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Claremont Residential Development, Co. Dublin
Strategic Housing Development
November 2019 | Response to ABP Opinion Item 03
Residential Amenity

PROJECT CLAREMONT

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MODEL WORKS

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01
INTRODUCTION

01 INTRODUCTION

This report has been prepared in support of an application submitted on behalf of Atlas GP Ltd. (the Applicant) for a new strategic housing development on the Howth Road at the entry to Howth Village, Co. Dublin. The report specifically responds to item no.3 of An Bord Pleanala's Pre Application Consultation Opinion.

Item 3
A report that addresses issues of residential amenity (both existing residents of nearby development and future occupants), specifically with regards to daylight/sunlight analysis, overlooking, overshadowing, overbearing and noise. The report shall include full and complete drawings including levels and cross-sections showing the relationship between the proposed development and nearby residential development.

This report looks at the residential amenity proposed for the new development with a focus on daylight/ sunlight analysis, overshadowing, overlooking, overbearing, noise and their associated impacts on both existing and future occupants. Good space standards, sound insulation and access to private open spaces have all been carefully considered by the design team in order to achieve a positive urban design solution.

The devlopment has been designed to encourage a sense of identity and place for future residents within the existing local community.

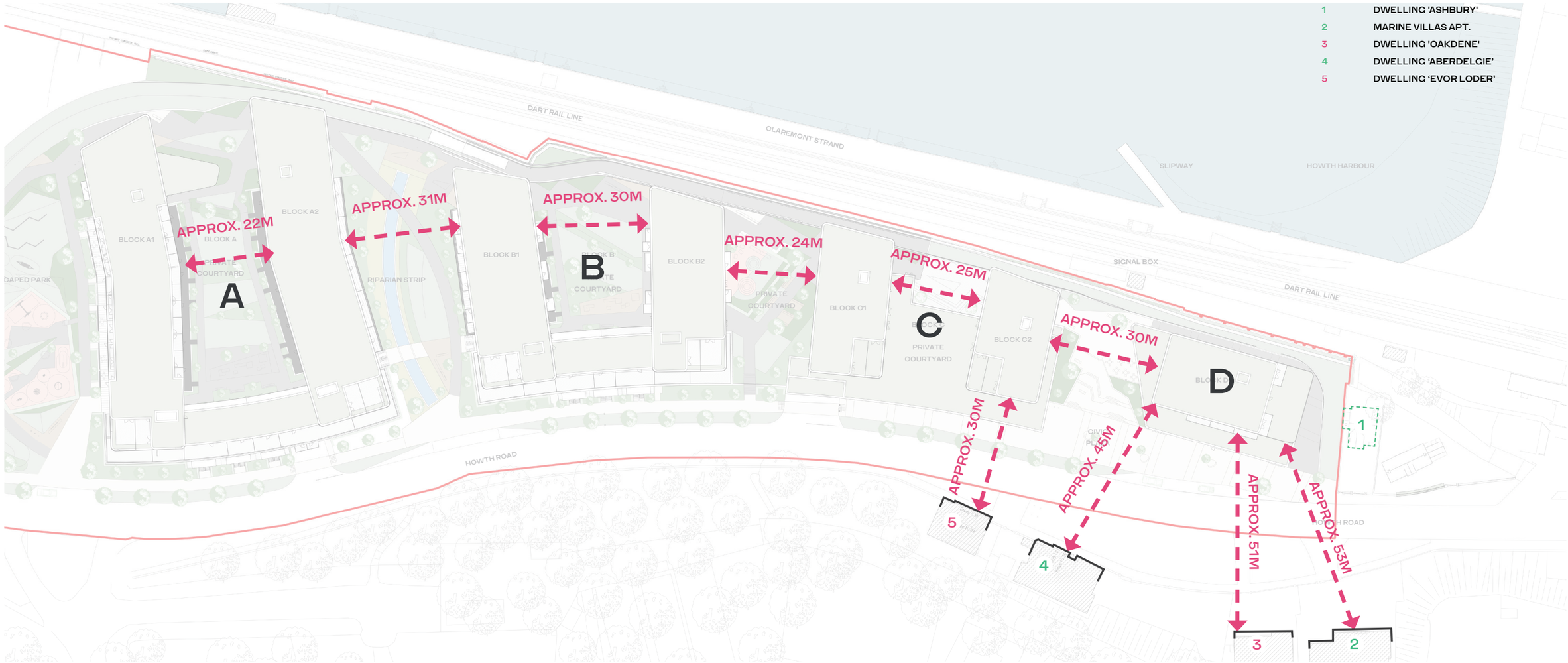
The report has been compiled by Henry J Lyons Architects with input from JV Tierney & Co. (Services Consultant) and AWN Consulting (Noise and Acoustic Consultant).

SITE KEY PLAN

1 DWELLING 'ASHBURY'
2 MARINE VILLAS APT.
3 DWELLING 'OAKDENE'
4 DWELLING 'ABERDELGIE'
5 DWELLING 'EVOR LODER'
6 FORMER STATION MASTER'S HOUSE (PROTECTED STRUCTURE)
7 RAILWAY BUILDING - SIGNAL BOX (PROTECTED STRUCTURE)
8 HOWTH RAILWAY STATION (PROTECTED STRUCTURE)
9 ST.MARY'S CHURCH (PROTECTED STRUCTURE)

02
OVERLOOKING

02 OVERLOOKING



THE DEVELOPMENT SITE LAYOUT - SEPERATION DISTANCES

The layout of the proposed devlopement was designed in such a way to reduce the likelihood of overlooking for both existing and future occupants. It is outlined in the Howth Urban Centre Strategy that *" It is an important quality of the residenti al environment that the private spaces should enjoy freedom from undue observati on by others and that no undue loss of light is caused by overshadowing from adjoining higher buildings. In general, 20 metres of separating distance between opposing first floor habitable windows must be maintained."*

Minimum separation distances of +22m are achieved between opposing finger blocks of the development allowing for excellent sunlight penetration and providing sea views to a large number of apartments.

The building form along Howth road is kept at a lower level to address the existing scale of Howth Village and to minimise any overshadowing of the internal courtyards behind.

RESIDENTIAL BUILDINGS 02/03/04/05

Existing residential developments which have opposing first floor habitable windows on the southern side of Howth Road are a minimum of 30m from any proposed first floor habitable windows in the proposed development. This will provide a high level of privacy for both future and existing residents.

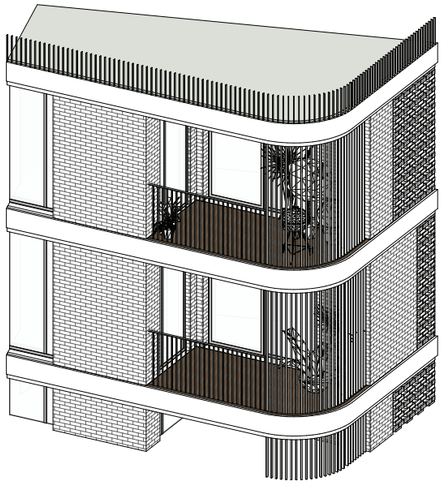
RESIDENTIAL BUILDING 01

The applicant has developed a proposal for the eastern elevation of Block D and implemented measures to prevent overlooking from inside the apartments to the east towards the neighbouring residential properties. Whilst the apartments are orientated primarily north/south, a series of perforated brick screens, with glazing behind, are also introduced along the gable end to maxmise daylight penetration whilst minimising potential overlooking. Vertical metal privacy screens are implemented on the balconies facing east to also reduce the potential for overlooking on private terraces.

Private terraces located at the setback on fourth floor are restricted and pulled away from the edge to prevent overlooking neighbouring buildings.

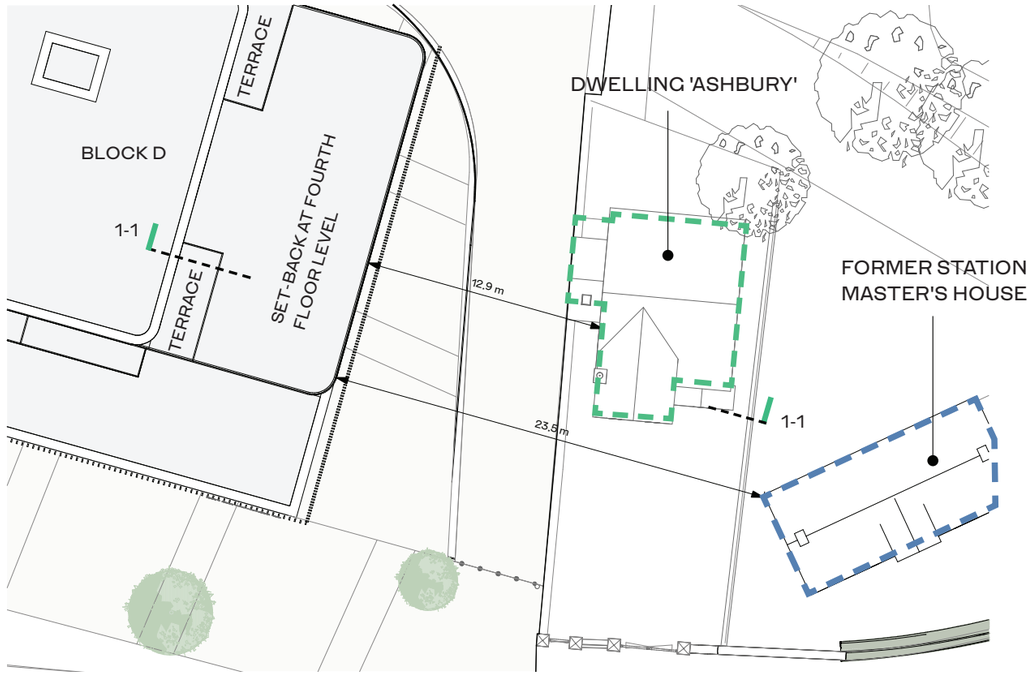
02 OVERLOOKING

A. DWELLING 'ABERDELGIE' & FORMER STATION MASTER'S HOUSE

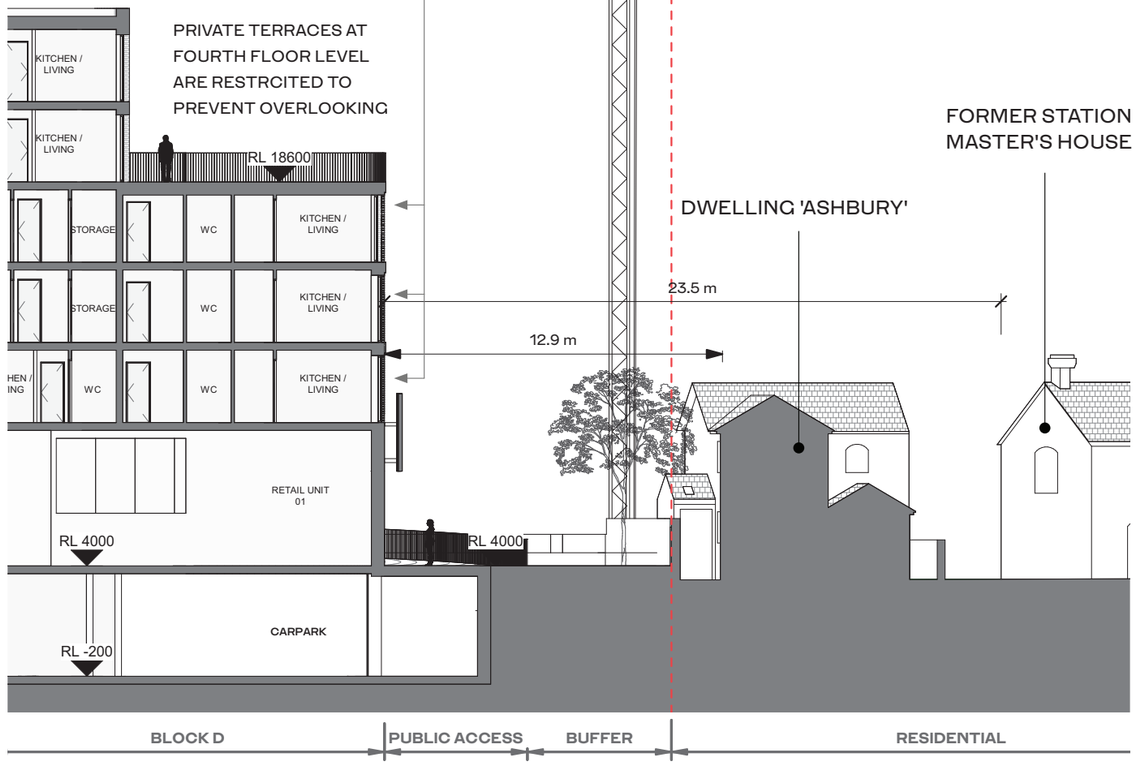


BALCONIES THAT ARE IN CLOSE PROXIMITY TO NEIGHBOURING RESIDENTIAL DEVELOPMENTS HAVE BEEN ORIENTATED NORTH/ SOUTH TO MINIMISE POTENTIAL OVERLOOKING. IMPLEMENTED ARE VERTICAL METAL SCREENS TO ALL BALCONIES ON THE MOST EASTERN FACADE.

BRICK SCREENS TO ALL WINDOWS ON THE MOST EASTERN FACADE PREVENT OVERLOOKING TO NEIGHBOURING PROPERTIES.



PLAN



SECTION 1-1

03
OVERBEARING

03 OVERBEARING

Particular care was applied to the overall arrangement of blocks to ensure that the development did not create an overbearing nature within its surrounding context. The layout of roads, building form and open space was designed in such a way as to provide a sense of openess and permeability.

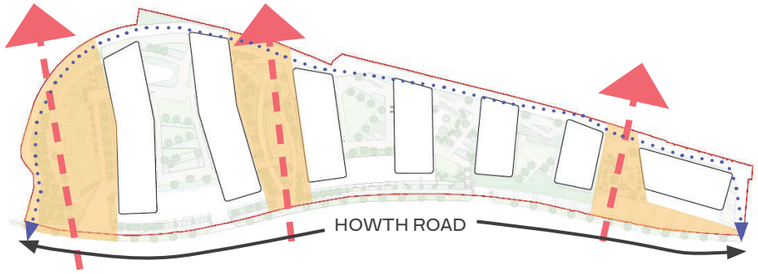
The seperation distances between blocks implemented throughout the proposed development, along with a considered approach to building height, materiality and orientation helps to reduce the scheme's overall perceived scale from both the public realm and within the developoment itself. In relation to Residential Building 01 (Dwelling 'Ashbury') to the eastern end of the site, the seperation distances mean that the proposed development will not feel to be on top of the dwelling house.

Along Howth Road, 4 storey blocks are expressed as a village terrace, and provide a new low scale built edge to the street on the approach to the town. Each block is set back between 7-9m from the road edge which allows for an appropriate scale to the public footpath and proposed grreen belt.

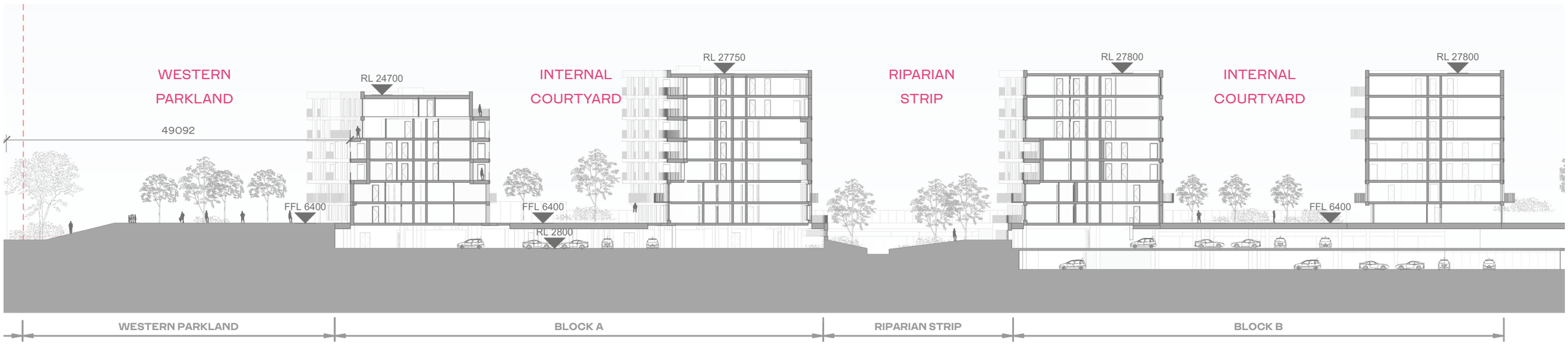
Upper levels are set back 5/ 6m along the Howth Road and a classical composition of base and entablature is evoked. This approach is intended to reduce scale and mass, breakdown the perception of monoliths, and create an appropriate village/ townscale along the street and the public park edges.

Public areas, including the civic plaza, riparian strip and western parkland all have wider seperation distances of approximately 30m to reduce the possible feeling of an overbearing character. All of these areas are also orientated north/south with open ends towards the Howth Road and the Irish Sea.

Visual and physical permeability is achieved in the layout of the blocks to break-up what is a sifgnificant stretch of street frontage as you enter Howth Village. The western parkland is placed adjacent to Baltray Park to allow for an appropriate change of scale as you begin the journey towards the village centre. As you meander down Howth Road you are met with large clearings in the development such as the Riparian Strip, a landscaped waterway which connects to the north walkway and the Civic Plaza, a new public node with commercial and retail units.



CGI - View Along Howth Road

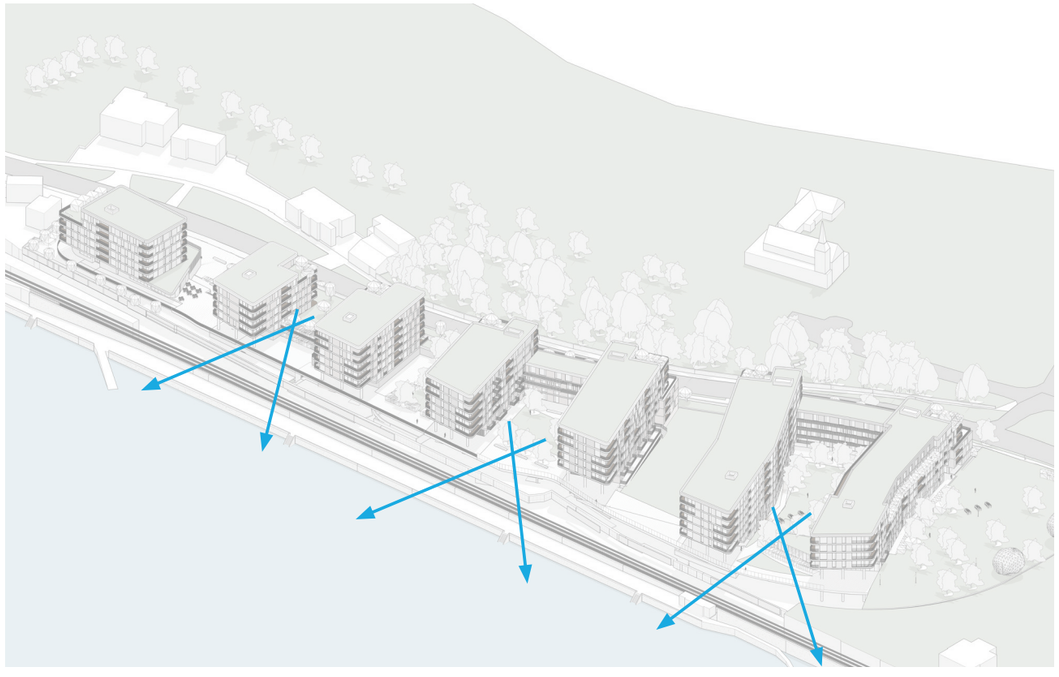


Site Section

03 OVERBEARING

South facing internal courtyards are raised to podium level which reduces the perceived height of the surrounding blocks and provides excellent views to the north towards Ireland's Eye. The raised podium also increases the amount of daylight and sunlight available to each space. Own door units and private gardens activate the internal courtyards, creating a vibrant and neighbourly character.

The finger block strategy used reduces the amount of shadows cast both on the existing Claremont beach promenade and the proposed public northern walkway. Double height spaces are created along the walkway to identify the various entrances to the residential blocks but also to discourage cavernous like spaces, opening up the areas to direct sunlight and pedestrian activity.



Views from Internal Courtyards

CGI - View from Internal Courtyard

04
DAYLIGHT SUNLIGHT ANALYSIS
JV Tierney Services Consultant

04 DAYLIGHT SUNLIGHT ANALYSIS
JV Tierney Services Consultant

The design process considered a number of different iterations in relation to daylight/ sunlight within the proposed development scheme. Preliminary analysis, carried out in line with “Site Layout Planning for Daylight and Sunlight” informed the design team of a baseline performance in relation to the daylight received within the apartments comprising the scheme. Early discussions with the design team concluded that with some minor changes, the amount of natural light penetration into the scheme could be maximized. Following on from these discussions, the following changes were investigated;

- Separation distances
- Overall height
- Scale
- Massing
- Window size
- Window angle
- Floor to ceiling heights
- Balcony layouts

An example of the early stage testing carried out included testing the optimum window angle/ balcony layout for maximum daylight penetration. Please see plan and 3D model below which highlight the two window angles/ balcony layouts tested;

The early stage testing concluded that the “developed design” maintained good Average Daylight Factors while optimizing the largest balcony area for living spaces.

Furthermore, in large scale developments it is common to see ground floor apartments receive lower amounts of daylight when compared to the upper levels. In order to combat this design constraint, the lower level apartments have included for the maximum amount of glazing that is feasible to ensure that the development still receives good levels of light penetration. Please see plan below of typical ground floor living space;

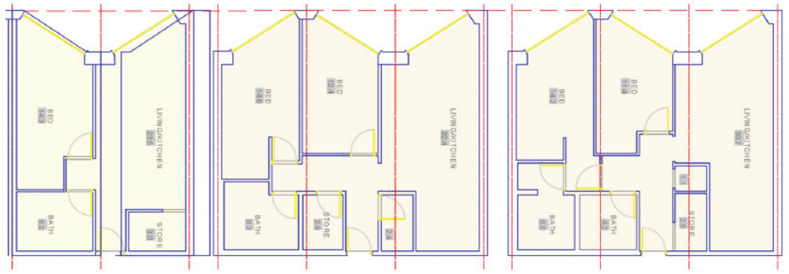
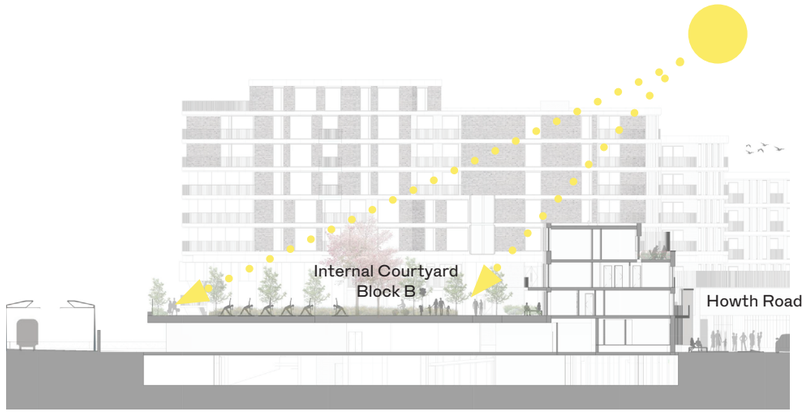


Figure 1 - Plans of Living Rooms and Bedrooms

*Note – Red dotted line indicates horizontal window position/ balcony layout used for testing.



Section through Internal Courtyard/ Howth Road

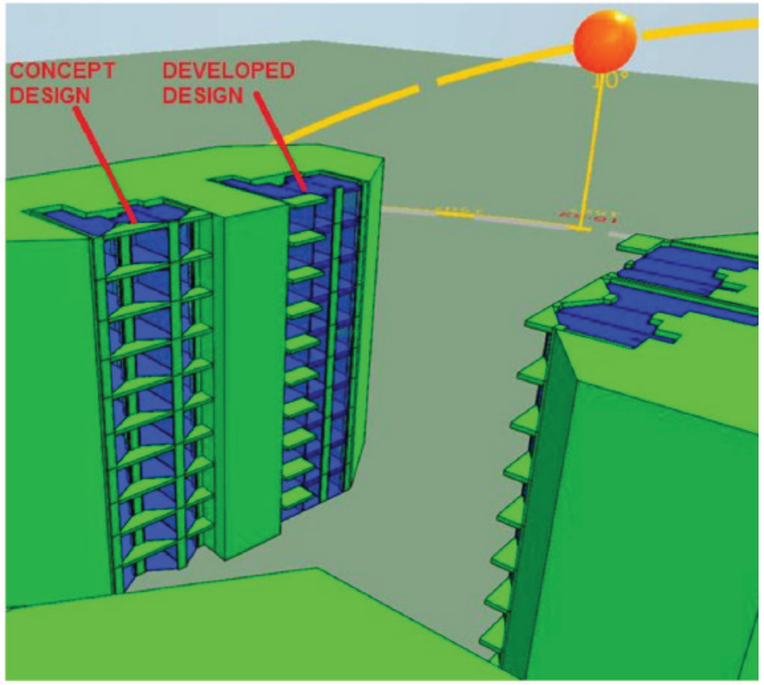


Figure 2 - 3D Model of Tested Rooms

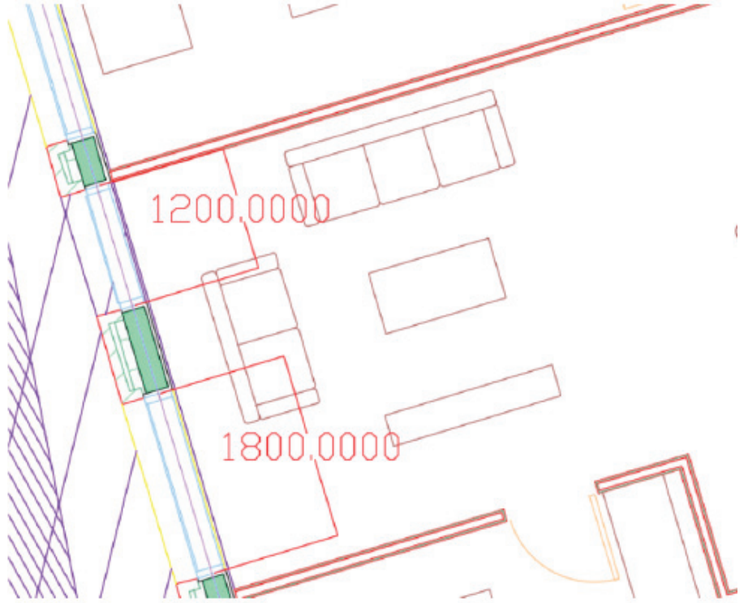


Figure 3 – Typical Ground Floor Apartment Plan

04 DAYLIGHT SUNLIGHT ANALYSIS
JV Tierney Services Consultant

Amenity area analysis was carried out in line with “Site Layout Planning for Daylight and Sunlight”, in which all spaces meet the relevant criteria. The sunlight enjoyed in these spaces is heavily influenced by the iterative approach taken by the design team. The scheme developed over time and encompassed the following design principles;

- Uninterrupted southerly facing light paths penetrate the scheme without any surrounding obstructions.
- Low south facing “U-Shaped” massing which allows all day sunlight penetration without compromising on other aspects of the scheme.
- Elimination of south facing massing in some areas which provides the maximum amount of sunlight availability.

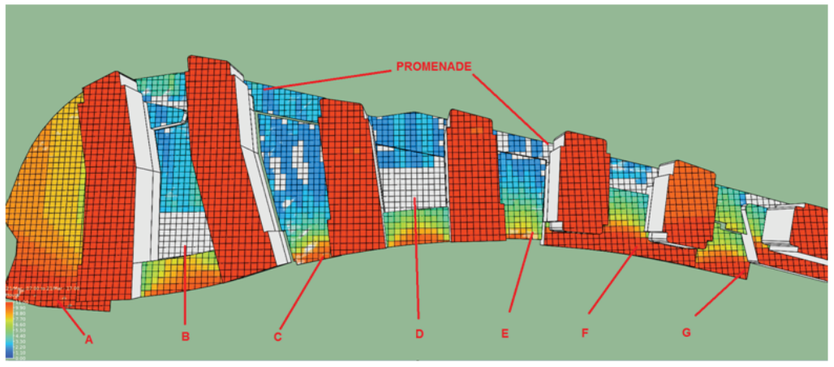


Figure 4 - Results for the 21st of March

General Information	Criteria				
Amenity Area	BRE Garden & Open Spaces Target [%]	Total Amenity Area [m2]	Total Amenity Area Receiving More Than 2 Hours [m2]	Percentage of Amenity Area Receiving 2 Hours [%]	Status
A	50	3736	3736	100.00	Meets Criteria
B	50	1541	991	64.31	Meets Criteria
C	50	1753	1459	83.23	Meets Criteria
D	50	1241	668.75	53.89	Meets Criteria
E	50	812	762	93.84	Meets Criteria
F	50	1032	1032	100.00	Meets Criteria
G	50	524	524	100.00	Meets Criteria
Promenade	50	3567	2206	61.84	Meets Criteria

Figure 5 - Garden and Open Spaces Results for the 21st of March

Figure 6 - Beach Area (FCC Development Plan)

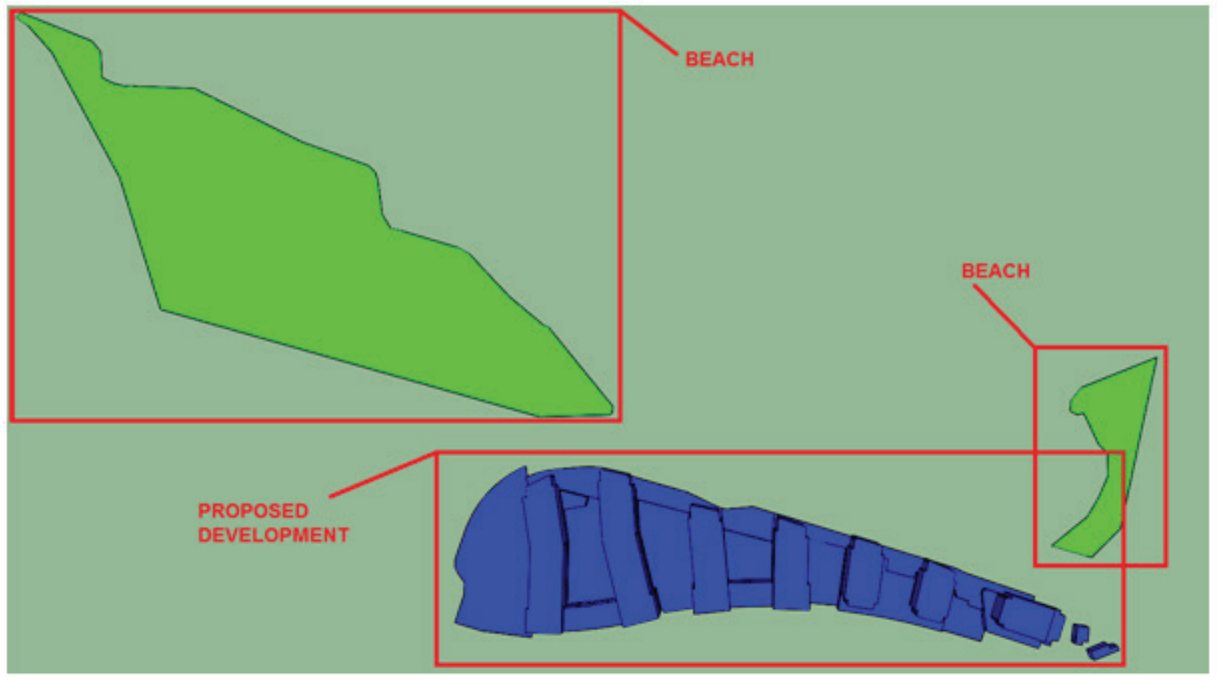


Figure 7 - Legend

05
OVERSHADOWING

JV Tierney Services Consultant

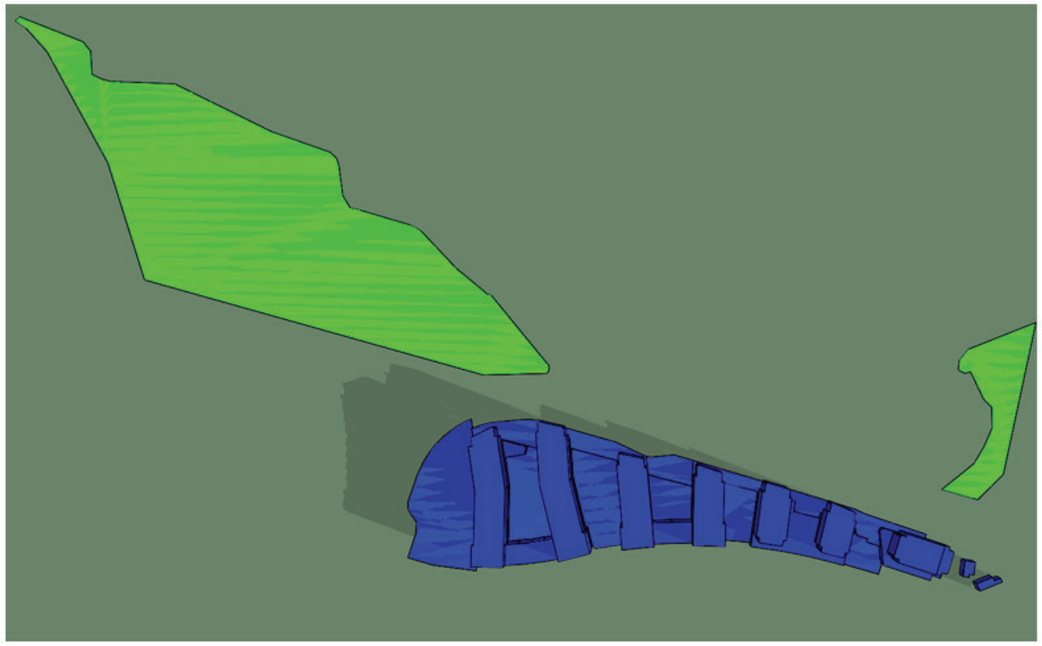


Figure 8 - March 21st 08.00 Am

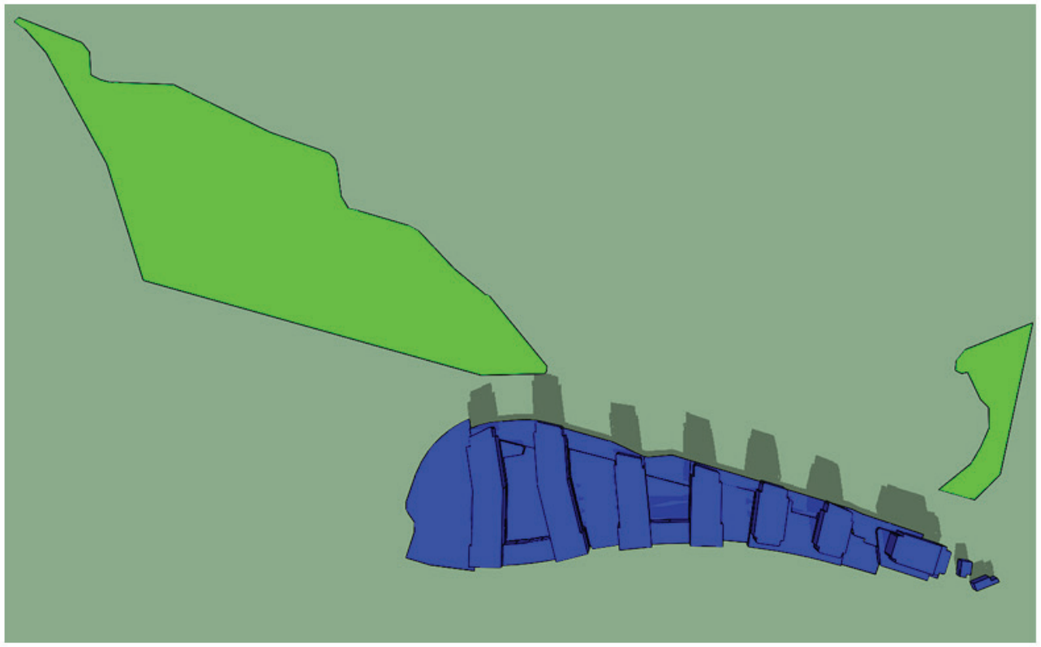


Figure 9 - March 21st 12.00 Noon

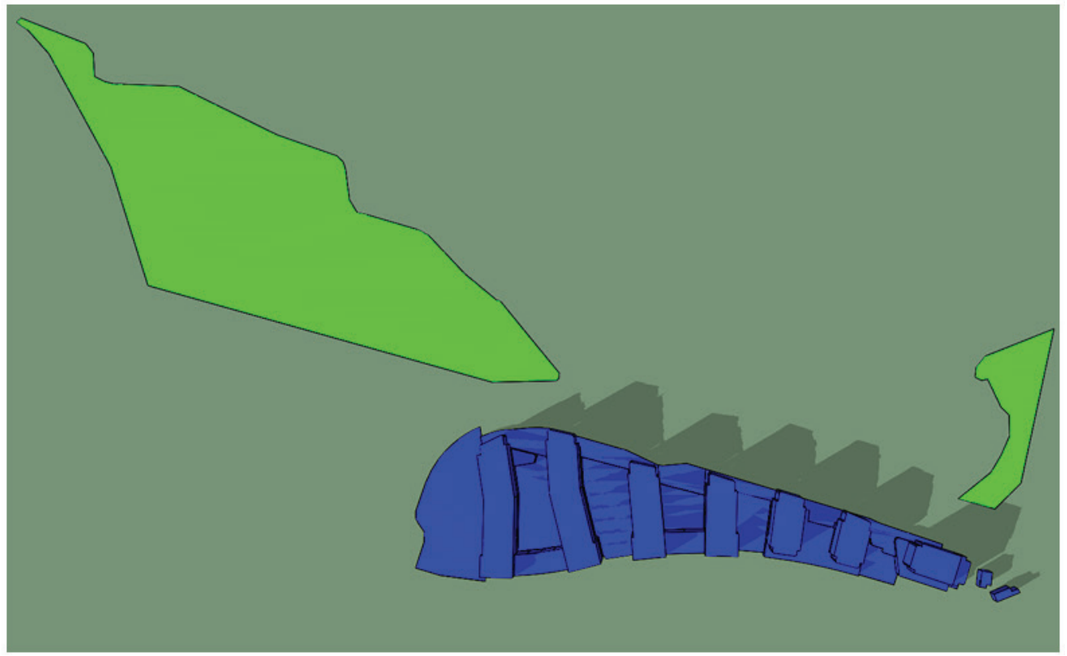


Figure 10 - March 21st 16.00

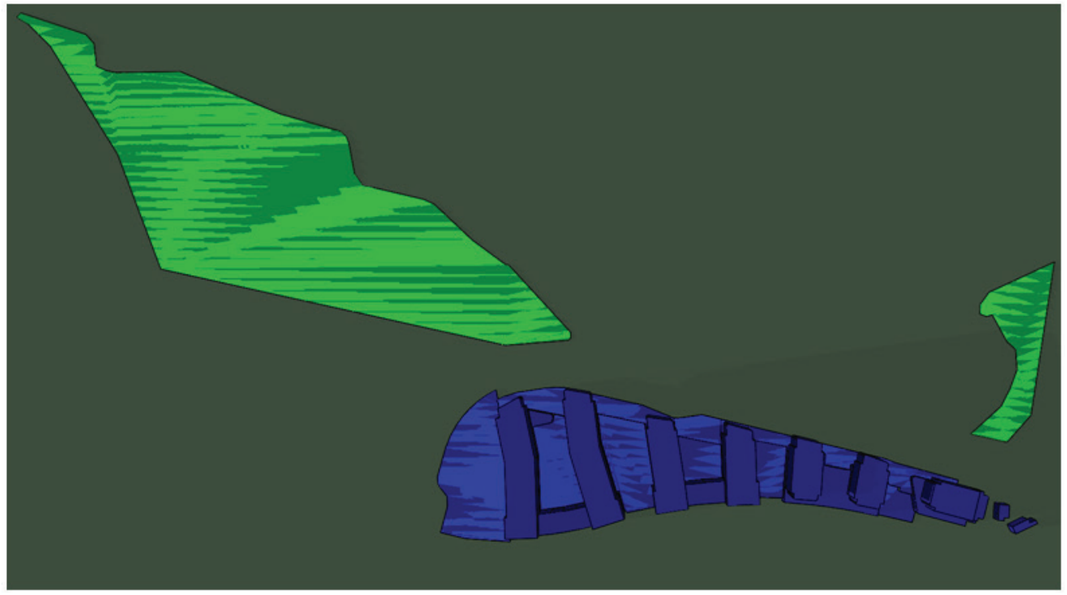


Figure 11 - March 21st 18.00

05 OVERSHADOWING
JV Tierney Services Consultant

The use of shadow cast plots are one of the most important aspects as they provide an instantaneous indication of how a development site performs in terms of overshadowing. 3D modelling was used to assess this aspect of overshadowing. Please see shadow cast plots below for the 21st of March (Equinox). The outline of the beach areas has been determined from the Fingal County Council Development Plan 2017 – 2023 and other sources such as Google/ Bing maps.

Surrounding houses have been tested in line with “Site Layout Planning for Daylight and Sunlight” and the analysis concluded that the houses to the east of the proposed development Project Claremont (A) will not be impacted by it. Houses towards the southerly end of the site (B) have also been analysed. No shadows will fall onto the southern side of the Howth Road, so as the residential amenity of these houses (B) are not affected by shadowing.

As an example, the window highlighted below, situated at “Surrounding Site A” achieves a VSC result of 28.58% which is in excess of the requirements as stipulated in “Site Layout Planning for Daylight and Sunlight”.

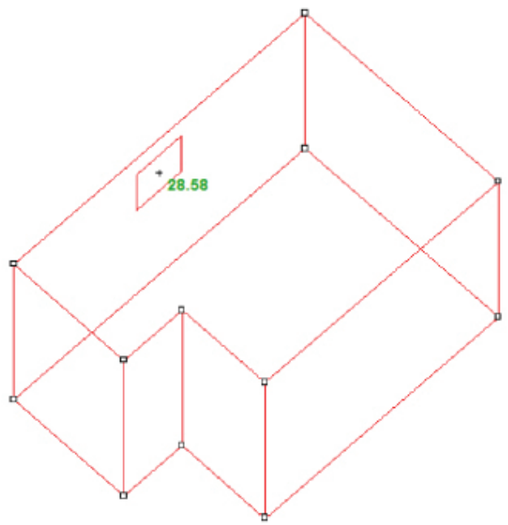


Figure 14 - Surrounding Site A Example Window VSC Result

Figure 12 - Surrounding Site Layout of Assessed Surrounding Houses

Figure 13 - Surrounding Site A Example Window

06
NOISE
AWN Consulting

Residential Amenity – Acoustics

Outward Impact to External Environment

Principal Receptors

The principal receptors external to the proposed development are those located along the eastern boundary ("Ashbury" residential property), dwelling houses and Marine Villas apartments buildings along the south-eastern boundary off the Howth Road.

Outward Impact of Proposed Development

The main potential source of outward noise from the proposed development will relate to mechanical and electrical services used to service the various retail and commercial areas, amenity spaces and leisure buildings and any potential noise breakout from the day to day operation of the non-residential elements of the proposed development as listed above. The relevant guidance documents used to assess potential operational noise and vibration impacts are summarised in Chapter 7 of the EIAR.

Mechanical and Electrical Services

The principal items of building and mechanical services plant will be associated with the retail, café, restaurants, units proposed as part of the overall development in Blocks C and D in addition to communal areas and creche in Blocks A and B. The specific requirements for mechanical and electrical plant items for each element of these units has not yet been progressed at this stage of the design. The layout plans for these development buildings, however, illustrates the location of plant areas within basement and lower ground floor plant rooms which are significantly screened from the nearest noise sensitive locations. Depending on the operational plant requirements, however, basement or other plant rooms will likely require ventilation to atmosphere via louvered areas and or ground or wall ventilation. These items have the potential to operate over day and night-time periods, depending on the operational phasing, there will be a requirement for operational items of plant to operate over specifics of the units.

The closest off-site noise sensitive locations to potential operational plant noise sources is the residential property to the east of Block D. The site layout and selection of plant will be designed so that there is no negative impact on noise sensitive locations within the development itself and at the closest noise sensitive locations external to the site. Operational plant noise levels at the residential dwellings within the development itself will be controlled to ensure the internal noise levels from BS8233 (2014) for residential dwellings are not exceeded. These are set as:

Daytime: 40dB L_{Aeq} within living rooms/ kitchen areas
35dB L_{Aeq} within bedrooms

Night-time 30dB L_{Aeq} within bedrooms

Noise levels associated with services plant at the existing noise sensitive locations outside the development boundary will therefore also be well controlled. Operational noise limits relating to fixed plant items at existing noise sensitive locations will be designed to ensure compliance with BS 4142 (2014) such that adverse impacts are avoided. The results of baseline surveys of the prevailing background sound level will be used to set appropriate operational limit values. Based on the survey results undertaken at Location N3 (Refer to Chapter 7 of the EIAR), cumulative noise levels associated with mechanical and electrical services at the nearest noise sensitive location will be controlled to not exceed a total noise level of 50dB $L_{Aeq,T}$ during daytime periods and 40dB $L_{Aeq,T}$ during night-time periods.

The use of low noise operational plant items, siting items of plant away from noise sensitive boundaries, screening and acoustic attenuation measures will all be considered, where relevant during the detailed design stage in order to ensure the limit values noted above are not exceeded.

Taking account of the site layout, location of plant areas below ground level and distance to nearest noise sensitive locations, the potential noise impact from these sources are expected to be well controlled and the adopted criteria readily achieved.

Internal Traffic Movements Within the Site

Once traffic enters the site it will access the site car parks and service areas for the residential and retail areas. The site has been designed such that the majority of car parking is located at basement levels. Vehicular traffic to the apartment buildings will access the site via the eastern site entrance between Blocks A2 and B1 and follow the internal road network at basement level. Traffic flows from these areas will therefore be substantially enclosed and hence screened from residential dwellings within the site and those external to the site such that resultant noise impacts will be negligible. There is a small element of car parking facilitated at ground floor level for apartment buildings. The nature of this activity is negligible to the external noise environment.

Vehicular traffic service the retail units for loading and unloading of goods will access the site adjacent to Block C and access the basement parking and service area for retail units. Service areas for the anchor retail and smaller retail units within the site will therefore be substantially enclosed and hence screened from residential dwellings within the site and those external to the site such that resultant noise impacts will be negligible.

Noise from general on-site activities

The residential tenant amenity spaces will be located within the apartment buildings at ground floor level which include concierge areas (Blocks A, B and C), a communal function room (Block A), lounge areas (Blocks A and B), gymnasium (Block A) and creche (Block B). The retail elements of the development are located within Blocks C and D.

There is no expected noise impact associated with these areas to noise sensitive locations outside the development boundary given these areas are internally located within the development buildings, the low noise sources associated with these spaces and screening provided by development buildings to off-site noise sensitive locations.

The key consideration relating noise impacts from amenity, commercial and creche areas relates to controlling airborne and structure borne noise transfer to residential apartments located above.

Building Regulations 2014: Part E

The sound insulation performance requirements as set out in *Part E* of the *Building Regulations 2014* are as follows:

Sound E1 Each wall and floor separating a dwelling from:

a) another dwelling or dwellings,
b) other parts of the same building, or

c) adjoining buildings,

shall be designed and constructed in such a way so as to provide reasonable resistance to sound.

Section 1 of *Technical Guidance Document E* provides sound performance levels required to meet the requirement of Regulation E1. Table x.1 below reproduces the performance levels specified.

Separating Construction	Airborne Sound Insulation $D_{nT,w}$ (dB)	Impact Sound Insulation $L'_{nT,w}$ (dB)
Walls	53 (min)	-
Floors (including stairs with a separating function)	53 (min)	58 (max)

Table x.1 Sound Performance Levels (*Building Regulations 2014 Technical Guidance Document E*)

The guidance also states that:

"A higher standard of sound insulation may be required between spaces used for normal domestic purposes and communal or non-domestic purposes. In these situations the appropriate level of sound insulation will depend on the noise generated in the communal or non-domestic space. Specialist advice may be needed to establish if a higher standard of sound insulation is required in order to achieve a reasonable resistance to sound."

It is this passage that is most relevant to the considerations for separating constructions between non-residential areas and dwellings above. Considering the adjacency of the function room areas, lounge areas, gym and retail areas to the residential areas above it is recommended that the airborne sound insulation value between these spaces is increased to accommodate the various uses that the communal spaces may entail that could result in higher than typical noise emissions.

Giving consideration to the aforementioned criteria and guidance, it is recommended that an airborne sound insulation performance of ≥65dB $D_{nT,w}$ is adopted between the gym, retail units, function rooms, creche and adjacent residential apartments. For areas of lower source noise emissions , i.e. lounge and concierge areas, an airborne sound insulation performance of ≥60dB $D_{nT,w}$ is recommended

The level of noise transfer between spaces within a building is not only determined by the sound insulation performance of the intervening structure but also the level of noise produced in the "source" room (e.g. the gym in this instance). The term "sound proofing" is an often used albeit somewhat misleading phrase, since the level of sound insulation specified between spaces is typically designed to adequately contain only the expected level of noise. If the level of noise increases above that assumed by the acoustic designer then the "sound proofing" performance is considered to be inadequate since more noise will be transferred than intended. It is therefore important to note that the sound insulation afforded by the structure must be matched to the level of noise that has to be contained.

In this respect it must be acknowledged that specification of suitable separating constructions alone may not be sufficient in controlling noise from common areas alone (e.g. from gym / function room areas), and that further noise control measures may be imposed where noise levels are expected to be elevated. This may be particularly important if amplified sound is required for example during gym classes.

During the detailed design stage of the development buildings, the constructions will be designed to achieve the minimum sound insulation values discussed above. This will likely necessitate the use of mass barrier ceilings within communal areas below the main separating slab.

Finally, it is also recommended that a suitable vibration isolated floor is installed in any gym area to avoid structureborne transfer to the apartments. The final specification of the floor will depend on the activity within the gym, with those activities that generate impacts on the floor the greatest risk, e.g. free weights.

Due to the complexities of vibration transfer within a building, it is largely not possible to predict the level of building response to vibration excitation without conducting specific site testing. Buildings of a similar construction can respond significantly differently depending on small changes in the structural make up. Notwithstanding the above, the choice of floor system must be capable of providing an adequate level of isolation at frequencies below 50Hz. For the building in question, allowance should be made for a floor build-up of minimum thickness/ height of 30mm.

The most common forms of vibration isolation used for gym floors within sensitive buildings tend to comprise one or a combination of an Acoustic Floating Floor, or, a resilient mat build up Floor.

Inward Impact of External Sources to Development Buildings

Noise sensitive areas associated with the proposed development include the residential buildings across all blocks at varying floor levels up to seven storeys.

The results of the baseline survey have determined the noise climate across the site is governed by road traffic along the southern boundary from the R105 Howth Road and passing DART fleet along the rail line which runs along the northern site boundary. Moving towards the central part of the site, noise levels associated with these sources is reduced as the distance from road traffic and rail traffic increases.

The railway line which runs to the north of the development currently operates daily DART trains commencing from approximately 05:30 until approximately 00:30hrs. Reference to noise levels measured at Location N4 surveyed adjacent to the railway line over day and night-time periods indicates that the operation of the line contributes elevated noise levels along its immediate boundary during individual pass by's. During lulls in passing rail, specifically between 00:30 and 05:30hrs, noise levels are reduced to background noise levels.

Along the southern site boundary, road traffic noise levels at the location of the development buildings are governed by passing road traffic along the R105 Howth Road.

Making reference to the measured baseline noise monitoring data and traffic flow data along the DART line to the north and R105 Howth Road to the south, noise levels across the site have been modelled and calibrated against the baseline survey data. This confirms that daytime noise levels are in the range of 65 to 70dB $L_{Aeq,16hr}$ across the south and northern site boundaries respectively reducing to between 55 to 60dB L_{Aeq} towards the central part of the site set back from both sources. During night-time periods, noise levels across the north and southern site boundaries are in the range of 55 to 60dB $L_{Aeq,8hr}$ reducing to between ≤45 to 50dB $L_{Aeq,8hr}$ within the central parts of the site.

Figure x.1 presents calculated cumulative road and rail noise levels across the development site during the daytime period (07:00 to 23:00hrs) calculated to a height of 4m above ground level.

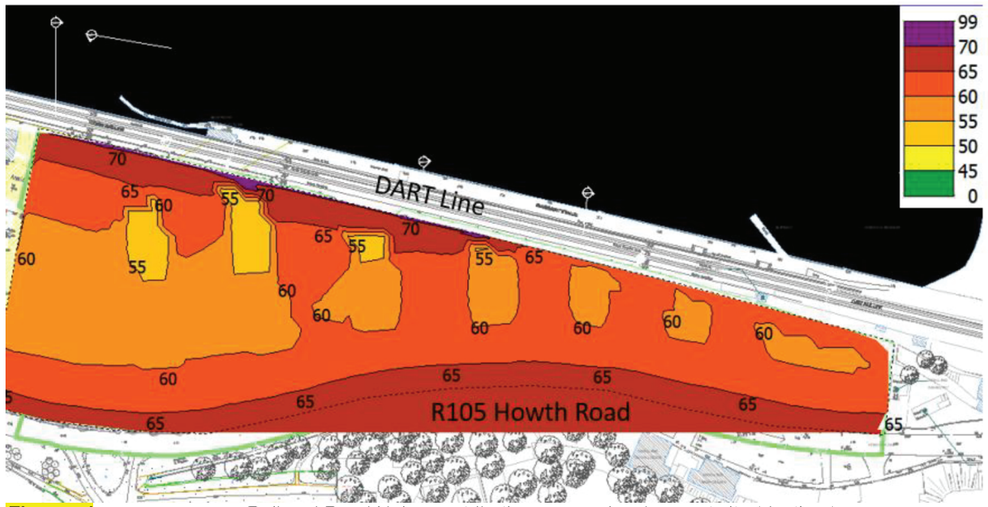


Figure x1 Rail and Road Noise contribution across development site (daytime)

Figure x.2 presents calculated cumulative road and rail noise levels across the development site during the night-time period (23:00 to 07:00hrs) calculated to a height of 4m above ground level.

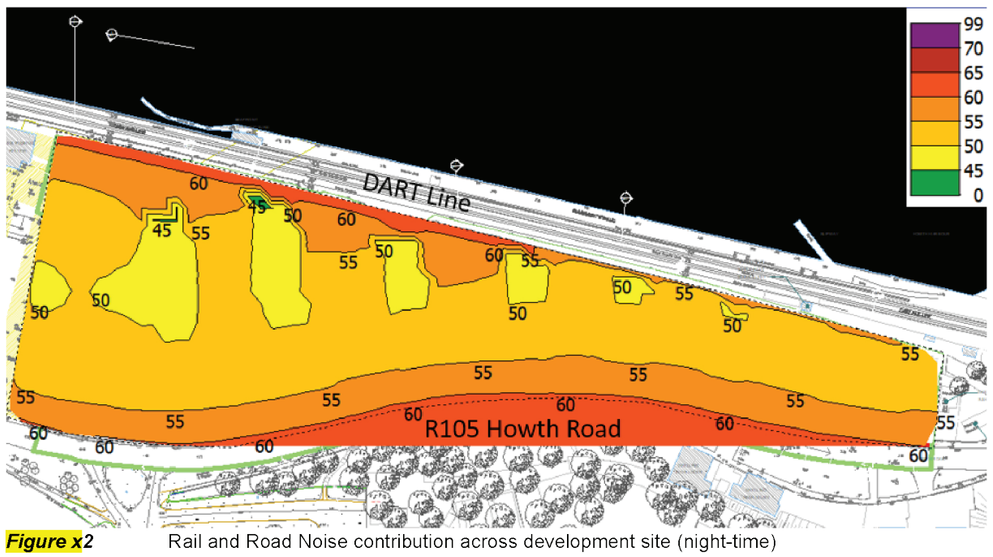


Figure x2 Rail and Road Noise contribution across development site (night-time)

Façade Noise Levels

The façade of the residential buildings within the development site will be designed to achieve internal noise levels included in BS 8233:2014 *Guidance on Sound Insulation and Noise Reduction for Buildings*. The recommended internal noise levels within dwellings from this standard are summarised in Table x.2.

Activity	Location	(07:00 to 23:00hrs)	(23:00 to 07:00hrs)
Resting	Living room	35 dB $L_{Aeq,16hr}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$ 45 dB $L_{Amax,T}$*

Table x 2 Internal Noise Levels Design Criteria (BS8233: 2014)

Noise levels have been calculated across the development site during day and night-time periods using the calibrated noise model to include the proposed development buildings.

With the inclusion of the proposed development buildings on site, noise levels have been calculated at the apartment facades to determine the range of noise levels incident on the apartment buildings. This information has been used to determine the level of sound insulation required in order to achieve the internal noise levels from BS 8233 referred to above.

Figures x.3 and x.4 displays the calculated noise levels across the site for day and night-time periods respectively with the proposed development buildings in place.

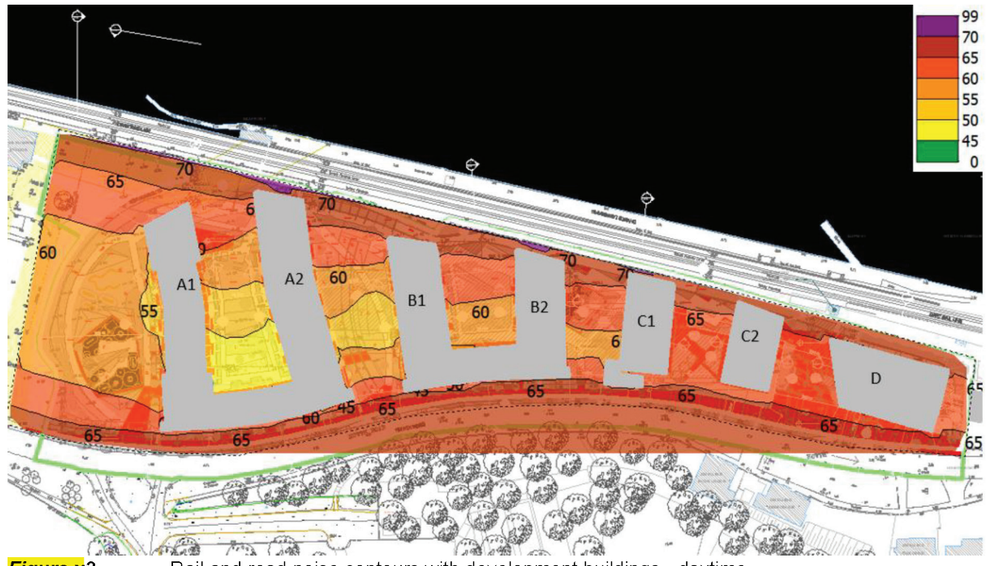


Figure x3 Rail and road noise contours with development buildings - daytime

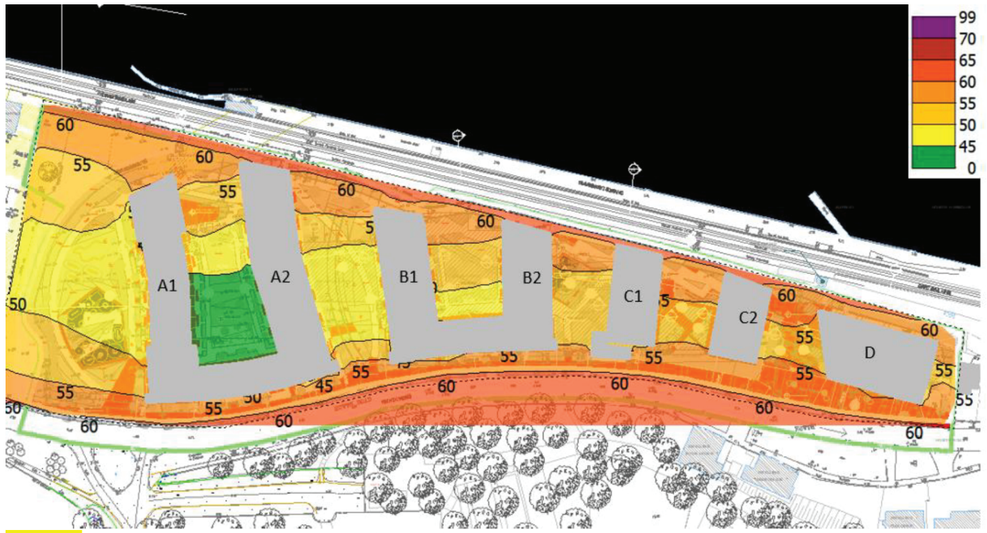


Figure x4 Rail and road noise contours with development buildings - night-time

The calculated noise contours across the development buildings during night-time periods is presented in Figure x.5 to illustrate the varying noise levels across different facades and heights.

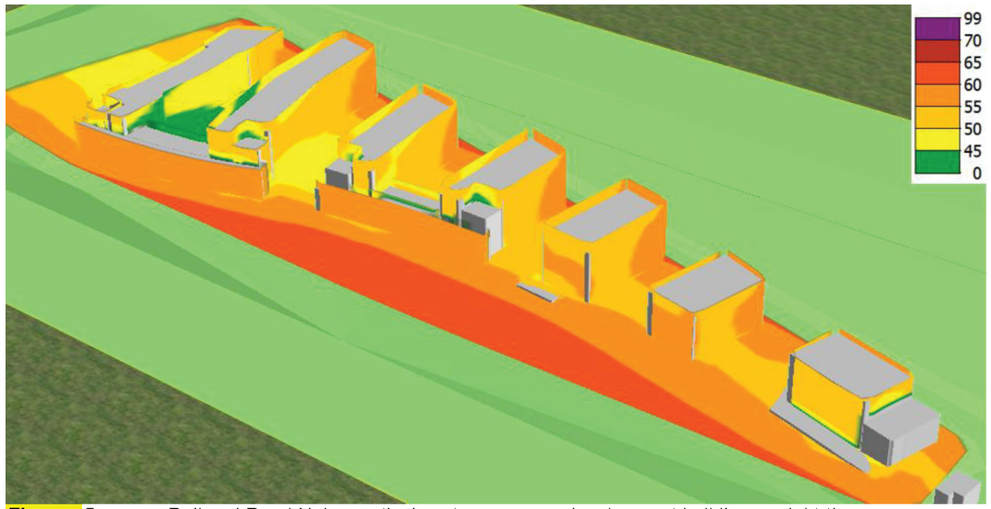


Figure x5 Rail and Road Noise vertical contours across development buildings - night-time

As is the case in most buildings, the glazed elements and ventilation paths of the building envelope are typically the weakest element from a sound insulation perspective. In general, all wall constructions (i.e. block work or concrete and spandrel elements) offer a high degree of sound insulation, much greater than that offered by the glazing systems. Therefore, noise intrusion via the wall construction will be minimal.

Where façade noise levels are less than 55dB $L_{Aeq,16hr}$ during the day and 50dB $L_{Aeq,8hr}$ at night it is possible to achieve reasonable internal noise levels while also ventilating the dwellings with open windows.

Where façade levels are above these levels, the sound insulation performance of the building façade becomes important and a minimum sound insulation performance specification is required for windows to ensure the internal noise criteria are achieved. For these buildings, the recommended internal noise levels are achieved only with windows closed.

Based on the results of the assessment the following is concluded:

- Residential facades overlooking the southern courtyard between Blocks A1 and A2 and the mid-western facades of Block A1 will experience lowest façade noise levels. Calculated noise levels at these facades are equal to or below 55dB $L_{Aeq,16hr}$ during the day and 50dB $L_{Aeq,8hr}$ at night. In this instance, a standard double-glazed window system providing a sound insulation of ≥30dB R_w will provide sufficient sound insulation to achieve acceptable internal day and night-time noise levels within the apartment spaces with windows open and closed.

- Residential facades facing towards the rail line along the northern site boundary experience highest day and night-time noise levels and hence require the highest level of sound insulation performance to the facades. A glazing system providing a sound insulation of ≥36dB R_w is required for these facades.

- For the remainder of the site, the calculated noise levels along the south, east and western apartment facades will experience a high to moderate noise level over day and night-time periods and also require a level of enhanced sound insulation to the façade. A glazing system providing a sound insulation of ≥34dB R_w is required for these facades.

The glazing types are shown in Figure X.6 for the residential elements of the development buildings.

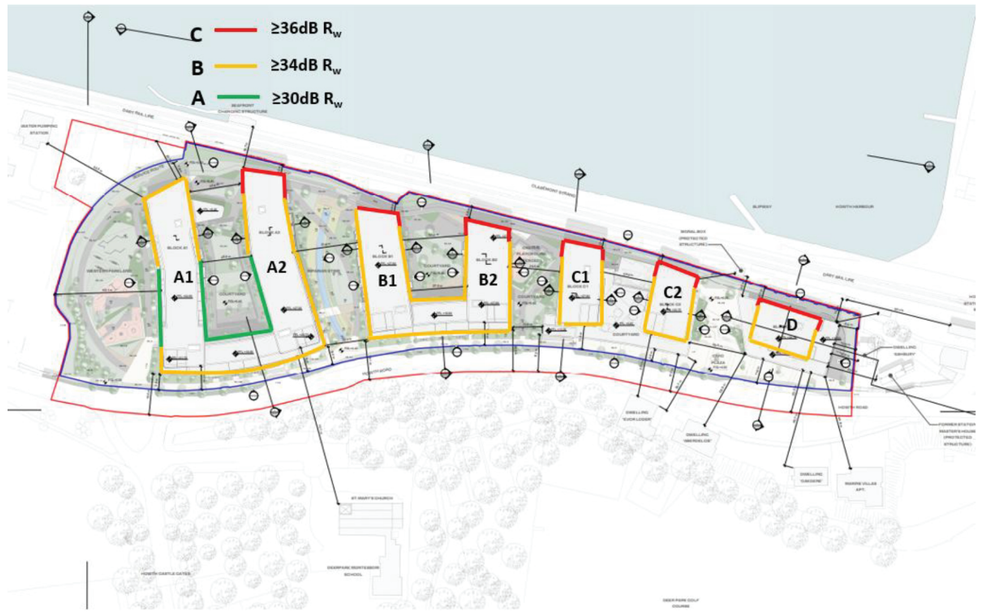


Figure x.6 Sound Insulation for glazing types across development buildings

The overall R_w outlined above are provided for information purposes only. The over-riding requirement is the octave band sound insulation performance values. The minimum octave band sound insulation performance for each glazing type is set out in Table x.3. Any selected system will be required to provide a sound insulation performance equal to or greater to those set out in Table x.3.

Glazing Specification	Octave Band Centre Frequency (Hz)						R_w
	125	250	500	1k	2k	4k	
A	20	22	28	33	34	28	30
B	21	25	31	34	34	36	34
C	30	32	38	36	40	49	36

Table x.3 Sound Insulation Performance Requirements for Glazing, SRI (dB)

It is important to note that the acoustic performance specifications detailed herein are minimum requirements which apply to the overall glazing system. In the context of the acoustic performance specification the 'glazing system' is understood to include any and all of the component parts that form part of the glazing element of the façade, i.e. glass, frames, seals, openable elements etc.

With these measures in place the internal noise levels within those proposed buildings most exposed to environmental noise from the road and rail network will achieve the criteria outlined in Table x.2 when the windows are closed. For apartments with glazing Type A, the internal noise levels in Table x.2 can be achieved with windows both open and closed.

Henry J Lyons