

**SOCIAL HOUSING BUNDLE 4 & 5, DEVELOPMENT AT
BALLYMUN**

FOUNDATION REPORT

DUBLIN CITY COUNCIL
October 2024

Contents Amendment Record

2B Richview Office Park, Clonskeagh, Dublin 14
Tel: +353-1-260 2655 Fax: +353-1-260 2660 E-mail: info@MORce.ie



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Prepared By: Kordian Ignatiuk

Signed: P.P. S.F.

Prepared By: Sergio Freitas

Signed: S.F.

Checked By: Douglas Weir

Signed: D. Weir

Approved By: Douglas Weir

Signed: D. Weir

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CONTENTS

		Page No.
1	INTRODUCTION.....	1
1.1	Introduction	1
1.2	T.I.I	3
1.3	Programme	3
1.4	Structural Analysis	3
2	GEOTECHNICAL INVESTIGATION.....	4
2.1	Specialist Investigations	4
2.2	Investigation Map	4
2.3	Results	5
2.4	Analysis	5
2.5	Foundation Proposal	5
3	FOUNDATION LOADS.....	6
3.1	Site & Loading Assumptions	6
3.2	Site Summary	7
3.2.1	Site 5	7
3.2.2	Raft Foundations.....	7
3.2.3	Site 15	8
3.2.4	Site 16	9
3.2.5	Site 17	10
3.2.6	Raft Foundations.....	10
3.2.7	Site 18	11
4	DESIGN CRITERIA.....	12
4.1	Loadings	12
4.2	Raft Foundation Design	12
5	SUMMARY	13
6	APPENDIX A – FOUNDATION PLANS.....	14

1 INTRODUCTION

1.1 Introduction

This report is prepared on behalf of the National Development Finance (NDFa) in consultation with Dublin City Council for the construction of 288 apartment/duplex and housing units at a site of c. 2.6 ha (c. 2.2 ha net) bound by Balbutcher Lane to the north, Balcurris Park to the west, the Ballymun Road to the east, and Balcurris Gardens to the south-west, Ballymun, Dublin 11.

The meeting held on the 14 May 2024 between NDFa, TII and MOR representatives, all those present were informed by T.I. I's exclusion zone guidelines for tunnel works. This in turn had an impact on MOR's preliminary design of deep foundation's i.e. Piles. This led to MOR having to investigate other foundation solutions.

The proposed development will consist of the following:

- Construction of 288 no. apartment/duplex and housing units across 5 sites (Sites 5, 15, 16, 17 and 18) ranging from 2 to 6 storeys containing 138 no one-bed, 87 no. 2-bed units, 61 no. 3-bed and 2 no. 4-bed dwellings.
 - Site 5 consists of 132 no. apartment units (66 no. 1 bed, 44 no. 2 bed units and 22 no. 3 bed units) and ranges from 4 to 5 storeys including a new urban edge along Ballymun Road;
 - Site 15 consists of 8 no. dwellings comprising 6 no. 1 bed own-door apartments and 2 no. 3 bed houses adjoining Balcurris Gardens
 - Site 16 consists of 5 no. dwellings comprising 2 no. 1 bed own-door apartments, 1 no. 3 bed house and 2 no. 4 bed houses adjoining Balcurris Gardens
 - Site 17 consists of 34 no. apartment units (17 no. 1 bed units, 9 no. 2 bed units and 8 no. 3 bed units) and ranges from 3 to 6 storeys forming an urban block with incomplete urban cell at the Linnbhla and Charter apartments;
 - Site 18 consists of 109 no. apartments (47 no. 1 bed units, 34 no. 2 bed units and 28 no. 3 bed units) and ranges from 4 to 5 storeys with edges to Balcurris Road, Balcurris Park and a new edge to Balbutcher Lane;
- 70 no. car parking spaces, 4 no. loading bays and 4 no. motorbike parking spaces
- 551 no. long stay and 180 no. short stay bicycle parking spaces to serve the housing units.
- Provision of 1611 m² Retail/Commercial floor space at ground level facing Ballymun Road/St. Pappins Square (sites 5 and 17)
- Provision of a 324 m² childcare facility at ground floor in Site 5.
- Provision of 1,058 m² of community, cultural and arts space located at ground floor level in sites 5 and 17.
- Provision of 91 no bicycle spaces to serve the non-residential uses distributed across the site.
- The provision of a public open space in a new plaza at St Pappin's Square (1,953 m²) and additional areas of 979m², 496m² and 839 m² with 2,969 m² of communal open space

- Realignment of Balcurris Road, provision of two new vehicular accesses (one off the Balbutcher Lane and one off the Ballymun Road) and a dedicated pedestrian and cycle lane off the Balbutcher Lane
- Boundary treatments, public lighting, site drainage works, internal road surfacing and footpaths, ESB meter rooms, ESB substations, stores, bin and cycle storage, plant rooms, landscaping; and
- All ancillary site services and development works above and below ground.



Figure 1-1 – Proposed Site Layout



Figure 1-2 - Site Plan outlining Sites 5, 15&16, 17, 18

1.2 T.I.I

TII have provided details, of the proposed 9.2m(outside) diameter, of their proposed metro tunnel which would, when constructed, run underneath the proposed Ballymun development. The metro will run at an approximate depth below ground level of 16.5m. TII set out their requirements for their tunnel as below:

- Route – as per their drawing forwarded to MOR
- Depth – 16.5m, approximately, from ground level to crown of the tunnel
- Diameter – 9.2m to the outside of the tunnel walls
- Diameter – 9.5m to the outside of the tunnel excavated by the tunnel boring machine
- Horizontal exclusion zone – 21.0m (6.0m+15.0m) from the centre of the tunnel
- Horizontal exclusion zone – 7.0m (1.0m+6.0m) Vertically form the Crown of the tunnel
- Acceptable additional loading – 75kN/m² immediately above the crown of the tunnel

1.3 Programme

The NDFA expect to obtain planning permission by Q1 2025, to commence construction in Q1 2026 and to complete construction in Q3/Q4 2027.

T.I.I. expect approval in July/August 2024, to obtain railway order in Q1 2025 and commence tunnelling in Ballymun area Q1 2028. Hence current expectations are that the residential development on the Ballymun site will be completed before tunnelling operations commence.

T.I.I. seek comfort that the foundation system (i.e. piles, rafts, floor beams, etc.) and associated transfer loads onto the tunnel do not exceed the T.I.I. design criteria. T.I.I. also advise that the horizontal alignment of the proposed tunnel must be flexible due to potential unforeseen circumstances. The width of such flexibility is not stated but is understood to be small.

1.4 Structural Analysis

This report will inform T.I.I. of the design criteria and the structural analysis used to calculate the additional loading that will be transferred to the crown of the tunnel immediately above the crown of the tunnel. It confirms that the limit set by the TII of 75kN/m² will not be exceeded.

The NDFA propose to apply for planning permission from An Bord Pleanala under the part B planning process. Upon receipt of the planning permission, NDFA will seek tenders for the construction and managed operation of the proposed development for a minimum period of 25 years from approved PPPCo contractors. It is the clear policy of NDFA that these tenders must conform to agreement now sought from TII based on this report. Accordingly, it is hoped that TII will have no fundamental objections to our proposals to the current proposed residential development proceeding to part 8, planning process.

2 GEOTECHNICAL INVESTIGATION

2.1 Specialist Investigations

On instruction of Malone O'Regan Consultant Engineers, a site investigation was carried out by Ground Investigations Ireland Ltd.

The investigation included:

- 12 No. trial pits
- 5 No. Soakaway
- 22 No. Cable Percussion boreholes
- 5 No. Rotary core Boreholes
- 14 No. Slit Trenches
- 3 No. Groundwater monitoring wells
- Geotechnical and Environmental laboratory testing

The specialists suggest that piled foundations may be more economical due to the high loading anticipated.

Laboratory tests indicate that no special precautions against sulphate attack are required across the site with exception of BH04 which may require protection.

2.2 Investigation Map

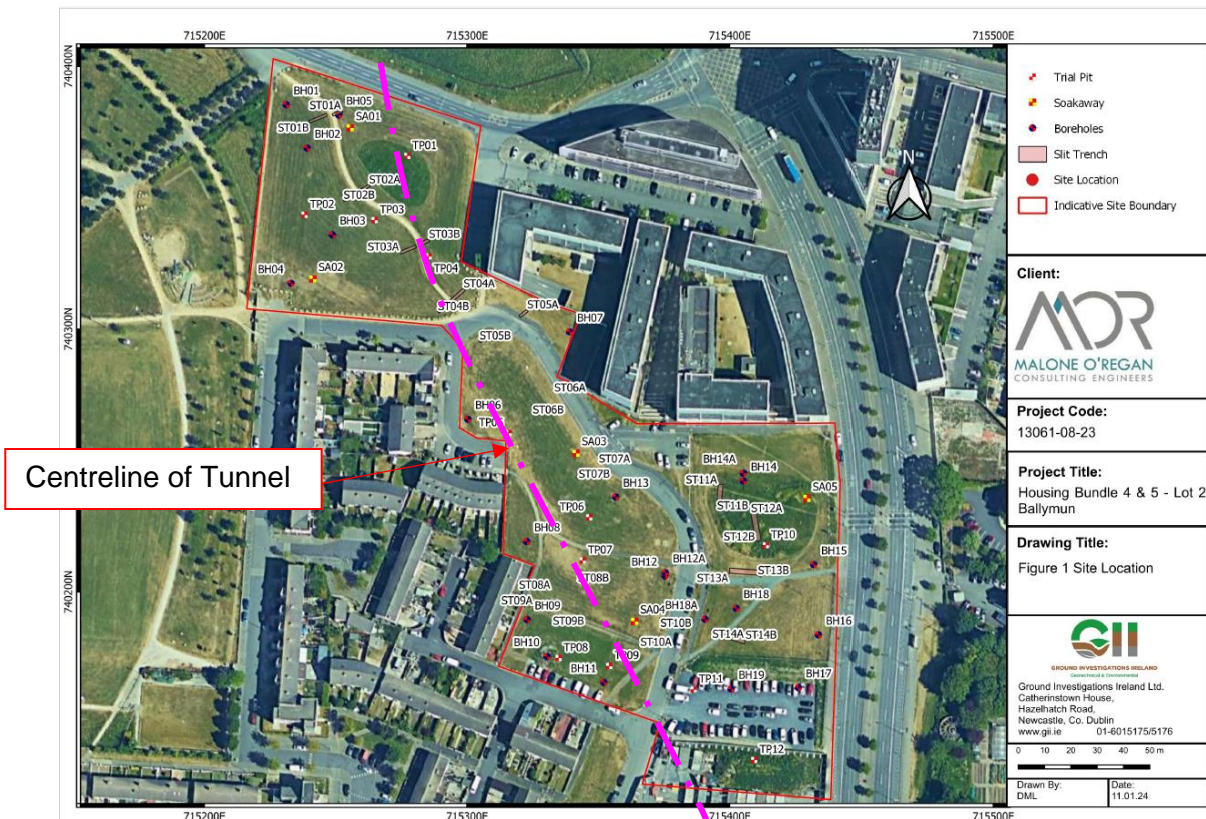


Figure 2-1 - Site Investigation Layout

Figure 2.2 Shows the locations of all the field tests conducted by Ground Investigations Ireland in relation the centre line of the proposed TII tunnel.

2.3 Results

The results of the borehole tests are tabulated in table 2.3 below.

Borehole	Allowable Bearing Capacities (ABC) kN/m ²						Comment
	ABC	Depth	Comment	Borehole	ABC	Depth	
No.	kN/m ²	m BGL		No.	kN/m ²	m BGL	
BH01	125	1.5	Cohesive	BH01	250	3.0	Cohesive
BH02	125	1.5	Cohesive	BH02	250	2.5	Cohesive
BH03	N/A	-	Made Ground	BH03	250	4.1	Cohesive
BH04	125	1.8	Cohesive	BH04	250	3.0	Cohesive
BH05	125	1.5	Cohesive	BH05	250	3.0	Cohesive
BH06	125	2.0	Cohesive	BH06	250	3.0	Cohesive
BH07	125	1.5	Cohesive	BH07	250	3.0	Cohesive
BH08	125	2.0	Cohesive	BH08	250	3.0	Cohesive
BH09	125	2.5	Cohesive	BH09	250	3.0	Cohesive
BH10	125	2.5	Cohesive	BH10	250	3.0	Cohesive
BH11	125	2.5	Cohesive	BH11	250	3.0	Cohesive
BH12A	125	2.5	Cohesive	BH12	250	3.0	Cohesive
BH13	125	1.9	Cohesive	BH13	250	3.0	Cohesive
BH14	125	1.8	Cohesive	BH13	250	3.0	Cohesive
BH15	125	2.0	Cohesive	BH14	250	3.0	Cohesive
BH16	125	1.5	Cohesive	BH15	250	3.0	Cohesive
BH17	125	2.0	Cohesive	BH17	250	3.0	Cohesive
BH18	125	1.5	Cohesive	BH18	250	3.0	Cohesive
BH19	125	1.5	Cohesive	BH19	250	3.0	Cohesive

Table 2-1: GII Borehole summary table extracted from SI report

2.4 Analysis

The results of the borehole tests conducted indicate that soil of allowable bearing capacity of 125kN/m² can be found across the site between 1.5m to 2.5m below ground level. Initially this did lead to a pile design recommendation by the geotechnical specialist but not limited to. 125kN soil would normally lead to pile foundations however, given the 75kN/m² surcharger connected, a raft slab solution is now adopted.

2.5 Foundation Proposal

Initially pile design was considered but due to the proposal of a new metro tunnel to traverse under the proposed Ballymun sites an alternative foundation arrangement was sought. MOR

have at a high level investigated the use of a raft foundation as it distributes loads evenly into the soil and allows for the full depth of the soil strata to be considered. Strip/pad solution is considered for 1 to 3 story buildings, raft solution is considered for taller buildings to accommodate the stated requirements of the T.I.I.

3 FOUNDATION LOADS

3.1 Site & Loading Assumptions

The proposed site plan is outlined in Figure 3-1 below. The foundation locations are mapped out and numbered on enlarged site plans for the individual sites. This information is attached in Appendix A.



Figure 3-1 – Overall Site Plan

Loadings were taken for the foundations based on assumptions about the composition of the buildings. The number of stories also varied which was included in the calculations.

The ground floor slab is to be a raft foundation. The upper-level apartment floors were assumed to be 300mm conventionally reinforced concrete slabs. The walls are assumed to be precast concrete structural walls 215mm thick with an external brick leaf.

The roof was assumed to be Blue/Green roof with a 300mm thick hollow core slab, 100mm screed for falls, 100mm of attenuation cell and 200mm of planting.

No buildings are proposed to have basements.

3.2 Site Summary

3.2.1 Site 5

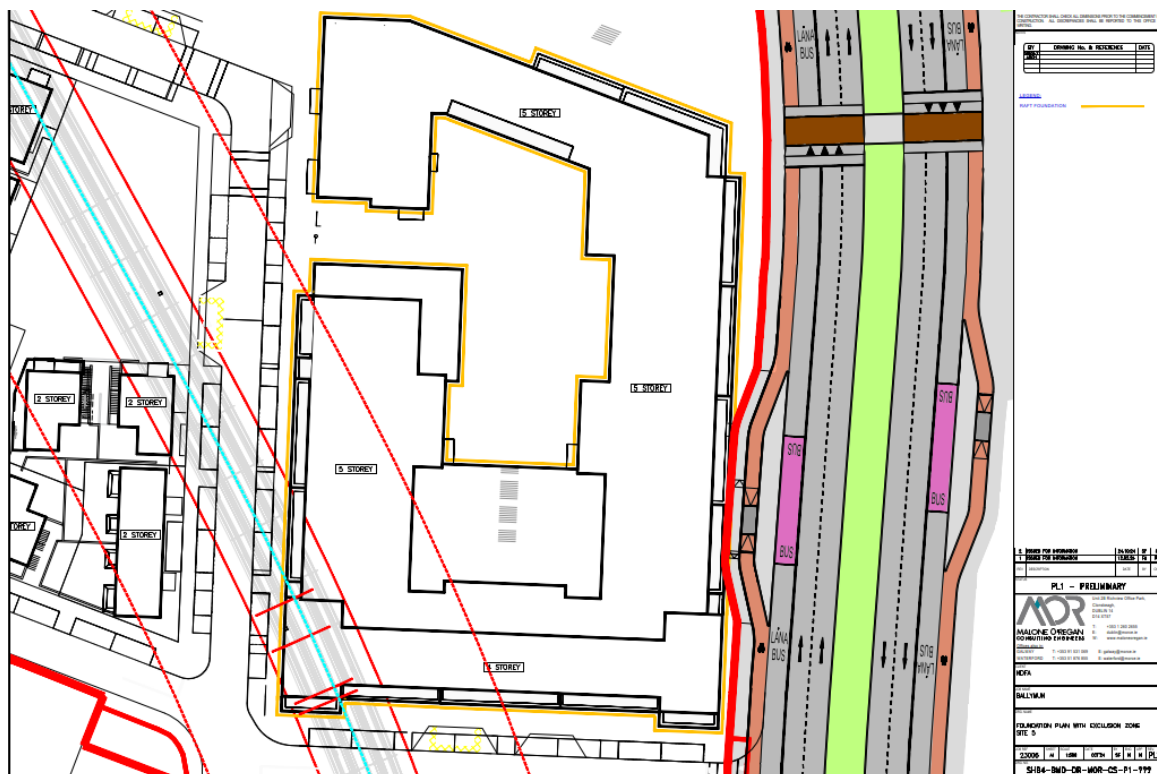


Figure 3-2 – Foundation Plan with Exclusion Zone Site 5

Site 5 consists of 132 no. apartment units (66 no. 1 bed, 44 no. 2 bed units and 22 no. 3 bed units) and ranges from 4 to 5 storeys including a new urban edge along Ballymun Road. The ground floor level is non-residential, plant, storage and commercial with dwellings located over.

3.2.2 Raft Foundations

Approximately a quarter of the building footprints on site 5 are located within the exclusion zone for the proposed metro tunnel route. The allowable bearing capacity of the soil in the top strata, as per Table 1 above, is 125kN/m². Based on the structural analysis of the proposed raft foundations, the applied bearing pressure to the underside of the proposed raft foundation is 34 kN/m².

3.2.3 Site 15



Figure 3-3 – Foundation Plan with Exclusion Zone Site 15

Site 15 consists of 8 no. dwellings comprising 6 no. 1 bed own-door apartments and 2 no. 3 bed houses adjoining Balcurris Gardens.

The site is located within the exclusion zone for the tunnel and part of the development is bearing directly over the tunnel itself. The loads are for standard housing construction and strip foundations would approximate to circa 100kN/m^2 max. The ground bearing slabs would approximate to circa 15kN/m^2 max.

3.2.5 Site 17

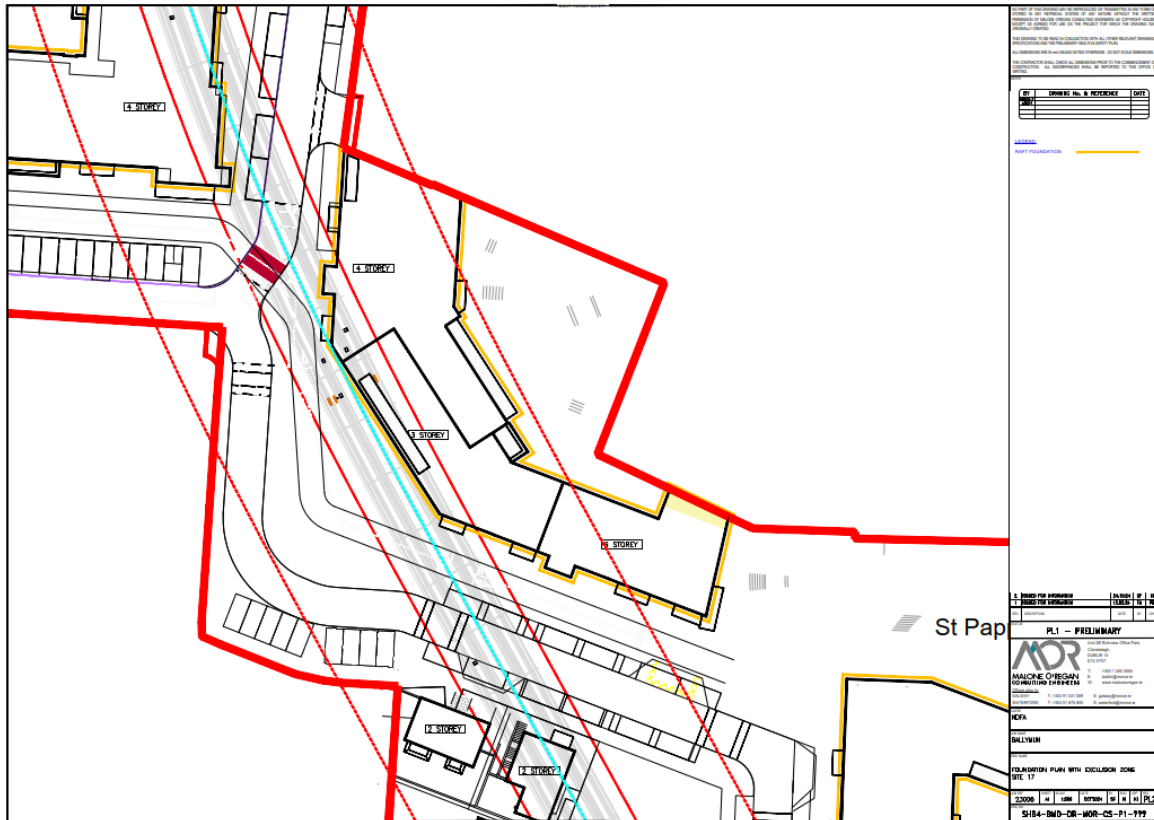


Figure 3-5 – Foundation Plan with Exclusion Zone Site 17

Site 17 consists of 34 no. apartment units (17 no. 1 bed units, 9 no. 2 bed units and 8 no. 3 bed units) and ranges from 3 to 6 storeys forming an urban block with incomplete urban cell at the Linnbhla and Charter apartments.

3.2.6 Raft Foundations

Majority of the 6-storey building is located within the proposed metro tunnel exclusion zone. Based on the assumed construction methodology and materials the raft foundation analysis yields a bearing pressure of 44 kN/m^2 to the underside of the proposed raft foundation.

3.2.7 Site 18

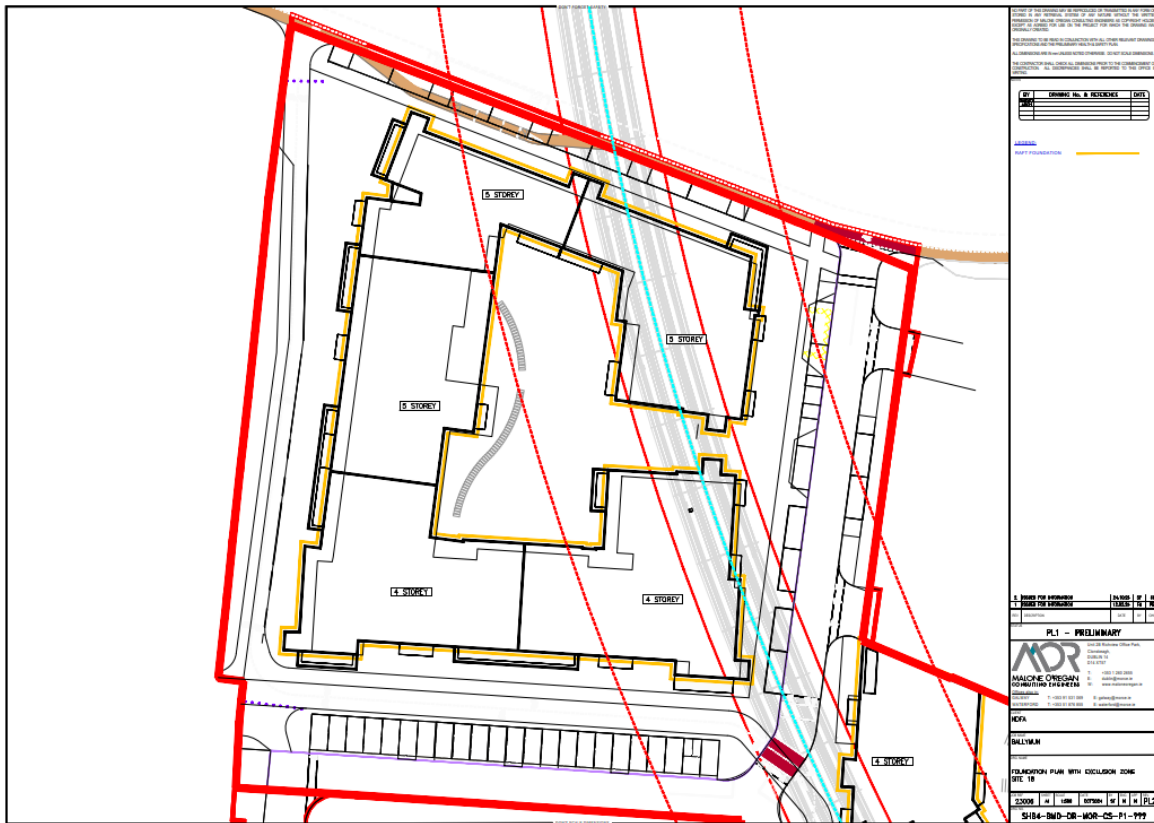


Figure 3-6 – Foundation Plan with Exclusion Zone Site 18

Site 18 consists of 109 no. apartments (47 no. 1 bed units, 34 no. 2 bed units and 28 no. 3 bed units) and ranges from 4 to 5 storeys with edges to Balcurris Road, Balcurris Park and a new edge to Balbutcher Lane. The ground floor level is residential, plant and storage with dwellings located over.

4 DESIGN CRITERIA

4.1 Loadings

The typical loads that have been used for this high-level analysis are tabulated in Table 2 below:

Description of Load	Value	Unit
Dead Loads		
Brickwork	22	kN/m ³
Blockwork	20	kN/m ³
Reinforced Concrete	25	kN/m ³
300mm THK Reinforced Concrete Slab	7.5	kN/m ²
Precast Concrete 215mm THK (3.1m from floor to floor)	16	kN/m
Finishes	1	kN/m ²
Blue Roof	4	kN/m ²
Green Roof	1.9	kN/m ²
Live Loads		
Family Dwelling	1.5	kN/m ²
Corridor Loading	3	kN/m ²
Balconies	2.5	kN/m ²

Table 4-1: Design loads considered for high-level assessment of raft foundations.

4.2 Raft Foundation Design

Several iterations of the high-level design were considered. The two primary iterations were for the five and six storey buildings and with varying construction materials ie. Block and brick walls or precast concrete walls. The use of a raft foundation allows for the even distribution of the applied bearing pressure through soil strata below. This distribution reduces the effect of the applied pressure the deeper the load is considered. For a raft foundation 17m wide with edge beams and internal beams and an applied bearing pressure of 50kN/m², the applied pressure to the crown of the tunnel would be equivalent to 20kN/m². This is well below the allowable applied surcharge load to the crown of the tunnel set by T.I.I of 75 kN/m². See the typical image below of load distribution through soil.

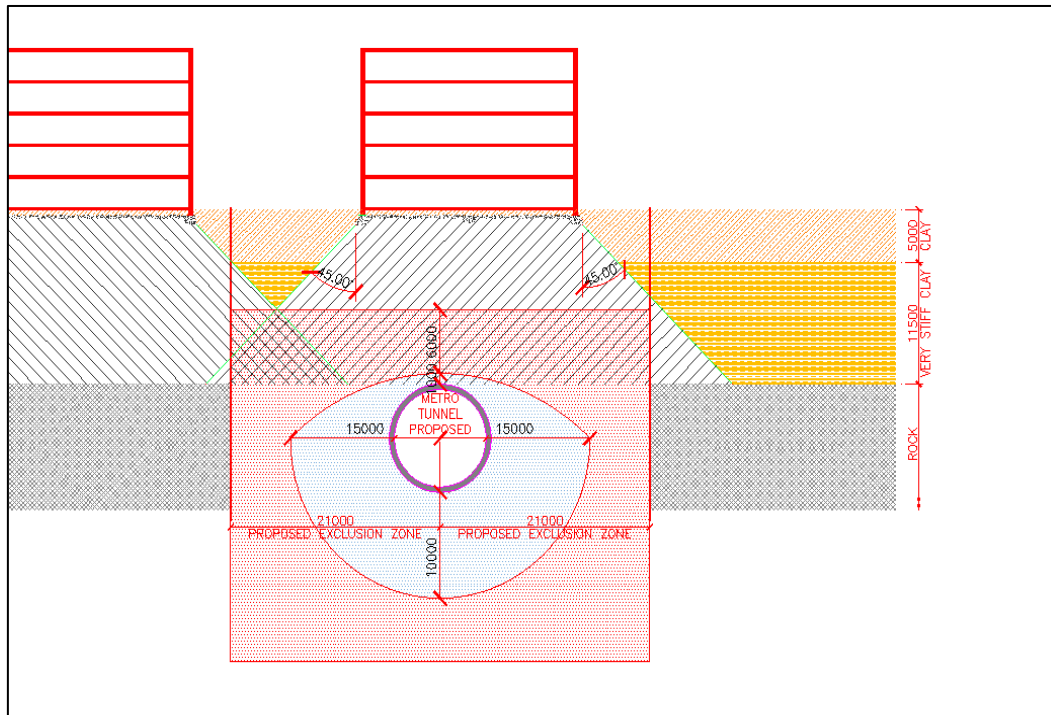


Figure 4-1 – Typical Image of Load Distribution through Soil

5 SUMMARY

The loading outlined for all sites is generally within the exclusion zone for the future tunnel project.

The limitation imposed by T.I.I and the properties of the soil strata within the site make the use of deep and piled foundations an uneconomical solution.

However, a raft foundation will allow for the distribution of forces/loads through the soil layers below which reduces the effect of the loads on the crown of the tunnel. Based on all the high-level analysis results and choices made depicted and displayed in this report, a raft foundation is highly suitable to overcome the boundaries and limitations of this project.

6 APPENDIX A – FOUNDATION PLANS

St Pappin's Square

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MOR
 MALONE O'REGAN
 CONSULTING ENGINEERS

Unit 2B Richview Office Park,
 Clonskeagh,
 DUBLIN 14
 D14 XT57

T: +353 1 260 2655
 E: dublin@mor.ie
 W: www.maloneoregan.ie

Offices also in:
 GALWAY T: +353 91 531 069 E: galway@mor.ie
 WATERFORD T: +353 51 876 855 E: waterford@mor.ie

CLIENT: NDFA

JOB NAME: BALLYMUN

DRG. NAME: FOUNDATION PLAN WITH EXCLUSION ZONE SITE 5

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MALONE O'REGAN
CONSULTING ENGINEERS

Unit 2B Richview Office Park,
Clonskeagh,
DUBLIN 14
D14 XT57

T: +353 1 260 2655
E: dublin@moroe.ie
W: www.maloneoregan.ie

Offices also in:
GALWAY T: +353 91 531 069 E: galway@moroe.ie
WATERFORD T: +353 51 876 855 E: waterford@moroe.ie

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SITE 15

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 CONSULTING ENGINEERS

Unit 2B Richview Office Park,
 Clonskeagh,
 DUBLIN 14
 D14 XT57

T: +353 1 260 2655
 E: dublin@moroe.ie
 W: www.maloneoregan.ie

Offices also in:
 GALWAY T: +353 91 531 069 E: galway@moroe.ie
 WATERFORD T: +353 51 876 855 E: waterford@moroe.ie

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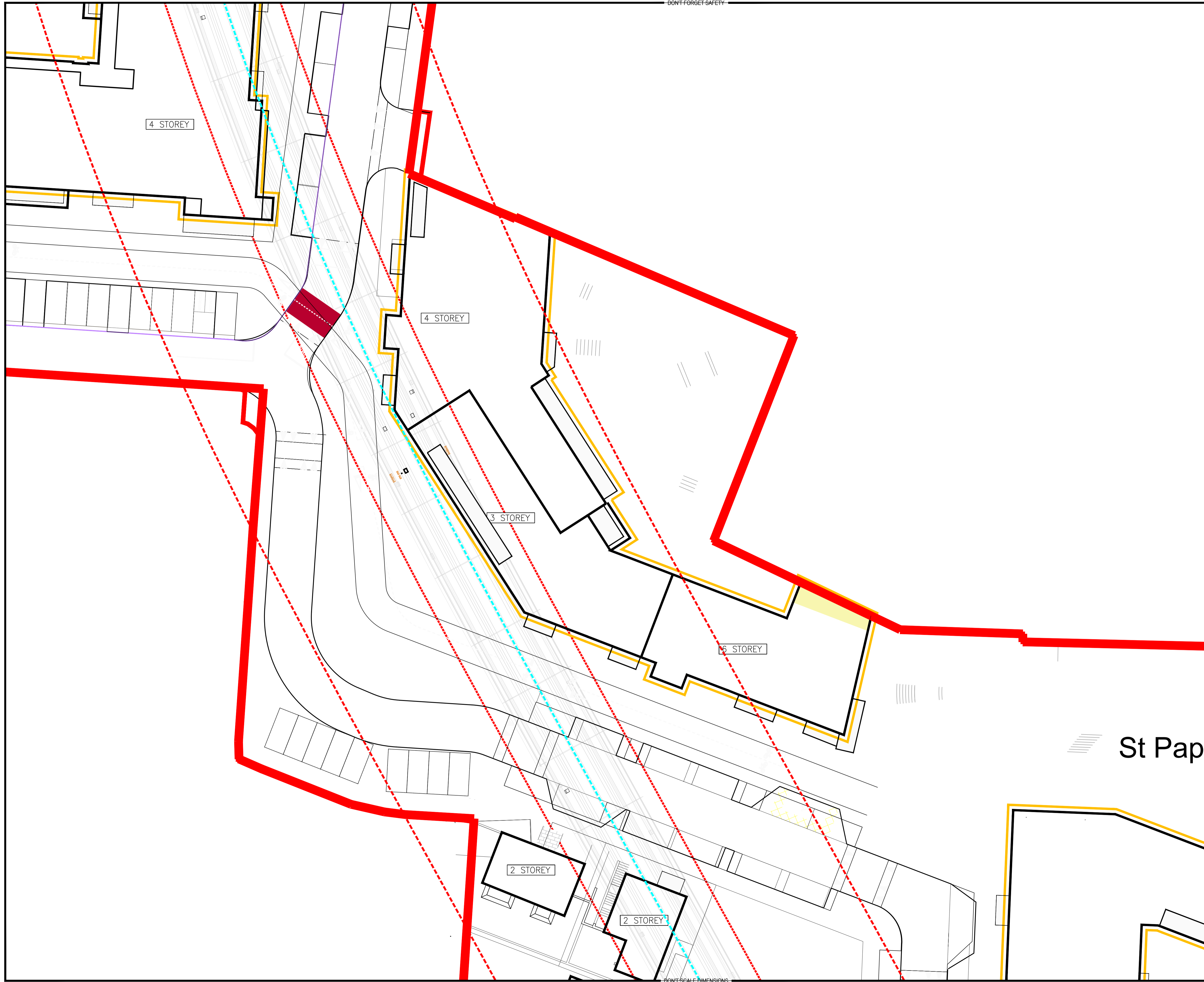
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 Clonskeagh,
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 D14 XT57

T: +353 1 260 2655
 E: dublin@moroe.ie
 W: www.maloneoregan.ie

Offices also in:
 GALWAY T: +353 91 531 069 E: galway@moroe.ie
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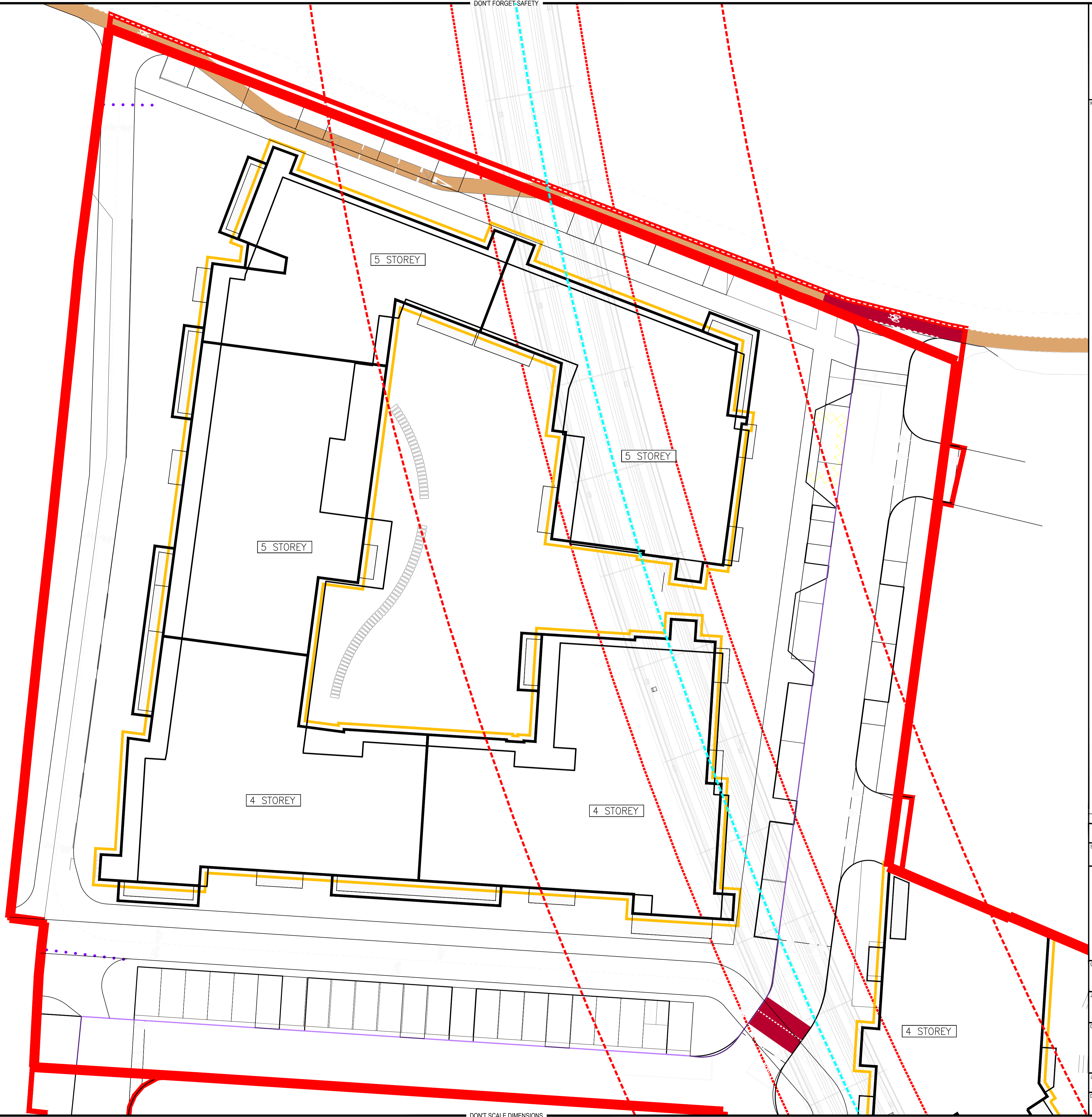
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