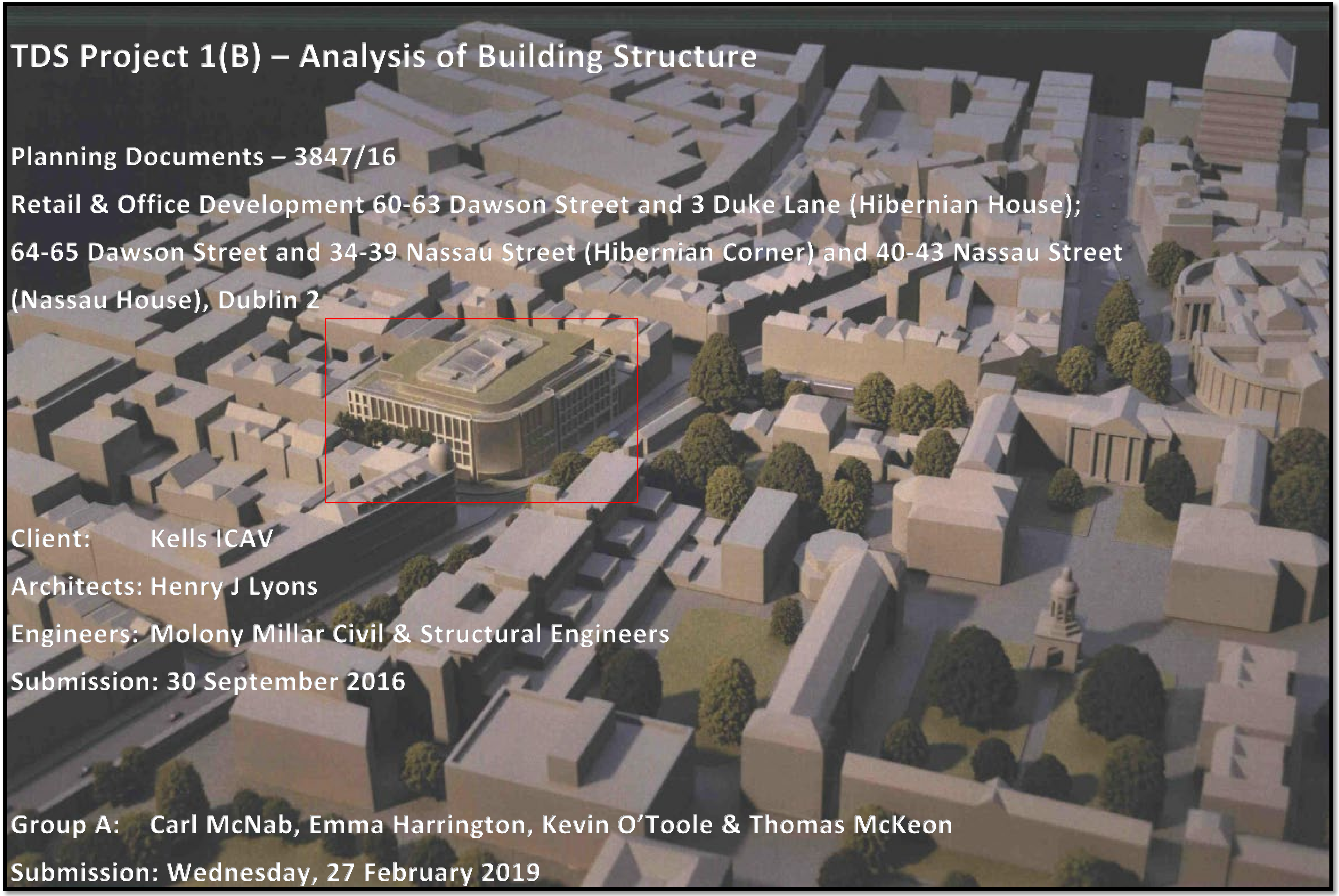

TDS Project 1(B) – Analysis of Building Structure

Planning Documents – 3847/16

Retail & Office Development 60-63 Dawson Street and 3 Duke Lane (Hibernian House); 64-65 Dawson Street and 34-39 Nassau Street (Hibernian Corner) and 40-43 Nassau Street (Nassau House), Dublin 2

Client: Kells ICAV

Architects: Henry J Lyons

Engineers: Molony Millar Civil & Structural Engineers

Submission: 30 September 2016

Group A: Carl McNab, Emma Harrington, Kevin O'Toole & Thomas McKeon

Submission: Wednesday, 27 February 2019

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(i) Sub Structure Construction – Piles, Demolition & Luas interface:

- **Luas Interface:** The design team met with the Luas Cross City project team in 2016 to advise them of this proposed development and discuss the practical aspects of constructing a double basement in close proximity to the Luas line (which was under construction at the time) and agreed a strict monitoring regime. Piling, excavating and building in close proximity to the Luas line posed hazards to both the construction process and the general public.
- **Prefabricated Reinforcing Cages:** Are to be used on the development. The rebar cages will be prefabricated off site and transported via lorries. The design of the cages must be strong enough to ensure that they can be lifted safely by crane.
- **Piling Mat:** A piling mat will be designed to provide a stable working platform for the piling machine to operate from. Crushed concrete from the demolished buildings may be used. A ground survey will be conducted to ensure there are no underground voids present below where the piling machine will be operating.
- **Guide Wall:** To be constructed to support and accurately set out the piles. The guide wall will be constructed from a minimum of 300mm thick concrete into the shape of the cylindrical piles. The objective of the guide wall is to prevent the piling camber from moving during the initial piling process. The utilisation of this process, ensures that piling mast does not move location as the piling process commences. The guide wall will be drilled through the existing floor slabs.
- **Existing Retaining Wall:** The existing retaining wall will be retained and a secant wall will be bored inside this wall. The wall will be rock anchored under the pavements of Nassau Street and Dawson Street at 3.5m centres. The rock anchor will be destressed when the permanent works are in place. The remainder of the perimeter will be strutted internally at 3.5m centres with steel column sections.

Concrete Basement Construction:

- **Formwork:** The formwork for the first set of lift/stair cores will be assembled on the first blinding area poured. A high-level kicker will also be poured which will form the start point for the climbing formwork.
- **Crane:** The crane base for the tower crane will be poured with the first section of the basement slab along with the pads for the two static pumps.
- **Basement Pour & Retaining Walls:** The basement will be poured in sequential pours. Maintaining a square as possible the pour to minimise the drying stresses and standardise the temperature inside the slab. When the lower basement pour has completed, the construction of the retaining walls will commence. The retaining walls will be poured 3.05m high x 6m long sections in a sequential pattern. The size and layout of the pours will be designed to limit the possibility of shrinkage, cracking due to the walls being poured against a secant wall.
- **Stair Cores:** All stair cores will be constructed with in-situ landings, connected to the core walls by conibar. The flights will be constructed from pre-cast concrete with steel support angles and dowels concreted into position. Floor landings will be poured with a 60mm recess to facilitate a smooth transition from stair flight to the in-situ landing. All half landings will be poured in two halves with the bottom half poured and left propped until the precast flight has been fitted. Post fitting of the flight to the top half of the landing will be poured.
- **Basement Columns:** All columns to be constructed using a metal formwork system for casting columns. These columns will be cast *after* the floor slabs and retaining walls are poured. The columns will be cast before the decking commences for the above floor. By delaying the casting of the columns as late as possible, this will facilitate the storage of materials on the slab.

(ii) Super Structure Construction:

Concrete Frame:

- The main frame of the building will be flat concrete slabs supported by the core walls and columns. The lift and stair cores will provide stability to the building against later sway. The floor slabs will be approximately 350mm to 450mm. Note: The Ground Floor and First Floor will be composite steel / concrete floors to provide flexibility for escalators in the future.
- As stated above, the lift and stair cores will be constructed in conjunction with the basement construction. Upon commencement of the first-floor slab, the cores will be completed. Rising elements will commence from the Ground Floor in the form of columns and nib walls. As the rising elements are cast the decking will commence for the next level of floor slab.
- In line with the 'open plan' design of the building – the floors will be cast using prefabricated 'timber tables'. These tables are constructed from timber beams in two directions lined with plywood on the top. The tables are lifted into position by the tower crane between the columns and walls. The decking areas around the columns will be filled in by 'loose laying' the formwork.
- Upon laying the decking the reinforcing steel will commence. The reinforcing steel will be delivered to site in 20T deliveries. The steel is divided into 2 x categories: Top Matt and Grid Sections – this division allows better sequencing for the delivery of steel as it is required. The steel will be lifted from the lorries directly onto the timber decking and fitted in place eastward along the decks. When the reinforcing steel is tied in position the edge shutters will be fabricated and fixed into position. All openings in the slab will be lined with timber formwork. When all the reinforced steel has been laid and the edge shutters and openings have been positioned, then the slab can be poured.
- Slab pouring: The slab pour will be completed using two static pumps. The concrete trucks will enter the site via Duke Street to a trailer pump located in the loading bay. The lorries will drive up to the trailer pump and discharge the load into the hopper. The trail pump will pump the concrete to one of the two static pumps located within the building. The static pump will distribute the concrete the concrete to the required location via an extendable 20m boom. The first to roof level slab pours will be completed in 2 x pours per floor. Each pour will measure approximately 450m^3. Following the floor slab pour, the concrete will be allowed to cure for 7 days. Post day 7, the striking of the deck will commence. As the deck is being struck back, propping of the slab will commence. The tables will be removed from the floor by a table hoist and re-positioned on top of the last slab pour. The tables will be wheeled into position by a table trolley and levelled to the correct height for the next slab pour.

Steel Frame:

- The Ground Floor and First Floors will have composite steel and concrete floors. This is to afford more flexibility in the event of escalators being installed from Level -1 to the First-Floor levels within the 3 x proposed Retail units in the future.
- Steel columns will rise from Level -1 to the underside of the First Floor. This is to better facilitate the connection of the columns and the main steel beams. The steel beams and columns for the Ground and First Floor will be brought to site by truck via the Dawson Street site entrance. The steel beam will be required to be propped before pouring the concrete screed and remain propped for a minimum of 7 days.

Glazing & Pre-cast Panels:

- The glazing installation will commence when the concrete frame has been erected, lined, levelled and floors poured up to Level 5. (Note: The loading and distribution of the panels will be the responsibility of the glazing contractor.)
- All glazing panels from levels 1-5, will be distributed by the hoist located on the atrium (starts at Level 2). The panels must be delivered to the site in small deliveries by a vehicle suitable for offloading by a mini teleporter/buggy. The panels must be capable of being carried from the hoist via an electric pallet truck or similar device.
- The precast concrete panels will be transported by articulated truck to site. The tower crane will remove the panels directly from the lorry into position.

Roofing:

- The roof concrete slabs will be primed, but not less thank 28 days after being poured to allow sufficient drying out. The concrete must be free from surface water, debris and swept clean before this operation can commence. A 2mm vapour check layer will be bonded to the concrete under all insulated areas. It is intended to complete the whole roof area in vapour barrier to provide a temporary water seal before following behind with the remainder of a build-up of the proposed green roof.
- 150mm insulation will be bonded by hot bitumen to the surface of the vapour barrier. The insulation will be in the form of a composite board, with a bitumen impregnated fibre layer to receive the underlay sheet. The 3mm underlay sheet will be torched to the insulation, working away from the outlets. The 4mm cap sheet will then be torch bonded to the underlay.
- The construction sequence of the up stands against the atrium glazing screen and the outer leading edge is based on the roofer completing the works and the glazing contractors following with the counter flashing.
- The grass, decked or paved finishes will be applied after all of the roofing has been completed.

See Image 2 opposite: Rendered Image of Building Structure

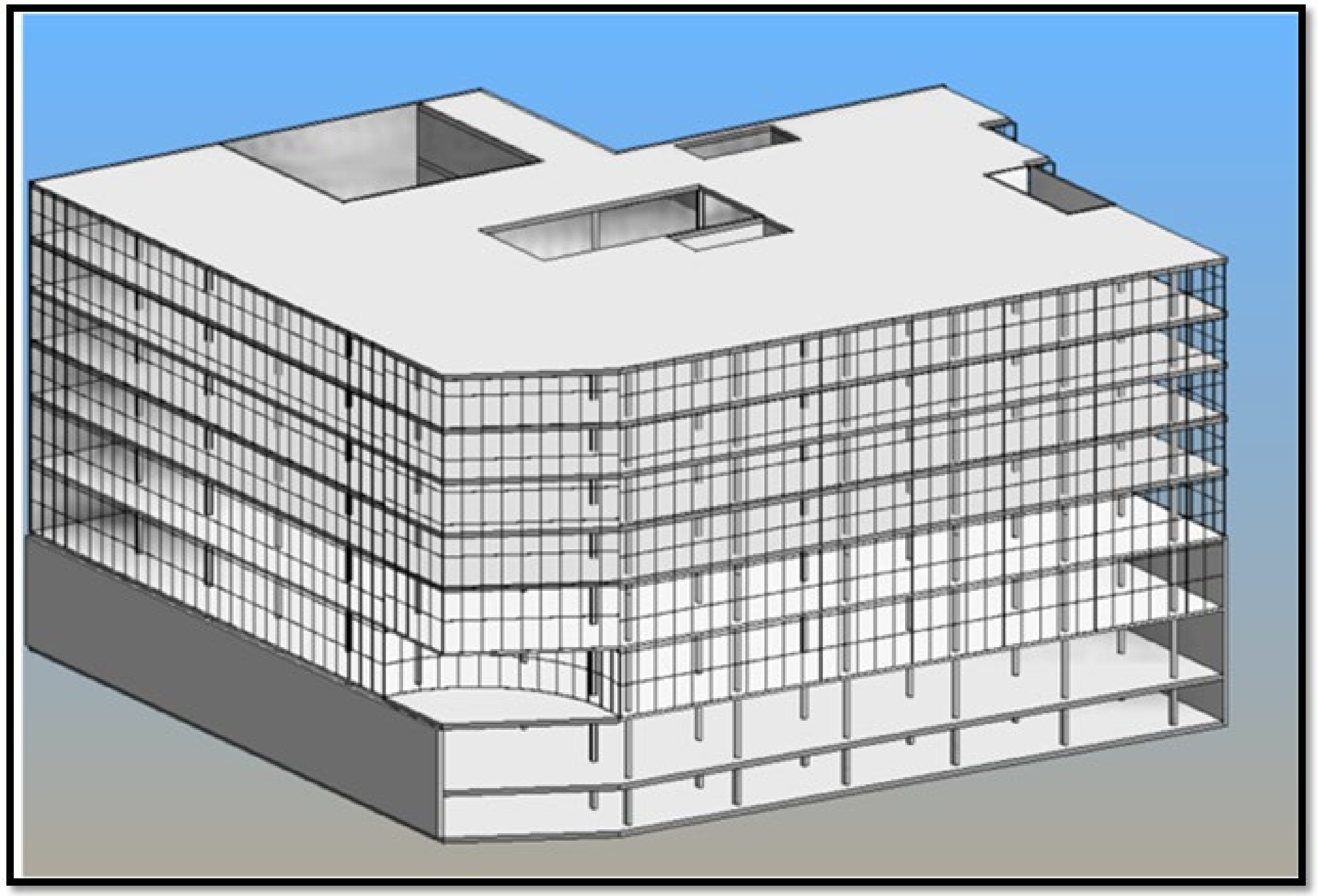
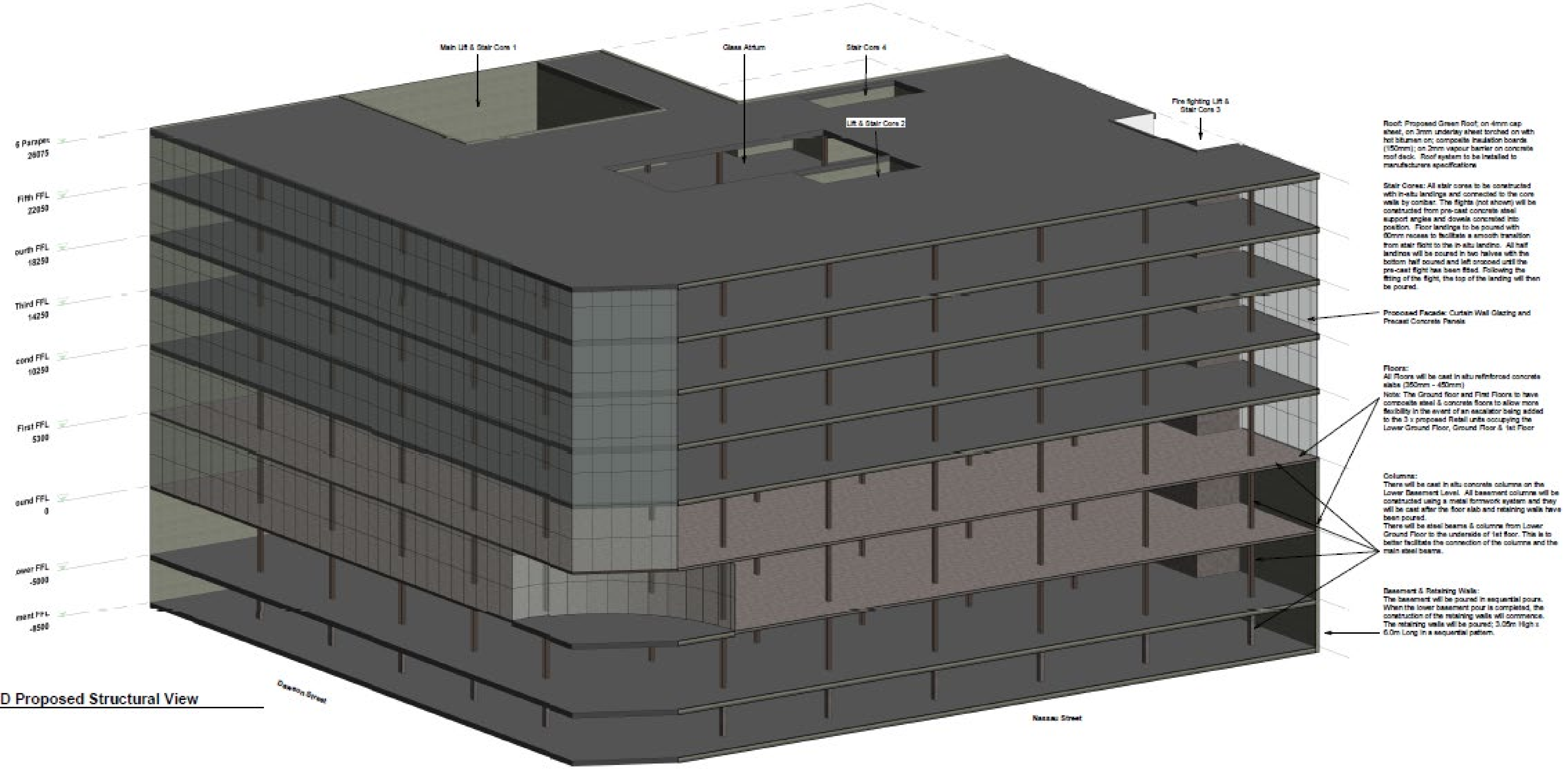
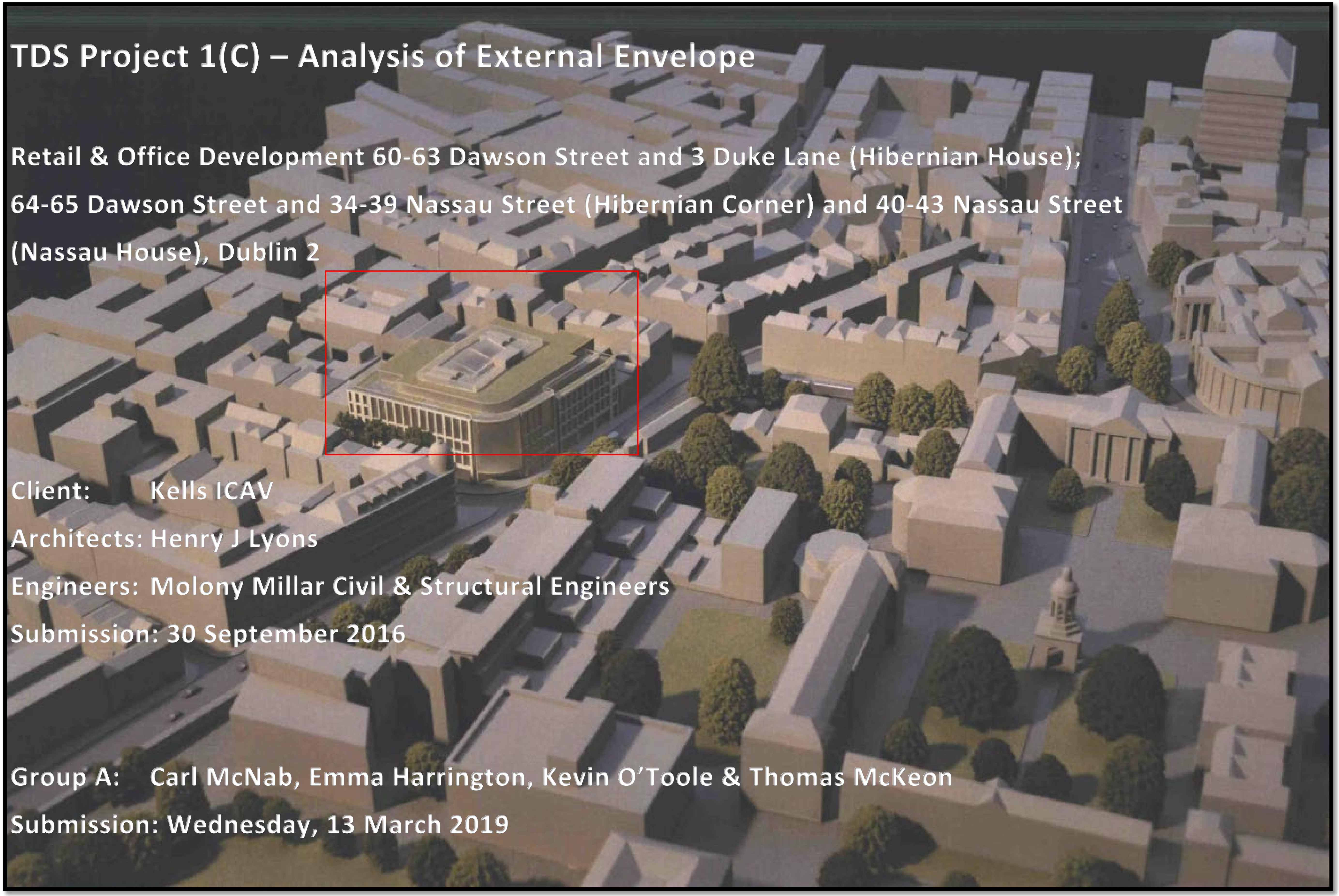


Image 2: **Proposed Structural Composition of building (Assumptions based on Engineers Reports).**



1 3D Proposed Structural View



TDS Project 1(C) – Analysis of External Envelope

Retail & Office Development 60-63 Dawson Street and 3 Duke Lane (Hibernian House); 64-65 Dawson Street and 34-39 Nassau Street (Hibernian Corner) and 40-43 Nassau Street (Nassau House), Dublin 2

Client: Kells ICAV

Architects: Henry J Lyons

Engineers: Molony Millar Civil & Structural Engineers

Submission: 30 September 2016

Group A: Carl McNab, Emma Harrington, Kevin O'Toole & Thomas McKeon

Submission: Wednesday, 13 March 2019

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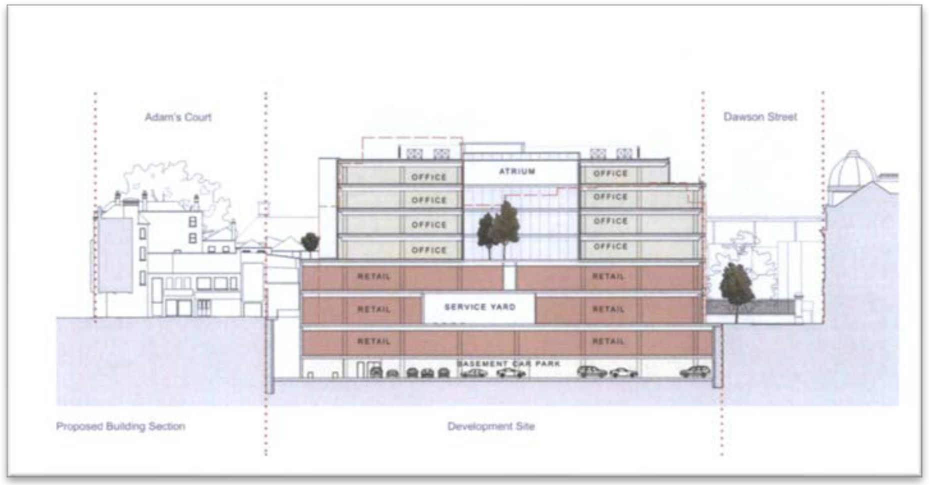
1. BUILDING DESCRIPTION – Recap

As noted in Project 1(A), the proposed building structure is a reinforced concrete and steel frame, arranged to facilitate sustainable and environmental Commercial Offices and Retail units. The building will extend to six storeys over ground above two basement levels. The Retail space will be arranged over three levels accessed from the street. (Upper basement, Ground Level & 1st Floor).

The building shell and core vertical circulation is located as far back from the street frontage as possible, to provide for uninterrupted Retail space accommodating larger units, in the size range of 550-1,500sq.m as per the Grafton Street or South Retail Core Area referred to in the Dublin City Development Plan. Ground to first floor and first floor to second floor heights for retail are proposed as 5.2m and 4.8m respectively with a tall single level shop front to ground level and windows at first floor level.

Office space is arranged over four levels around a central atrium with external windows on three sides. The atrium is glazed to the office levels with a glazed roof light, which will also provide natural and smoke ventilation to the space. The atrium will provide adequate daylight requirements due to the deep plan of the proposed building. The two Dawson and Nassau Street elevations and the existing eight storeys over ground level west elevation form the extent of the external window walls of the office.



Picture 1: Henry J Lyons Architects (September 2016) Retail & Office Development at Dawson Street – Nassau Street Architectural Design Statement (Page 19)

The first basement level provides Retail and ancillary space. The second basement level provides car and cycle parking, shower, locker and changing spaces. Mechanical heating and part cooling plant as well as water storage, rainwater harvesting, surface water attenuation and sprinkler tanks as well as electrical distribution and emergency generator plant are provided at this level also. Mechanical ventilation plant is provided in enclosed plant rooms at fifth floor level with low level cooling plant with required full external air circulation located within a roof level set back screened plant area adjacent to the atrium roof light.

The proposed development is designed when complete to be capable of a BER A3 Rating and LEED (Leadership in Energy and Environmental Design) 'Gold' level on Version 4 standard.

2. BUILDING STRUCTURE & CONSTRUCTION SEQUENCE - Recap

As noted in Project 1(B) the building will be constructed in the following stages:

1. Sub-structure:
   - Concrete Basement Construction will start after demolition and removal of existing buildings (x3) from site and site works for new development have completed including: pile matting & foundations, foundation for crane etc.
   - When the lower basement pour has completed, the construction of the retaining walls will commence. The retaining walls will be poured 3.05m high x 6m long sections in a sequential pattern.
   - Stair cores with in-situ landings will be constructed during in this phase. Stair flights will be constructed with precast concrete with steel support angles and dowels concreted into position.
   - Basement columns will be constructed next using a metal formwork system for casting columns. These columns will be cast after the floor slabs and retaining walls are poured. The columns will be cast before the decking commences for the above floor.
2. Super structure:
   - Concrete Frame: The main frame of the building will be flat concrete slabs supported by the core walls and columns. The lift and stair cores will provide stability to the building against later sway. The floor slabs will be approximately 350mm to 450mm thick. As stated above, the lift and stair cores will be constructed in conjunction with the basement construction. Upon commencement of the first-floor slab, the cores will be completed. Rising elements will commence from the Ground Floor in the form of columns and nib walls. As the rising elements are cast the decking will commence for the next level of floor slab.
   - Steel Frame: The Ground Floor and First Floors will have composite steel and concrete floors. This is to afford more flexibility in the event of escalators being installed from Level -1 to the First-Floor levels within the three proposed Retail units in the future. Steel columns will rise from Level -1 to the underside of the First Floor, to better facilitate the connection of the columns and the main steel beams.
3. Glazing & Pre-cast Concrete Panels:
   - The glazing installation will commence when the concrete frame has been erected, lined, levelled and floors poured up to Level 5. (Note: The loading and distribution of the panels will be the responsibility of the glazing contractor.)
   - All glazing panels from levels 1-5, will be distributed by the hoist located on the atrium (starts at Level 2). The panels must be delivered to the site in small deliveries by a vehicle suitable for offloading by a mini teleporter/buggy. The panels must be capable of being carried from the hoist via an electric pallet truck or similar device.
   - The precast concrete panels will be transported by articulated truck to site. The tower crane will remove the panels directly from the lorry into position.

3. BUILDING ENVELOPE

Despite the detailed drawings and multiple professional reports from, Architects, Archaeologists, Engineers, Environmental Consultants and Planning Consultants (See Reference list in Appendix 1) there is minimal information available on either the Building Envelope or Façade. The only reference to Building Fabric and Envelope is contained with EDPs[1] Sustainability Energy Statement notes in Section 2.4 Building Fabric (Page 5) …'In order to limit the heat loss through the building fabric of the project the thermal insulation for each of plane elements of the development (not specified) will be equal or better than the area weighted average elemental U Values (Um) as specified in Table1 Section 1.2.2.of TGD Part L (2008 and 2011). In addition to TGD L (which relates to Dwellings), EDP has also undertaken NEAP calculations (Non-Domestic Energy Assessment Procedure) calculations to demonstrate compliance and achievability of an A3 Building Energy Certificate rating'. The provisional BER results will be analysed in further detail in TDS - Project 1(D) Analysis of Environmental Strategy due for circulation on Wednesday 3rd April 2019. Similarly, LEED (Leadership in Energy & Environmental Design) analysis was also completed and again these results and overall Environmental Strategy will be included in TDS Project 1D.

On the basis that no information has been provided on facade material – Precast Concrete Panels – size, thickness etc. or insulation used – type, size etc. Assumptions have been made for the purpose of this exercise based on other Henry J Lyons projects that have been completed for example 10 Molesworth Street which appeared to use (based on walk bys); prefabricated insulated sandwich panels with brick finish to Front and Side Elevations and stone finish – to rear elevation. As is evident from the project below the design at Nassau Street and Dawson street will be reversed with Brick panels at the rear elevation and stone and glazing at the front and West Elevations.

4. FAÇADE DESIGN

Picture 2 -6: Reference: Henry J Lyons Architects (September 2016) Retail & Office Development at Dawson Street – Nassau Street Architectural Design Statement

According to the Architects HJL Design Statement, the proposed façade design reflects the different architectural character of both Dawson Street and Nassau Street. The design intention is to create a strong continuous high-quality Retail and Office façade on both streets. A distinctive corner element is proposed to form a transition between the two street facades and respond to the prominent location opposite the Nassau Street / TCD Arts Block entrance and Morrison Chambers building. The office access proposed is located on Dawson Street and a highly visible and separate entrance is formed at the south end of the façade. A vertical emphasis within a modular structural bay is proposed with stone reveals. At office levels the stone window bay is further vertically divided by a projecting glazing mullion / fin of bronze anodized aluminium.

Key Features of the Façade Design:

- Vertical emphasis of the façade elements within a 9m wide structural bay which facilitates optimum retail shop sub-division and office space planning.
- Single level 4 – 4.5m high glazed shop front with stone fascia and pilasters as an integral part of the overall building façade.
- Double height office entrance with bronze screen gates and projecting canopy.
- Large scale (more than single storey) articulation of vertical façade bay over the open 9m shop front bay width.
- Bronze coloured window framing (bronze anodized aluminium).

[1] Environmental Design Partnership (September 2016); Sustainability Energy Statement and Justification for Development – To accompany a planning application for the comprehensive redevelopment of a site that is situated at the corner of Dawson Street and Nassau Street, Dublin 2 for mixed use purposes.

5. FAÇADE MATERIALS & REFERENCES

The following are the key building materials used on the proposed development;

- Stone: A light-coloured limestone or such other selected natural stone cladding.
- Brick: To be applied to the rear elevation facing Adam Court and Duke Lane. The brick facing has been proposed to be in keeping with the character of Duke Lane and the rear elevations of the adjoining streets and to reduce visual impact and scale.
- Windows & Metal: The window and corner elements are proposed as bronze anodized aluminium framed glazed screens. The office entrance has a bronze anodized aluminium gate / screen and a bronze anodized aluminium clad projecting canopy to signal its location within the ground floor retail expression. (See Section 7 for Planner's Approval Condition in relation to signage).
- Shop Front: The shop fronts are illustrated as frameless structurally glazed screens framed by the main stone pilasters of the building. The detailed design of the shop fronts will depend on the final sub-division of the ground floor retail space. (See examples below for reference.)
- Glazing: It is not clear from the Molony Millar Engineers Report Outline Construction & Demolition Plan (July 2017), whether the glazing & precast panels are a unitised system – panels prefabricated off site incorporating the glazing, frame, spandrel panel etc. or a stick system with prefabricated individual mullions and transoms installed on site. Either system is suitable for use as as the superstructure is comprised of both a Steel Frame and Concrete Frame system so movement /sway will be limited. A further review of the reports and drawings (Elevations and Plans) leads me to a conclusion that a 'stick system' will be used. In this instance the mullions will be connected to either the Primary Structure – Concrete floor slabs or Steel Columns and via steel connectors, followed by the transoms, glazing and capping pieces. This system is slower than the unitized system and requires good workmanship and safe scaffolding access to the glazing areas. (See separate butter paper notes outlining the Advantages / Disadvantages of stick systems.)
- Roof & Setback: At roof setback level the office and ancillary spaces to the Dawson and Nassau Street visible elevations are substantially finished in a 'frameless' glazed aluminium curtain wall system. Curtain walling to service spaces or structural frame elements is opaque. Both clear and opaque is proposed to be selected to closely match colour and reflectance to form unified roof level element. At roof level a low level aluminium louvered screen located centrally on plan is proposed to screen open plant. This element will be a light grey colour as it is generally viewed against a grey-blue sky background.

See Pictures below for Façade References:

Retail

High Quality Retail at Ground and First - Valentino, Old Bond St, London

Bronze Framed Glazing/ Metal Fins - Valentino, New York

4.5m+ Shop Front Height / Stone Pilasters - Brown Thomas, Grafton St

Offices

Bronze surround entrance, canopy and screen - 7 Air St, London

Double height entrance, stone facade - Finsbury Circus House, London

Pictures 7-11: Reference: Henry J Lyons Architects (September 2016) Retail & Office Development at Dawson Street – Nassau Street Architectural Design Statement

6. U VALUE CALCULATIONS OF PROPOSED FACADE

In the absence of information, I am using a Creagh Concrete precast concrete sandwich panel to determine the average U values and required insulation thickness to meet 2017 TGD L Maximum Elemental U Values for Walls 0.21W/m²K. For the purpose of this exercise, the calculations are based on the Outer Leaf = 100mm and Inner Leaf of 150mm & 200mm depending on the Insulation type used (PUR, Mineral Wool and EPS). As expected, the PUR Insulation (100mm) with the lowest conductivity range (0.019 - 0.021 W/mK) produces the lowest U Value at 0.197W/m2k. However, as the building is greater than 5 storeys in height Mineral Wool insulation has also been compared using a thicker outer leaf (200mm) and maximum insulation (130mm) and it does not meet TGD L requirements. If the Inner Leaf is increased to 200mm and the mineral wool insulation is increased to 160mm – TGD L requirements are satisfied with a resultant U value of 0.204w/m²K. EPS insulation has also been used for comparative purposes only.

U Value Calculation with 3 Insulation Type using Creagh Concrete Average Panel Sizes

Outer Leaf: 80mm - 100mm
Insulation: 60mm - 130mm
Inner Leaf: 150mm - 200mm

Pre Cast Concrete Sandwich Panels

Option 1 - TGD L Standard

PUR Rigid Insulation (0.019- 0.023m²K/W) - Average 0.021	Thickness M	Conductivity W/mK	Resistance m²K/W
Outside Surface Resistance (RSO)			0.040
100mm Pre Cast Concrete Panel (Medium Density)	0.100	1.150	0.087
100mm Rigid PUR Insulation	0.100	0.021	4.762
Vapour Control Layer			Not Included
200mm Reinforced Concrete Shell (2% Steel)	0.150	2.500	0.060
Internal Surface Resistance (RSI)			0.130
Total Resistance (m²K/W)			5.079
U Value	Lowest Value		0.197 W/m²K

Option 2 - Non TGD L Standard

Mineral Wool Rigid Insulation (0.031 - 0.039 m²K/W), Average 0.035	Thickness M	Conductivity W/mK	Resistance m²K/W
Outside Surface Resistance (RSO)			0.040
100mm Pre Cast Concrete Panel (Medium Density)	0.100	1.150	0.087
130mm Mineral Wool Insulation	0.130	0.035	3.714
Vapour Control Layer			Not Included
Reinforced Concrete Shell (2% Steel)	0.200	2.500	0.080
Internal Surface Resistance (RSI)			0.130
Total Resistance (m²K/W)			4.051
U Value			0.247 W/m²K

Option 3 - Non TGD L Standard

EPS Rigid Insulation (0.033 - 0.040 m²K/W) Average = 0.037	Thickness M	Conductivity W/mK	Resistance m²K/W
Outside Surface Resistance (RSO)			0.040
100mm Pre Cast Concrete Panel (Medium Density)	0.100	1.150	0.087
130mm Rigid EPS Insulation	0.130	0.037	3.562
Vapour Control Layer			Not Included
Reinforced Concrete Shell (2% Steel)	0.200	2.500	0.080
Internal Surface Resistance (RSI)			0.130
Total Resistance (m²K/W)			3.899
U Value			0.257 W/m²K

Pre Cast Concrete Sandwich Panels

Option 1 - Passive House Standard

PUR Rigid Insulation (0.019- 0.023m²K/W) - Average 0.021	Thickness M	Conductivity W/mK	Resistance m²K/W
Outside Surface Resistance (RSO)			0.040
100mm Pre Cast Concrete Panel (Medium Density)	0.100	1.150	0.087
140mm Rigid PUR Insulation	0.140	0.021	6.667
Vapour Control Layer			Not Included
200mm Reinforced Concrete Shell (2% Steel)	0.150	2.500	0.060
Internal Surface Resistance (RSI)			0.130
Total Resistance (m²K/W)			6.984
U Value	Lowest Value		0.143 W/m²K

Option 2 - TGD L Standard

Mineral Wool Rigid Insulation (0.031 - 0.039 m²K/W), Average 0.035	Thickness M	Conductivity W/mK	Resistance m²K/W
Outside Surface Resistance (RSO)			0.040
100mm Pre Cast Concrete Panel (Medium Density)	0.100	1.150	0.087
160mm Mineral Wool Insulation	0.160	0.035	4.571
Vapour Control Layer			Not Included
Reinforced Concrete Shell (2% Steel)	0.200	2.500	0.080
Internal Surface Resistance (RSI)			0.130
Total Resistance (m²K/W)			4.908
U Value			0.204 W/m²K

Option 3 - TGD L Standard

EPS Rigid Insulation (0.033 - 0.040 m²K/W) Average = 0.037	Thickness M	Conductivity W/mK	Resistance m²K/W
Outside Surface Resistance (RSO)			0.040
100mm Pre Cast Concrete Panel (Medium Density)	0.100	1.150	0.087
170mm Rigid EPS Insulation	0.170	0.037	4.658
Vapour Control Layer			Not Included
Reinforced Concrete Shell (2% Steel)	0.200	2.500	0.080
Internal Surface Resistance (RSI)			0.130
Total Resistance (m²K/W)			4.994
U Value			0.200 W/m²K

Notes;
Average Conductivity Values used for calculation purposes.
Source: Conductivity Values Lyons (5th Edition) Materials for Architects and Builders

Source: TGD L (2011) Table A1 Thermal Conductivity of some common building materials

7. PLANNER'S APPROVAL CONDITIONS IN RELATION TO THE FAÇADE

See below for the following Approval conditions see in place by both Dublin City Council Planner's Office and recommendations by An Bord Pleanala in reference to the Façade

Dublin City Council Planning & Development Department (01-03-2017) Deputy Planning Officers – Final Report – Permission with Conditions for Approval

- Condition 3 The proposed fascia signage shall be permanently omitted from the development. Name/letter signage for each individual unit shall be confined to a position similar in height to the main entrance signage, in the form of an internal hanging sign or similar, the detail of which to be submitted for agreement by the Planning Authority prior to the occupation of the building. (See Picture 2 & 5 above for context.)

Reason: *I*n the interests of visual amenity.

- Condition 12 Notwithstanding the provisions of the Planning & Development Regulations 2001 (As Amended), no advertisement signs (including any signs installed to be visible through the windows); advertisement structures, *banners, canopies, flags, or other projecting element shall be displayed or erected on the building or within the curtilage, or attached to the glazing without the prior grant of planning permission.*

Reason: In the interests of visual amenity.

- Condition 13 A window display shall be maintained at all times and the glazing to the shopfront shall be kept free of all stickers, posters and advertisements.

Reason: In the interests of visual amenity.

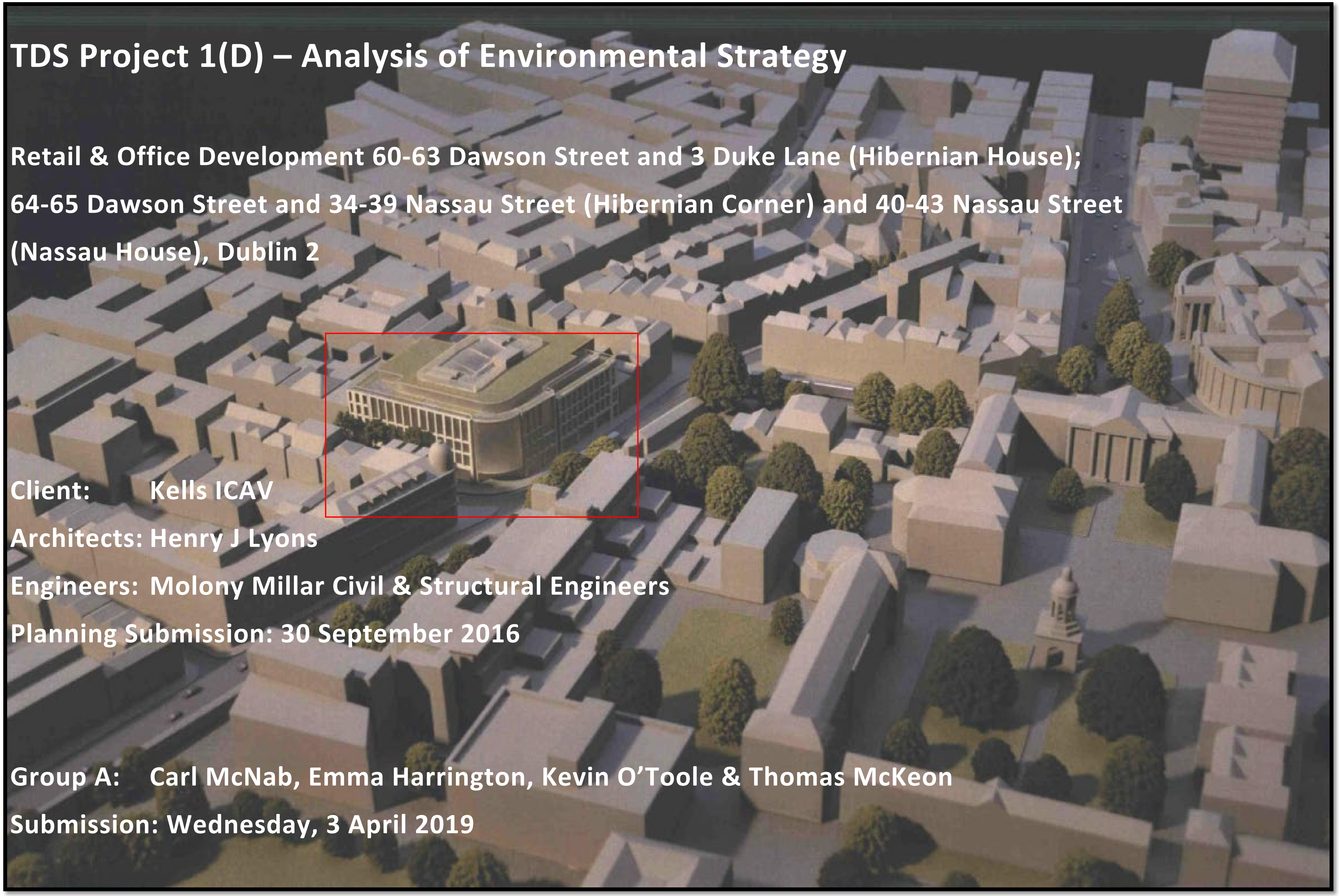
- Condition 15 No additional development shall take place above roof level, including lift motors, air handling equipment, storage tanks, ducts or other external plant other than thoseshown on the drawings hereby approved, unless authorised by a prior grant of Planning Permission.

Reason: To safeguard the amenities of surrounding occupiers and the visual amenities of the area in general.

An Bord Pleanala Inspector's Report 29S 248181 (7 June 2017) recommended that should permission be granted, it is recommended that a condition be attached with a requirement for a uniform blind system, if one is required, for the office fenestration throughout the Nassau Street and Dawson Street for reasons of visual amenity and orderly presentation of the building especially at night time.

8. REFERENCES

- An Bord Pleanala (June 2017) Inspector's Report
- Dublin City Council Planning Department (March 2017) Planner's Decision Final Report
- Environmental Design Partnership (September 2016) Sustainability Energy Statement & Justification for Demolition
- Henry J Lyons (September 2016) Architectural Drawings (Proposed Plans, Elevations and Sections)
- Henry J Lyons & 3D Designs (September 2016) Architectural Design Statement Retail & Office Development at Dawson Street – Nassau Street
- Moloney Millar Engineers (July 2016) Outline Construction & Demolition Plan
- www.creaghconcrete.co.uk Structural Precast Range Brochure
- www.techrete.com Sandwich Panel Brochure



TDS Project 1(D) – Analysis of Environmental Strategy

Retail & Office Development 60-63 Dawson Street and 3 Duke Lane (Hibernian House); 64-65 Dawson Street and 34-39 Nassau Street (Hibernian Corner) and 40-43 Nassau Street (Nassau House), Dublin 2

Client: Kells ICAV

Architects: Henry J Lyons

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Planning Submission: 30 September 2016

Group A: Carl McNab, Emma Harrington, Kevin O'Toole & Thomas McKeon

Submission: Wednesday, 3 April 2019

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Scope of TDS Project 1D Report

Each group to carry out an analysis on the overall environmental strategy if explicit, or determined where implicit. In planning terms this section may not be as explicit as other sections so the group is encouraged to propose a suitable environmental strategy to achieve or confirm NZEB performance.

Building Description (Recap)

The proposed development at the corner of Dawson Street and Nassau Street, comprises the demolition of all existing buildings on site. With the construction of a new 6-storey over double basement level, mixed use building to provide ancillary car parking, services and plant at lower basement level with retail at upper basement, ground and first floor level (7,728 sq.m) and office floorspace (11,388 sq.m) on the floors above. Vehicular access to serve the development and lower basement level will be provided from Duke Lane.

Pictures 1 & 2: Henry J Lyons Architects, Retail & Office Development at Dawson Street – Nassau Street, Architectural Design Statement

1. Background to NZEB in Ireland

Definition *'Nearly Zero Energy Buildings' NZEB means a building that has a very high energy performance, where the nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources including energy from renewable sources produced on-site or nearby'.*

NZEB & Ireland

- **NZEB Standard** Will apply to all new buildings occupied after the 31st December 2020. For Public Sector bodies, the standard will apply to all new buildings owned and occupied by the 31st December 2018. As with previous Building Regulations there are transitional arrangements in place where buildings are occupied after these dates but work commenced prior to 31st December 2018.
- **Non-Domestic Buildings** For all new builds, an equivalent to a 60% improvement in energy performance on the 2008 Building Regulations is required. This means an improved energy performance for the fabric, services and lighting specification. NZEB also introduces a mandatory requirement for renewable sources. The renewable sources must in general provide **20%** of the primary energy use, however there is flexibility where the building is more energy efficient than the regulations. This typically corresponds to an A3 Building Energy Rating. (Reference: www.seai.ie – Requirements for Non-Domestic Buildings.)
- **Renewable Energy Ratio (RER)** There are 2 routes to achieve compliance with this ratio;
  - If the BER target of A3 is achieved with no tolerance (0% margin), 20% of the building energy must be provided by onsite /near site renewable technologies.
  - If the BER target of A3 is achieved with a minimum of 10% margin, then 10% of the building energy used must be provided by onsite / near site renewable technologies. E.g. Solar PV, Combined Heat & Power (CHP), District Heating, On Site Wind Generation

How is Compliance with Non-Domestic buildings demonstrated?

- For non-domestic buildings, compliance will be demonstrated using the NEAP methodology. The NEAP Software for Non-Residential Buildings has been updated to demonstrate compliance with NZEB and Part L of the Building Regulations. (See Appendix 1 for more information on NEAP.) SBEMie software version 5.5h is the latest version for demonstrating compliance with NZEB requirements.

2. Dublin City Council / European Design Requirements (EU Energy Performance of Buildings Directives)

As part of the planning application and in compliance with Dublin City Council – Development Plan (2011 – 2017) objective *No. SI090,* Kells ICAV - the developers of the proposed development, engaged Environmental Design Partnership to develop a Sustainable Energy Statement to accompany the planning application. The statement demonstrates how the new building's energy application and management will be addressed. (See more details on *SIO90 o*n the following pages.)

This strategy document sets out all sustainability measures to demonstrate compliance and achievability of an A3 Building Energy Certificate rating and compliance with Part L 2011 of the Building Regulations. This report also sets out the design and built intent to achieve a LEED 'Gold' Certification. (See Appendix 2 for more details on LEED.)

Note: Henry J Lyons' – 1 Molesworth Street building recently completed has been awarded LEED 'Platinum Rating'.

The proposed development is expected to exceed the requirements of the current building regulations, in particular Part L 2008 – see requirements and preliminary results for the building in Table 1 below. (A snapshot of the Offices BRIRL is attached in Appendix 3.)

Table 1: Building Regulations Requirements

Requirement	TGD L 2008	Provisional BER & Part L Compliance Results
Minimum fabric & air permeability requirements	$5m^3/(h.m^2)$ @50pa	
Energy performance coefficients	<1	
Maximum energy performance coefficients (MPEPC)	1	EPC: Landlord: 0.54 Retail: 0.51 Offices: 0.38
Carbon dioxide performance coefficients	<1	
Maximum carbon performance coefficients (MPCPC)	1	CPC: Landlord: 0.53 Retail: 0.51 Offices: 0.37
Required Rating	A3	A3 for all of above.

Source: EDP – Sustainability Energy Statement & Justification for Demolition Report (2016) Page 10.

Note: See Appendix 1, Table1 for TGD L 2017 performance specification for new buildings which is effective from 1 January 2019.

EDP as part of their report evaluated and considered Dublin City Council policies and objectives as part of their Development Plan (2011-2017). The key policies and objectives relating to this development are listed below.

<u>Energy Supply</u>

- It is the <u>*policy*</u> of Dublin City Council (SI60) To support a wide range of energy solutions to meet consumptions needs, with particular emphasis on renewable energy sources to secure a low carbon electricity supply.
- It is an *objective* of Dublin City Council (SI089) To support the Government targets of having 40% of electricity consumption generated from renewable energy sources by 2020.

<u>Energy Efficiency</u>

- It is the <u>*policy*</u> of Dublin City Council (SI61) To promote energy efficiency, energy conservation and the use of renewable energy in existing and new developments.
- It is an *objective* of Dublin City Council
  - o (SI090) To require that proposals for large scale developments (typically 50 units or 5,000sq.m and above) or as may be determined by the planning authority, should include an Energy Statement to accompany any application, illustrating how the proposal incorporates the above design considerations and how it addresses energy efficiency with regard to the demolition, construction and long-term management of the development.
  - o SI091 To encourage responsible environmental management in construction.
  - o SI092 To promote sustainable approaches to developments by spatial planning, layout, design and detailed specification.
  - o SI093 To ensure high standards of energy efficiency in existing and new developments and encouraging developers, owners and tenants to improve the environmental performance of the building stock, including the deployment of renewable energy.
  - o SI094 To promote implementation of Dublin City Sustainable Plans.

District Heating & Combined Heat & Power

- It is the <u>*policy*</u> of Dublin City Council;
  - o SI62 To support the development of energy efficient initiatives such as the district heating network for Dublin and combined heat and power
  - o SI63 To promote the use of Combined Heat and Power in large developments
  - o SI64 To promote more sustainable development through energy end use efficiency, increasing the use of renewable energy, and improved energy performance of all new building developments throughout the city.

3. Limitation of Primary Energy Use and CO2 Emissions

- The primary energy consumption and carbon dioxide (CO2) emissions of the proposed development, including the services design, will be calculated using the NEAP methodology. To demonstrate that an acceptable primary energy consumption rate has been achieved, the calculated Energy Performance Coefficient (EPC) must not exceed the Maximum Energy Performance Coefficient (MPEPC) of **1.0.** This means that the actual building has to match the reference building in terms of energy based on the 2008 Building regulations. On this project, the design facilitates an MPEPC of no more than **0.5**, achieving a further 50% saving in Primary Energy.
- To demonstrate that an acceptable CO^2 emission rate has been achieved, the calculated Carbon Performance Coefficient (CPC) of the building being assessed must not exceed the Maximum Carbon Performance Coefficient (MPCPC) of **1.0.** Similar to the EPC, the design aims to achieve an improved Carbon Performance target in the order of **0.55** CPC. (Note: The proposed development was assessed using the NEAP software which demonstrates Part L compliance. The preliminary outputs from the software are provided in Table 1 opposite and a more detailed breakdown of BRIRL Offices is included in Appendix 3.) Please note a breakdown for Retail and Landlord Preliminary estimates are available on request.

4. Energy Efficient Design & Strategy

The proposed Nassau Street / Dawson Street development design, installation and strategy, will achieve a very high standards of energy efficiency/sustainable design and construction solutions as reflected in its **A3** Building Energy Rating and A LEED 'Gold' achievement. During the design and build process a full NEAP (Non-Domestic Energy Assessment Procedure) calculation compliance will be ongoing to ensure that the proposed design is in compliance with the limited energy consumption and CO2 emissions requirements. (See Project 1 C – Analysis of External Envelope for U Value calculations of proposed façade which will support the overall Energy Efficient Design & Strategy.)

To achieve the optimal energy efficient strategy, the building design will incorporate:

- Flexible Building Use including wireless technology, multiple point connections to internet and internal networks, intelligent lighting arrangements and flexible internal temperature control and automatic adjustment.
- Water Consumption storage & consumption of potable water in relation to Dublin City Council and water authority recommendations and the use of rainwater harvesting as part of the overall SUDS strategy (See Section 6 on the following pages.)
- Passive Solar Design the objective being to capture free heat, daylight and ventilation and minimise unwanted solar gain. To support this objective the development will have glazing specified with an appropriate 'g Value' to reduce unwanted solar gain, without impacting on daylight levels which should remain between 2% and 5%. (Note: Requirement for Offices is 2%.)

  As the building is deep plan 54m (North to South Elevation) and 57m East to West Elevation) the Architects' Henry J Lyons have introduced an atrium into the centre of the building to bring in natural daylight. The proposed office spaces (2^{nd} – 5^{th} floor) will be wrapped around this internal glazed atrium allowing central light penetration to the space internally. There will also be a roof garden on the 2^{nd} floor. The atrium in the central area has reduced the floor spaces to 18m on each side of the atrium, thus increasing daylight penetration.

- Building Fabric in order to limit the heat loss through the building, the materials used to thermally insulate the building must at least comply with elemental U Values in TGD L 2008, Table 1 (Section 1.2.2.2.) and but, preferably meet Table 3 (TGD L 2017) –Building Specification for Non-Domestic Buildings *See Appendix 1 for more details*.
- Building Envelope / Air Permeability the design will aim to minimise air permeability which can lead to uncontrolled ventilation. The design objective of the building is to achieve at least $5m^3/(m^2h)$. However, future system specification will most likely aim for $\mathbf{3m^3/(m^2h)}$ – this will require mechanical ventilation. Note: *TGD L 2017 Building Specification for Non-Domestic Buildings* for Air Permeability below;
  - Air Permeability – Gross Internal Area *less* than $250m^2$ = $5m^3$/hour x m^2.
  - Air Permeability – Gross Internal Area *greater* than $250m^2$ = $3m^3$/hour x m^2.

- Building Services Compliance via;
  - Energy Efficient Mechanical Ventilation Solutions: Due to the proposed high occupancy levels (c. 430 people[1] on average per floor) and the deep plan of the building (which is >12m optimal floor depth as per CIBSE AM10) full mechanical ventilation will be used with heat recovery and demand control ventilation. (*See TGD F – Ventilation Section 1.3.2 – Ventilation of Offices - Table 3: Basic ventilation provision using background ventilators and specific provision for extract and purge ventilation* and *CIBSE AM10 – Natural Ventilation in Non-Domestic Buildings for requirements and rules of thumb.)* A good Non-Residential DCV system would be Aereco's VMX demand control ventilation system which operates using with three detection modes including: Presence, CO^2 and Movement sensors. DCV systems provide ventilation 'as required', therefore saving energy when the building is unoccupied. (Note: Commercial Kitchens ventilation are subject to more stringent ventilation requirements. See *CIBSE TMSO 2009 – Energy Efficiency in Commercial Kitchens*.) It should be noted that the central atrium from 2^{nd} floor to roof level will also support natural ventilation via the 'Stack Effect' with mechanical operating louvres and / or fans at the top.
  - Specific Fan Power Reduction: To achieve this the design will ensure that all ductwork is correctly sized and service routes are optimal.
  - Variable Speed Pumps and Ventilation Fans: will be specified as they can operate at 'partial load' most of the year as opposed to peak design load. (Note: All pumps specified will comply with the Energy related Products (Earp) Directive.)
  - Metering & Sub Metering: As per *CIBSE TM39 2009 Building Energy Metering*, which is required as part of the calculation for Display Energy Certificates - which are mandatory for public sector buildings with floor areas $>500m^2$ and buildings frequently visited by the public. This development will fall within the latter category due to the 3 x proposed Retail units on Lower Ground Floor, Ground Floor and 1^{st} Floor.
  - All Hot Water Storage Vessels, Pipes and Ducts to be insulated in line with *TGD G – Hygiene* requirements.
  - Building User Guides: to be provided to the appointed building representatives to support the continued energy efficient management of the building after hand over.
- Energy Efficient Lighting Design: To be adopted to control and maximise the use of natural daylight using LEDS, TS linear tubes and CFLs (compact fluorescent lamps) in smaller areas like toilets and corridors. (Note: *EN12464-1* requires an illuminance of minimum 500 lux in Offices, 100 – 150 lux in corridors and 200 lux in restrooms and canteens.)
- Energy Efficient HVAC Systems including: Fan Coil Systems and Variable Refrigerant Flow (VRF) will also be considered as part of the proposed energy strategy for the building.

5. Sustainability & Renewable Energies

The following renewable energies will be considered for the proposed development:

- Combined Heat & Power (CHP) / co-generation: is the use of a heat engine or power station to generate electricity and useful heat at the same time. Combined heat and power (CHP) plants recover otherwise wasted thermal energy for heating. This is also called combined heat and power district heating.
- Heat Pumps are devices that transfer heat energy from a source of heat to what is called a heat sink. Heat pumps move thermal energy in the opposite direction of spontaneous heat transfer, by absorbing heat from a cold space and releasing it to a warmer one.
- Solar PVs & Solar Thermals (Most likely option). These are panels made from materials which generate DC electricity when exposed to light. There are a number of considerations when determining whether or not solar panels are the correct choice for the building. One aspect to be consider is how much of the generated electricity is required, is it an economical solution? Solar PV systems generate electricity during daylight hours, predominantly around the middle of the day. For businesses with high daytime electricity demands PV panels can be a good option. As this is a mixed use (Offices & Retail) solar and thermal pvs will be a good choice for this building based on electricity production and building usage patterns.

  It is worth noting that c. 75% of the annual energy from a solar PV system is produced from May-September. Therefore the design needs to be cognisant of electricity / energy requirements, based on the pattern of generation from the solar PV system Vs the pattern of energy usage for your business. Without any additional systems, a lot of the generated electricity can be spilled (exported) to the grid, and there is currently no mechanism for generators to claim a payment for this. This is expected to change in the coming years. Finally the review should take into account the suitability of the roof for solar PVs:

[1] Building Occupancy calculations based on TGD B Para 1.0.10 – Area of Storey (m^2) / Occupancy Load Factor. Occupancy Load factor for Offices = 7.0. 3,010 x 7 = 430

- What is the orientation of the roof?
- Is there any potential shading from nearby trees or buildings?
- Will the use of solar panels on the roof, negate the ability to have a green roof – SUDS strategy?

The best rooftops for maximising electricity generation are those that are south-facing, in good condition and with minimal shading from trees or adjacent structures. This building meets these criteria.

Note: Larger solar PV systems in a business or industrial setting will typically require planning permission. Solar PV systems installed in such a setting under 50 sq. m (and representing less than 50% of the total roof area) are exempt from planning.

- On Site Wind Generation – unlikely for this site due to its city centre location.

- SEAI Financial Supports for Renewable Energies:
  - Accelerated Capital Allowances: the ACA is a tax incentive aimed at companies paying corporation tax, sole-traders and non-corporates. The scheme allows them to write off 100% of the purchase value of qualifying energy efficient equipment against their profit in the first year of purpose. Solar PV systems can qualify for the scheme provided the model of solar panel is registered on the Triple E Register.
  - Grants via EXEED: The Excellence in Energy Efficiency Design (EXEED) programme offers grant support to business and industry for energy improvements and can encompass grant support for solar PV systems. More detail can be found on the EXEED webpage.
- For additional information on Renewable Energy types - See TDS Project 2&3 – Part D for a detailed description of each of the above renewable energies and their suitability to a city centre location.

6. Surface Water Drainage and SUDS

The foul and surface water drainage for the existing three buildings discharge into combined sewers on Dawson Street and Nassau Street. These sewers are the middle of the road and are located between the two Luas tracks currently being laid down. They have been relined. The sewer on Dawson Street is 2,070 x 780mm flowing Northwards and the sewer on Nassau Street is 1,580 x 770mm flowing Westwards.

There are six existing 150mm outlet pipes which discharge to the sewers, two to Dawson Street and four to Nassau Street. A CCTV survey has been carried out on these pipes. They are generally in good condition. There is some fibrous root intrusion. It is proposed that all the pipes will be retained and the pipes relined for the proposed new development. The existing site is totally covered by impermeable surface (100%). At the time of the report, it was not clear if there is segregation between foul and surface water. The site will continue to be totally covered by impermeable surfaces post-development. Going forward the foul and surface water drainage will be drained separately until the final manhole. The final manhole will drain by gravity to the combined sewer.

The SUDS strategy proposed comprises:

- Green Roofs: The proposed green roofs (c.1,714sq.m) will be on the roof over the 5th Floor - excluding mechanical plant area and on the 2nd Floor set back area to the rear.
- Attenuation Tank: The tank will be located at Level (- 1) under the footpath on Dawson Street, which will be drained by gravity to the combined sewer on Dawson Street. The outfall from the tank will be controlled by a hydrobrake.
- Storm water retention in the form of green roofs and an attenuation tank has been designed with a return period of 100 years plus 10% global warming.
- Rain Water Harvesting: The tank will be situated at basement level from where water will be pumped to the upper levels of the building for purposes of flushing toilets.
- Access to the basement Level (-2) will be via car and goods lifts and stairs. Gullies and a drainage network will be designed for water brought in by cars. This discharge will be pumped to Ground Floor level to a stand-off manhole and then drained by gravity to the combined sewer on Duke Lane. The surface water network has been designed for a 5-year return period and the calculations and drawing are enclosed within the Moloney Millar's Civil Engineering & Flood Risk Assessment report.

7. REFERENCES

- *CIBSE;* (2005) AM 10 – Natural Ventilation in Non-Domestic Buildings
- *Declan Brassil & Company Chartered Planners*; (2016) Planning Report - Accompanying a planning application for the redevelopment of a site at the corner of Dawson Street and Nassau Street, Dublin 2, for mixed-use purposes.
- *Environmental Design Partnership*; (2016) Sustainability Energy Statement & Justification for Demolition – To accompany a planning application for the comprehensive redevelopment of a site that is situated at the corner of Dawson Street and Nassau Street, Dublin 2 for mixed use purposes.
- *Moloney Millar Civil & Structural Engineers* (2016) Civil Engineering Report & Flood Risk Assessment - To accompany a planning application for the comprehensive redevelopment of a site that is situated at the corner of Dawson Street and Nassau Street, Dublin 2 for mixed use purposes.
- TGD F – Ventilation (Building Regulations 2009)
- TGD G – Hygiene (Building Regulations 2008) Reprinted in July 2011
- TGD L - Conservation of Fuel & Energy - Buildings other than Dwellings (Building Regulations 2017) *Operative with effect from 1 January 2019*
- TGD L - Conservation of Fuel & Energy – Dwellings (Building Regulations 2011) Reprinted in 2008 R
- www.igbc.ie/certification/leed (Irish Green Building Council)
- www.seai.ie
  - Non-Domestic Energy Assessment Procedure (NEAP) Proposed Changes for Part L 2017 Public Consultation
  - Solar Energy / Renewable Energy

Appendix 1: NEAP – Non Domestic Energy Assessment Programme *Ref: www.seai.ie*

- Non-Domestic Energy Assessment Procedure (NEAP) is the methodology for demonstrating compliance with specific aspects of Part L of the Building Regulations.
- NEAP is also used to generate the Building Energy Rating (BER) and advisory report for new and existing non domestic buildings.
- NEAP calculates the energy consumption and CO2 emissions associated with a standardised use of a building. The energy consumption is expressed as kilowatt hours per square metre floor area per year (kWh/m2/yr) and the CO2 emissions expressed in terms of kilograms of CO2 per square metre floor area per year (kg CO2/m2/yr). NEAP allows the calculation to be carried out by approved software packages or by the default calculation tool, Simplified Building Energy Model (SBEM), which is based on CEN standards and has been developed by BRE on behalf of the UK Department of Communities and Local Government. SBEM, accompanied by a basic user interface, iSBEM, calculates monthly energy use and CO2 emissions based on building geometry, construction, use and HVAC and lighting equipment. The purpose of SBEM and its interface iSBEM is to produce consistent and reliable evaluations of energy use in non-domestic buildings for Building Regulations compliance and Building Energy Rating purposes. Although SBEM may assist in the design process, it is not primarily a design tool.
- The Simplified Building Energy Model (SBEM) is used in the UK and Republic of Ireland to calculate the energy performance of non-domestic buildings, and assess building regulation compliance for the purposes of both BER certification and compliance assessment against Part L of the building regulations.

Table 1 2017 Reference Building Specification for Non-residential Buildings

Element	Performance value for reference building
Roof U Value ($W/(m^2K)$)	0.15
Wall U Value ($W/(m^2K)$)	0.18
Floor U Value ($W/(m^2K)$)	0.15
Thermal Bridging	Key TB length x psi value in Table 2
Window U Value ($W/(m^2K)$) Side lit :Exposed facades will have windows with area that is the lesser of either: 1.5m high × full facade width OR 40% of exposed facade area Top Lit[1]::12% of exposed roof area will be made up of roof-lights*	1.4 (10% FF) (for side lit or unlit buldings) 1.6 (30% FF) (for top lit buildings)
G-Value (%)	40
Light Transmittance (%)	71
Air Permeability ($m^3/(m^2h)$) Gross internal area less than 250 m^2	5
Air Permeability ($m^3/(m^2h)$) Gross internal area greater than 250 m^2	3
Lighting luminaire (lm/circuit watt)	65
Occupancy Control	Yes
Daylight Control	Yes
Maintenance Factor	0.8
Heating efficiency (heating and hot water)%	91
Central Ventilation SFP (W/(l/s))	1.8
Terminal unit SFP	0.3
Cooling-where applicable (air-conditioned) (SEER/SSEER)	4.5/3.6
Cooling where applicable (mixed mode) (SSEER)	2.7
SFP (W/(l/s)) for air distribution systems where applicable	As per maximum values in Table 3 and Table 4 in Section 1.4.3
Variable speed control of fans and pumps controlled via multipe sensors	Yes
Demand Control (mechanical ventilation only) Variable speed control of fans via CO_2 sensors	Yes
Shading and Orientation	Same as actual building
Fuel	Auxiliary Energy= grid electricity Cooling=grid electricity Space Heating=gas boiler Domestic hot water =gas boiler
Renewable Energy Ratio (RER) %	20

Note 1: Mixed mode assumed to be cooled by DX Unit where SSEER includes indoor and outdoor units and fans, pumps and losses.

Note 2: The renewable energy ratio RER from EN 15603 is given by:

$$RER = \frac{E_{Pren}}{E_{Ptot}}$$

where: E_{Ptot} is the total primary energy including renewable energy and E_{Pren} is the renewable primary energy, [kWh/m2a] the perameters defined in Table A9;

Table 3 Maximum elemental U-value [1,2] (W/m^2)

•		
• Column 1 • Fabric Elements	• Column 2 • Area – weighted • Average	• Column 3 Elemental U-value Individual element or section of element
• Roofs • Pitched roof • - Insulation at ceiling • - Insulation on slope • • Flat roof	• • • 0.16 • • 0.16 • • 0.20	• • • • 0.3
• Walls	• 0.21	• 0.6
• Ground Floors[3]	• 0.21	• 0.6
• Other exposed floors	• 0.21	• 0.6
• External personnel doors, windows and rooflights[4,5,6,]	• 1.6	• 3.0
• Opaque Curtain Walling[7]	• 0.21	• 3.0
• Vehicle access and similar large doors	• 1.5	• 3.0

- *Notes:*
- 1. The U-value includes the effect of unheated voids or other spaces.
- 2. Reasonable provision would also be achieved if the total heat loss through all the opaque elements did not exceed that which would be the case if each of the area weighted average U-value (Um) set out in Table 2 were achieved individually.
- 3. Where the source of space heating is underfloor heating, a floor U-value of 0.15 W/m2K should generally be satisfactory.
- 4. Excludes display windows and similar glazing but their impact on overall performance must be taken into account in EPC and CPC calculation.
- 5. Includes glazed sections of curtain walling.
- 6. In buildings with high internal heat gains a less demanding

Appendix 2: LEED (Leadership in Energy & Environmental Design) ***Ref: Irish Green Building Council***

- LEED (Leadership in Energy and Environmental Design) is a voluntary rating system to certify sustainable buildings and neighbourhoods. Launched by the US Green Building Council in 1998, LEED has been gaining traction around the world – in fact 1 of every 3 LEED projects is outside the United States.

- According to Ireland's Country Market Brief, there are 213 registered LEED projects in Ireland, and 36 certified projects. (Data retrieved from the USGBC 5 April 2018.) The current version of LEED is v4, and the USGBC has just released the first draft version of LEEDv4.1 for Building Operations and Maintenance projects (as well as a new system for released for O&M: Interiors).

- The Irish Green Building Council is part of the International LEED round table. This develops alternative compliance paths for LEED for use in Europe and the regional priority credits. Along with LEED, European project teams might also pursue WELL, BREEAM, DGNB, SKA or other national or international rating systems. The IGBC offers tools and support for teams considering certification; contact us for more information.

LEED Categories:

Category	Possible Points	Prerequisites
Location & Transportation	21	
Sustainable Sites (SS)	11	1
Water Efficiency (WE)	11	3
Energy and Atmosphere (EA)	33	4
Materials and Resources (MR)	14	2
Indoor Environmental Quality	10	2
Innovation and Design Process	6	
Regional Priority (RP)	4	
Total Points Available:	**110**	**12**

LEED Scores:

Certified	40 - 49 Points
Silver	50 - 59 Points
Gold	60 - 79 Points
Platinum	80+ Points

Extract from EDP Report regarding LEED calculation for Dawson Street & Nassau Street Development:

Sustainable Sites (SS)
- Community Connectivity - The proposed development is located in an urban environment and is close to numerous amenities (i.e. ATM, cafe etc.)
- Public Transportation- The proposed development is surrounded by excellent quality transit access via bus, Luas and Dart.
- Sensitive Land Protection - The proposed development is located on a site that has been previously developed.

Water Efficiency (WE)
- Water Use Reduction - Through the combination of low flow sanitary fittings for flushing of WC's and Urinals, the Water efficiency credits have been maximised.

Energy & Atmosphere (EA)
Energy Performance - Optimising Energy performance holds the greatest potential for achieving the LEED Gold rating. The following measures have significantly reduced the required energy and resulting carbon emissions from the building:
- Optimised facade and insulation levels
- Energy Efficient LEO lighting internally and externally
- Condensing Boilers
- Intelligent Controls
- Variable speed drives
- Maximizing Daylight (where possible)
- Refrigerant Management - The proposed chillers used will have low Ozone Depletion Potential (ODP) and Global Warming Potential (GWP) used for the Cooling system within the proposed development.
- Measurement and Verification - Extensive Metering will be used to monitor the proposed developments energy use.

Material & Resources
- Waste Management - The contractor, when appointed, will ensure that all construction waste will be recycled when possible and diverted from landfill.
- Recycled Content - The proposed materials to be used will have an overall minimum recycled content of 20% based on the total value of material costs.
- FSC Certified Wood - The procurement of timber to be used will be specified on the basis of FSC certified timber.

Indoor Environmental Quality (IEQ)
- Outdoor Air Delivery - The proposed Mechanical Ventilation System design will significantly increase the level of fresh air introduced into the building when compared to minimum ASHRAE standards.
- Construction Management - The contractor, once appointed, will ensure good site housekeeping is carried out daily (i.e. materials stored in dry areas, ducts covered etc.)
- Materials - The selection of low emitting materials and finishes will ensure a healthy indoor environment within the proposed development.
- Lighting - Providing lighting controls to the occupants will promote productivity, comfort and wellbeing within the work areas.
- Daylight - Providing daylight to the building occupants introduces the connection of outdoor and indoor spaces.

Conclusion
The level of 'Sustainable features' integrated into the design and construction of the proposed development will result in a minimum score of 60 points being achieved (LEED Gold rating).

Note:
While the initial indications suggest a 'Gold Rating' at the time of this report (2016), there is no doubt that the design strategy will continue to develop further and aim for Platinum Rating similar to 1 Molesworth Street which was recently designed and completed by the same architects Henry J Lyons.