 1

The sequence of works for the construction of the Type 1 foundations will be as follows:



Typical Piling Installation

- Excavate to foundation level
- Install Piling Mat
- Install Piles
- Construct RC Ground Beams Beams and Pile Caps
- Construct masonry/concrete rising elements over the pile caps and ground beams.
- Place and compact approved granular fill to the underside of ground floor slab
- Construct RC Ground Floor Slab

## 4.2 Foundations Type 2

The sequence of works for the construction of the type 2 foundations will be as follows:

- Excavate basement, secure excavation & Install Temporary Works (if required).
- Install Piling Mat & Temporary guide wall (if required)
- Install Piles
- Construct RC Ground Beams and Pile Caps
- Construct Basement RC Slab
- Construct Basement RC Walls and Columns
- Construct Podium/Transfer Slab

## 4.3 Foundations Type 3

The sequence of works for the construction of the type 3 foundations will be as follows:

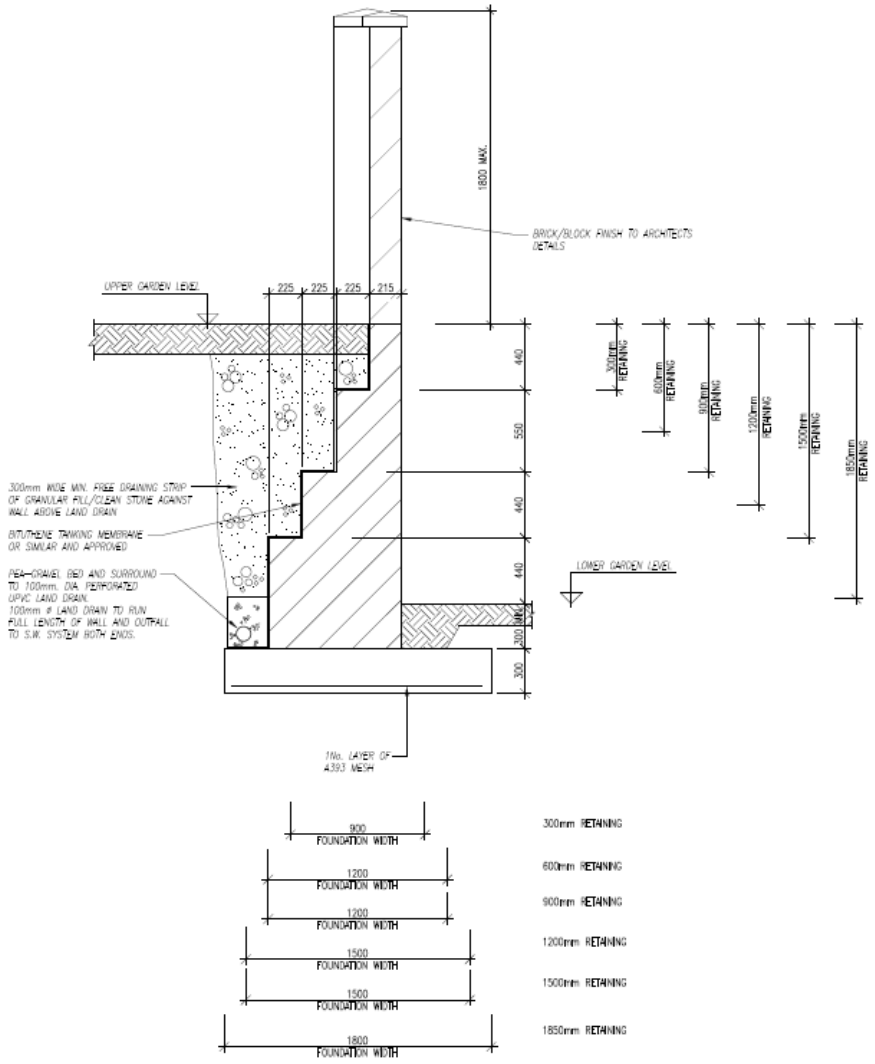
- Excavate to formation level
- Place lean mix to reach foundation level (if required)
- Construct RC Strip footings
- Construct masonry rising walls
- Place and compact approved granular fill to the underside of ground floor slab
- Construct RC Ground Floor Slab

## 4.4 Civil Works / Retaining Structures

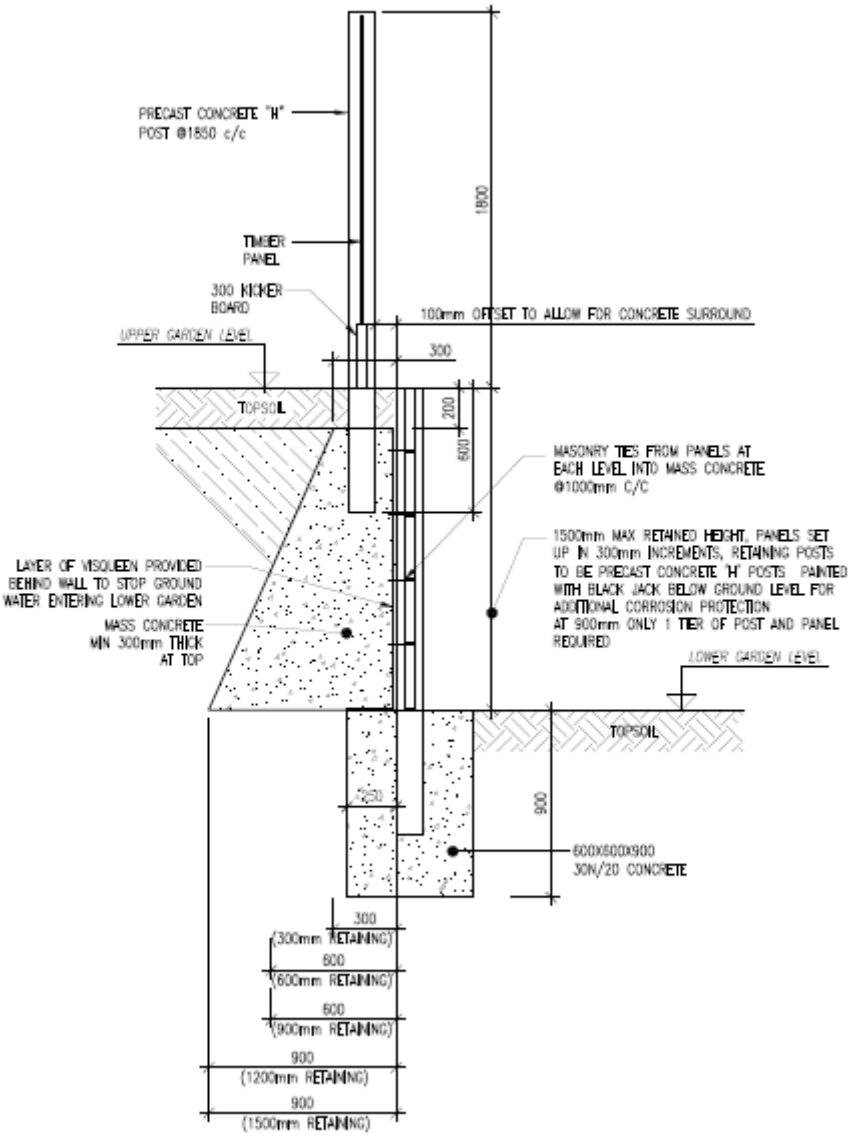
Back of garden areas will be treated with various types of retaining wall structures. The finished boundary structure above retaining level may vary (blockwork, timber post and panel, railings, etc.) Depending on retained heights, the form of the retaining structure may be as follows:

- Post and Panel Retaining (w/Mass Concrete)
    - Up to 1.5m Retaining
- Blockwork Retaining
    - Up to 1.85m Retaining
- Concrete Retaining
    - Up to a maximum of 3.5m

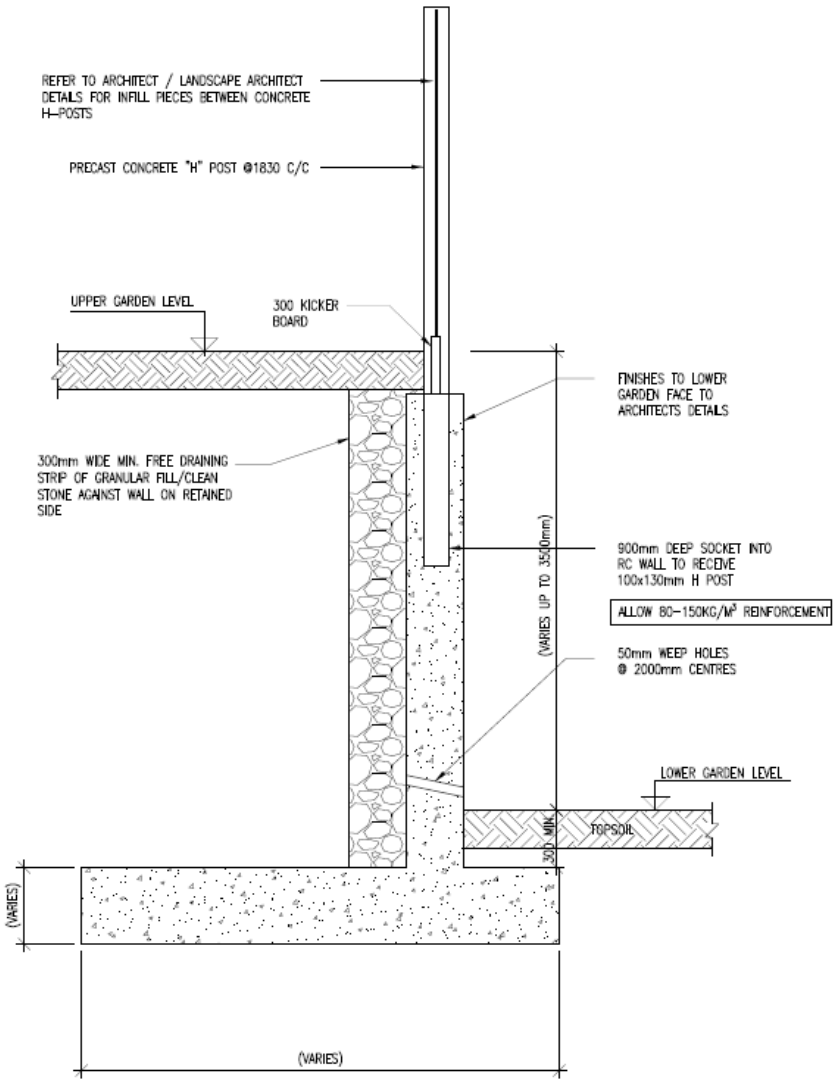
Example retaining sections are included below.




Typical Blockwork Retaining Wall




Typical Post and Panel Retaining Wall




Typical RC Retaining Wall (Up to 3.5m Retaining)

## 4.5 Measures to Protect Adjacent/Nearby Structures

The following measures have been considered in design over the Planning Stage to protect the adjacent/neighbouring structures:

(1) The extent of basements footprint and depth of basement have been kept to a minimum.

(2) The basements have been set-out and positioned away from the site boundaries. It is deemed that this is far enough away so that the zone of influence from the basement excavation will not affect the nearby buildings.

(3) Driven piles if used will have monitoring stations set up to confirm that piling vibrations are below acceptable limits.

(4) CFA Piling is also an option to minimise noise and vibration during the works.

(5) The basement walls will provide a groundwater cut-off and prevent groundwater movement between the basement excavation and surrounding subterranean area. This will mitigate the risk of changes to the existing groundwater levels during construction (subject to the ground investigation and level of the existing groundwater).

(6) Additional measures will be adopted by the Contractor during construction as per health and safety requirements and best practice.

# 5. Fire Protection of the Structures

It is currently understood that a 90-minute fire protection will be required generally for the apartments, with 120 minutes required for certain cores and escape routes, and 60 minutes for the houses and duplex apartment blocks, subject to the Fire Consultants Report.
240 minutes is required in electrical ESB substation rooms.

Fire protection to all concrete elements will be achieved as follows, as per IS EN 1992-2:

| | | |
|---|---|---|
| Core walls and Columns | - | RC concrete cover and minimum element dimensions |
| Horizontal members and hollowcore slabs | - | RC concrete cover and minimum element dimensions. |
| 120 minute areas | - | RC concrete cover and minimum element dimensions. |
| 240 minute areas | - | RC concrete cover and minimum element dimensions. |

# 6. Proposed Loadings

## 6.1 Design Loadings and Service Movements

### 6.1.1 Vertical Loads

These comprise superimposed live loads [due to occupancy, plant, storage, etc.], superimposed dead loads [due to M&E services, etc.] and self-weight of structure plus cladding. Superimposed live loads and dead loads are listed below and the design takes into account structure and cladding self-weight.

### 6.1.2 Horizontal Loads

These comprise either wind loading on the building façade or "EHF – Equivalent Horizontal Forces" as defined in Eurocode. EHF loads occur due to lack of fit of the structure, etc. The combination of these two are used in the design in accordance with IS EN 1990.

### 6.1.3 Service Movements

Horizontal and vertical movements due to superimposed live loads and wind loads are limited to the following:

Horizontal building sway [wind load] = $\frac{height}{500}$

Vertical slab/beam deflections [superimposed live load]:

i] Floor beams = $\frac{span}{360}$

ii] Slab/Beam supporting cladding = $\frac{span}{500}$ or 10 mm whichever is less.

### 6.1.4 Loading Table (Subject to Final Confirmations of Superstructure)

| | | |
|---|---|---|
| A | Typical Apartment Floor | |
| | 250 Insitu Slab | 6.25 kN/m$^2$ |
| | Floor Finishes | 0.35 kN/m$^2$ |
| | Ceiling & Services | 0.25 kN/m$^2$ |
| | | 6.85 kN/m$^2$ |
| | Imposed load (Class A2) | 3.0 kN/m$^2$ |
| | [Including 1.0kN/m$^2$ partitions] | |

B Typical Podium (Building Footprint)

| | |
|---|---|
| 750 normal weight slab | 18.75 kN/m$^2$ |
| Finishes | 0.50 kN/m$^2$ |
| 75mm Screed (2000kg/m$^3$) | 1.50 kN/m$^2$ |
| Floor insulation | 0.05 kN/m$^2$ |
| Ceiling &services | 0.45 kN/m$^2$ |
| | 21.25 kN/m$^2$ |
| | |
| imposed load (Class A2) | 3.0 kN/m$^2$ |
| [Including 1.0kN/m$^2$ partitions] | |

C Typical Podium (Landscaped Area)

| | |
|---|---|
| 550 normal weight slab | 13.75 kN/m$^2$ |
| Landscaping (TBC) | 10 kN/m$^2$ |
| Waterproofing | 0.5 kN/m$^2$ |
| Insulation | 0.20 kN/m$^2$ |
| Ceiling & Services | 0.45 kN/m$^2$ |
| | 24.9 kN/m$^2$ |
| | |
| Imposed load (Vehicle Access) | 10 kN/m$^2$ |

D Roof Areas

| | |
|---|---|
| 250 Insitu Slab | 6.25 kN/m$^2$ |
| Sedum | 3.00 kN/m$^2$ |
| Waterproofing | 0.30 kN/m$^2$ |
| Insulation | 0.20 kN/m$^2$ |
| | 9.75 kN/m$^2$ |
| | |
| imposed load (MEP) | 7.5 kN/m$^2$ |
| Imposed load (PVs) | 3.0 kN/m$^2$ |
| Access/Maintenance | 0.6 kN/m$^2$ |

E Corridor / Lobby Areas

| | |
|---|---|
| 250 Insitu Slab | 6.25 kN/m$^2$ |
| Floor Finishes | 0.35 kN/m$^2$ |
| Ceiling & Services | 0.45 kN/m$^2$ |
| | 7.05 kN/m$^2$ |
| | |
| Imposed load | 5.0 kN/m$^2$ |

F Disproportionate Collapse

The structure is in excess of five storeys and therefore will be checked for disproportionate collapse in accordance with IS EN 1991-1-7:2006 Annex A and Building Regulations.

Accidental loading at 34 kN/m$^2$ will be applied to "key elements", i.e. columns and beams carrying columns, and criteria in regard to perimeter ties and tying forces.

# UK and Ireland Office Locations