Prepared for
Wellington City Council
Co No.: N/A

HUP2 - T0 - Seismic Assessments - DSA Report

PUKA - 4 Brooklyn Road, Aro Valley

06-Dec-2024
WCC HUP2-T0-Seismic Assessments

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Prepared by

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06-Dec-2024

Job No.: 60723635

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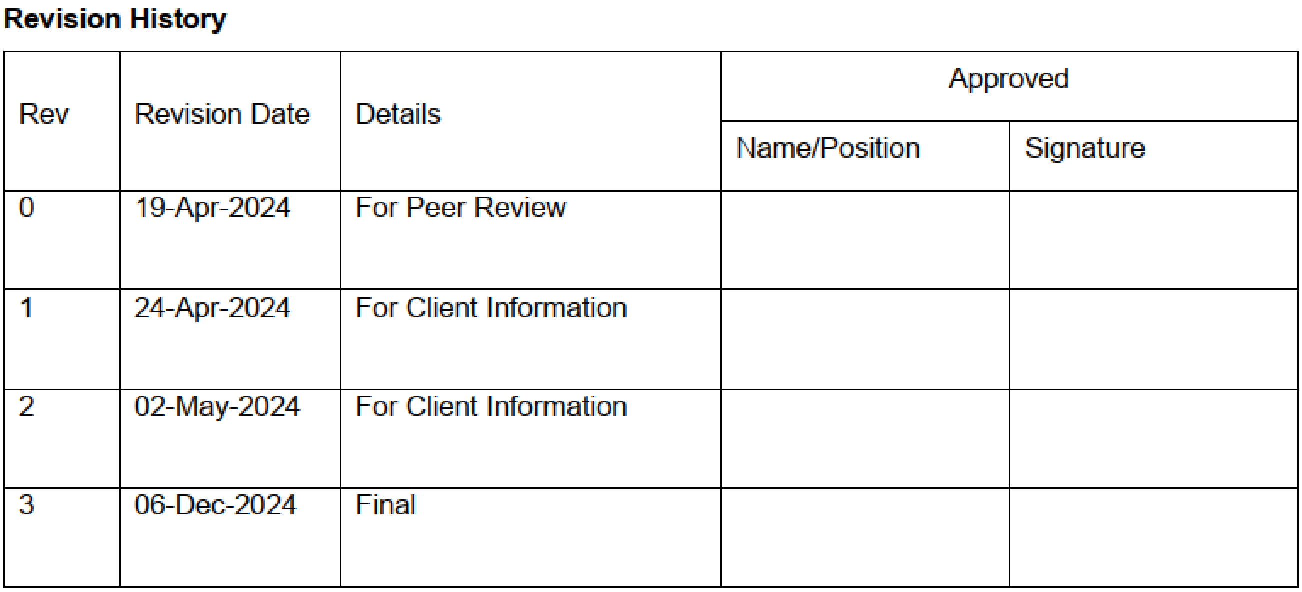
Quality Information

Document	HUP2 - T0 - Seismic Assessments - DSA Report
Ref	60723635
Date	06-Dec-2024



Revision History

Rev	Revision Date	Details	Approved	
			Name/Position	Signature
0	19-Apr-2024	For Peer Review		
1	24-Apr-2024	For Client Information		
2	02-May-2024	For Client Information		
3	06-Dec-2024	Final		

Table of Contents

Executive Summary

Scope and Basis of Assumptions

This report has been prepared for Wellington City Council to describe the results of our detailed seismic assessment for the Pukehinau Flat Block A at 4 Brooklyn Road, Aro Valey, and to provide a concept strengthening scheme if needed.

This report has been prepared in accordance with the scope of work described in *Consultancy Agreement – Structural Engineering Services, WCC Housing Upgrade Programme Phase 2 (HUP2) Seismic Assessment Project* dated 15 December 2023.

Results Summary

The results of our detailed seismic assessment indicate the buildings' earthquake rating to be 34*%NBS* (IL2) assessed in accordance with the guideline document *The Seismic Assessment of Existing Buildings - Technical Guidelines for Engineering Assessments*, dated July 2017 (Engineering Assessment Guidelines). The earthquake rating is based on an Importance Level 2 (IL2), in accordance with the joint Australian/ New Zealand Standard – Structural Design Actions Part 0, AS/NZS 1170/0:2002 as being deemed appropriate for these buildings. The link bridge is considered separately from the building earthquake rating and has a rating of 15*%NBS* (IL2). The results are summarised in the tables below.

Table 1 Summary of results – Main Building

Item	Description	
Building *%NBS* rating		34*%NBS* (IL2)
Importance level	Ordinary building	IL2
Assessed *%NBS* score and importance level (IL2)	Concrete Shear Walls (Piers)	35*%NBS*
	Concrete Shear Walls (Spandrels)	34*%NBS*
	Walls Out-of-Plane	40*%NBS*
	Beams	90*%NBS*
	Columns	95*%NBS*
	Diaphragms (rigid)	35*%NBS*
	Foundation - Ground Beams	35*%NBS*
	Foundation – Piles (axial)	70*%NBS*
	Foundation - Global Shear Resistance	45*%NBS*
Seismic grade and relative risk	Grade C, Medium Risk	
Potential Critical structural weaknesses	Concrete Shear Walls (spandrels) in shear.	

Table 2 Summary of Results - SSNS

Item	Description	
SSNS *%NBS* rating		15*%NBS* (IL2)
Importance level	Ordinary building	IL2
Assessed *%NBS* score and importance level (IL2)	Stairs	100*%NBS*
	Link Bridge	15*%NBS*
	Walkways	100*%NBS*
Seismic grade and relative risk	Grade E, Very High Risk	
Potential Critical structural weaknesses	**Buckling of link bridge support columns, which will loss the gravity support with no redundancy which will lead to collapse.**	

The focus of the assessment using these guidelines is on the life safety of those occupying and those immediately outside the building, rather than building damage and reparability considerations or business interruption. A building with an earthquake rating less than 34*%NBS* fulfils one of the requirements for the Territorial Authority to consider it to be an Earthquake-Prone Building (EPB) in terms of the Building Act 2004. A building rating less than 67*%NBS* is an Earthquake Risk Building (ERB) by the Engineering Guidelines.

The 4 Brooklyn Road, Block A building is therefore categorised as an Earthquake Risk Building.

Recommendations

We recommend that a cost-benefit analysis be performed to assess whether the building should be strengthened or demolished. Any strengthening works should be preceded by a detailed geotechnical investigation to confirm soil parameters and intrusive investigations to verify material strengths.

We highly recommend to carry out strengthening of the link bridge as soon as possible.

See Appendix F for strengthening concepts.

1.0 Introduction

AECOM New Zealand Ltd (AECOM) has been engaged by Wellington City Council (Client) to conduct a Detailed Seismic Assessment (DSA) of Block A at 4 Brooklyn Road, Wellington.

The objective of this DSA is to evaluate the likely seismic behaviour of the buildings in terms of percentage of New Building Standard *(%NBS*) and provide recommendations for seismic strengthening of the building, if necessary.

This report presents the result of this assessment and high-level strengthening works if applicable. The building has been assessed based on AECOM's interpretation of the information obtained from the existing drawings and site inspection.

1.1 Scope of Assessment

This report has been prepared in accordance with the scope of work described in *Consultancy Agreement – Structural Engineering Services, WCC Housing Upgrade Programme Phase 2 (HUP2) Seismic Assessment Project* dated 15 December 2023. AECOM's scope of works for this DSA is as follows:

- Review the existing drawings and other pertinent information provided by the Client.
- Undertake a site inspection to correlate the buildings with the information provided.
- Undertake a suitable structural analysis of the primary structure to establish a *%NBS* score for the building.
- Assistance to WCC in the establishment of a priority list for the installation of seismic upgrades.
- Development of a 67*%NBS* strengthening concept for primary structure elements (if needed).
- Assessment of SSNS items is not included in the scope of this DSA.

1.2 Regulatory Environment and Design Standards

The Earthquake-prone Building regulatory framework underwent significant changes during 2016 and 2017 as a result of learnings from the Christchurch earthquakes, and the more recent 2016 Kaikōura earthquake.

This resulted in the building (Earthquake-prone Buildings) Amendment Act 2016, the building (Specified Systems, Change the Use, and Earthquake-prone Buildings) Regulations 2005 including the Earthquake-prone Building Methodology, and the technical guideline document The Seismic Assessment of Existing Buildings - Technical Guidelines for Engineering Assessments (Engineering Assessment Guidelines). The important aspects of this regulatory framework are summarised below.

Earthquake-Prone Buildings (EPBs) are defined in Section 133AB of the building (Earthquake-prone Buildings) Amendment Act 2016 as buildings whose ultimate capacity will be exceeded in a moderate earthquake and, if it were to collapse, would likely result in injury or death or damage to another property. A moderate earthquake is defined as approximately one-third as strong but of the same duration as the earthquake shaking assumed in the design of a new building.

The official determination of whether a building is Earthquake-prone is the responsibility of the relevant Territorial Authority (TA). The earthquake rating resulting from an engineering assessment is only one, albeit significant, aspect considered by the TA in making their determination. If the TA determines a building to be Earthquake-prone, it will issue an EPB notice for the building and include it on the EPB register. The building (Earthquake-prone Buildings) Amendment Act 2016 then defines timeframes within which the owner must carry out building work (i.e. upgrade or demolish) to ensure the building is no longer Earthquake-prone.

These timeframes range from 7.5 to 35 years depending on the building type (priority or normal) and location (high, medium, or low risk area).

The building (Specified Systems, Change the Use, and Earthquake-prone Buildings) Regulations 2005 made significant changes to the system for identifying and remediating Earthquake-prone buildings. These include:

- providing an operational basis for identifying earthquake-prone buildings – the EPB methodology
- new definitions for key terms including ‘Earthquake-prone Buildings’ and ‘ultimate capacity.’
- a requirement to categorise Earthquake-prone Buildings in terms of their earthquake rating.
- providing a national-based system in place of individual earthquake-prone building policies for each TA.

The Engineering Assessment Guidelines document used by engineers to carry out seismic assessments is an integral part of the EPB methodology.

In addition, the New Zealand Society for Earthquake Engineering (NZSEE) defines a building with an earthquake rating less than 67*%NBS* as an Earthquake-Risk Building (ERB) and recommends a minimum target strengthening level of 67*%NBS*.

It is considered impractical and unaffordable to design every building to withstand the largest earthquake imaginable. Consequently, with respect to the determination of design loads for natural hazards, the New Zealand Loading Standard (NZS 1170) adopts a probabilistic approach taking into account the exposure hazard at a given location, along with factors such as building importance. Thus, the Loading Standard may be said to adopt a risk management approach in setting the loading levels that a given building is required to withstand.

For Importance Level 2 (IL2) buildings (e.g. normal structures), the ‘design’ earthquake load is set at the 1 in 500-year return period earthquake event. This event has approximately a 10% probability of exceedance over the assumed 50-year life of a building.

1.3 Assessment Methodology

This DSA follows the Engineering Assessment Guidelines, employing a force-based assessment procedure outlined in Section C2 of the guidelines.

Our methodology is briefly summarised below:

- Review of the available structural drawings to identify the main structural elements (primary and secondary) and any apparent ‘structural weaknesses’ of the buildings.
- Non-intrusive visual inspection of key elements of the buildings where visible including the general presence and arrangement of the concrete shear walls, stairs, bridge, and relationship to adjacent buildings, carried out on 31 January 2024.
- Selection of appropriate member properties and determination of structural element probable capacities.
- Determination of the likely earthquake rating of the buildings compared with equivalent new buildings at the site based on our inspections, the structural weaknesses identified, our calculations, and our engineering judgment.

1.3.1 Analysis Method and Application of Design Actions

Seismic analysis has been undertaken using the equivalent static method, conforming to NZS 1170.5:2002. The demand on the lateral load resisting system in the two directions has been calculated considering the recommended values of ductility and S_p factor from the NZS 1170.5 and NZS3101:2006. The calculated loads were applied in separately in two principal directions as well in combination with the 30% of the load in the orthogonal direction. Additionally, a modal response spectrum analysis was performed as defined in Section C2 of the Assessment Guidelines and the NZS 1170.5. The modal response was determined based on modes determined in ETABS V20.3.0, scaled so that the base shear was equal to or greater than the equivalent static base shear. The principal axes were adjusted to match those specified and the modes were combined using the complete quadratic combination (CQC) method. The directions were combined similarly to the equivalent static method with 100% in a given direction and 30% in the orthogonal direction.

1.3.2 Analysis of Diaphragms

The demand on the diaphragms was calculated following the pESA method as per section C2E.5 of the Assessment Guidelines with an overstrength factor ϕ_{ob}=1.0 (due to S_p = 0.925, μ = 1.25).

Upper bound forces on the diaphragms are those resulting from an ESA based on μ=1.25 and S_p=0.90.

These forces were amplified by 1.25 to account for accidental eccentricity and the possibility of an earthquake action not directly along an axis (100% +30%).

1.3.3 Site Inspection

A site inspection was carried out on 31st January 2024; that included a visual inspection from the outside with no internal inspections available. In undertaking our assessment we have, therefore, assumed that the wall layout shown in the drawings and the information inferred from the Specification are correct and that no damage affecting the seismic rating is present.

1.4 Building Description

The building is located on 4 Brooklyn Road, Aro Valley, Wellington. Refer to Figure 1 for the site location.

Figure 1 Site location

1.5 General

The Block A building was constructed circa 1976. The site consists of four other blocks also constructed around this time. The building shares a link bridge with the Block B building, though a sliding joint is present at the Block B interface.

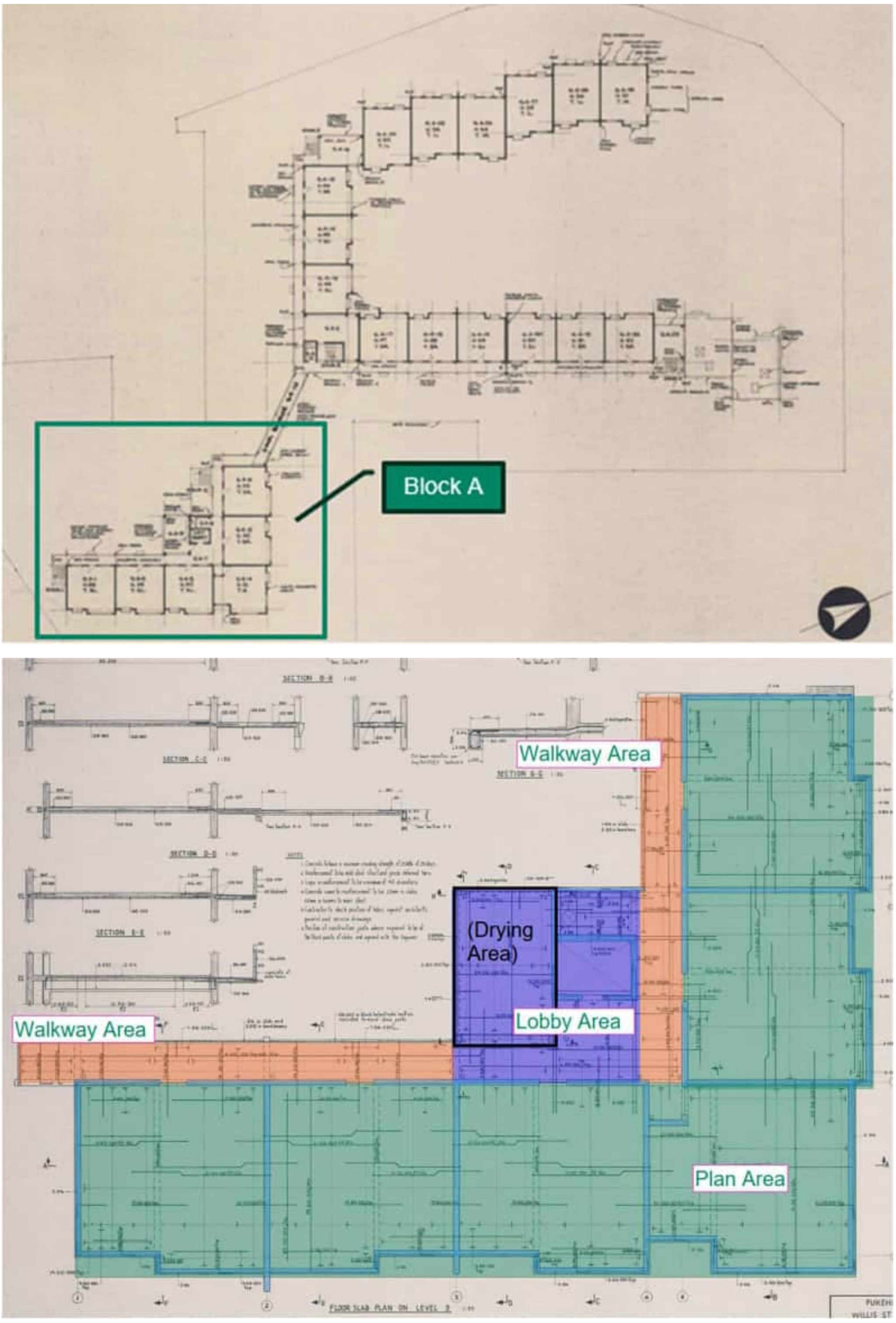


Figure 2 General structural layout

Table 3 below provides summary information for Block A.

Table 3 Building summary information

Building information	Details	Comment
Building name	Block A	
Street Address	4 Brooklyn Road	
Location	Wellington	
Construction time	Built circa 1976	
Description / Building Occupancy	Residential buildings	
Importance Level	IL2	
Building Footprint / Floor Area	378 m^2	
No. of storeys / basements	8 storeys	A lift room exist above the roof level
Structural system	Cast in-situ reinforced concrete shear walls	
Floor system	Reinforced concrete cast in-situ slabs	
Roof system	Light weight steel roofing on timer frame	
Earthquake resisting system	Reinforced concrete shear walls with rigid cast in-situ diaphragms at all floor levels and flexible timber roof.	
Foundation system	Reinforced concrete piles below strip footings	
Stair system	Steel framed tied back (bolted) into the building	Two stairs present, full height
Other notable features	Link Bridge supported at the 3rd floor by Block A which links to Block B but is not rigidly connected to. Vertical discontinuities and transfer structures along longitudinal walls (gridline A & 6) Significant openings along external shear walls Irregular in plan (L-shaped) Elevator core wall	
Past seismic strengthening	No	Recent initial seismic assessment was done in 2022 which showed a 45%*NBS* rating. A past detailed seismic assessment was done in 2008

Building information	Details	Comment
		which showed a >67*%NBS* rating.
Construction information	Original drawings (structures and architectural) Original specifications	
Likely Design Standards	NZS 3101:1970; NZSS 1693:1962; Ministry of Works Code of Practice: 1968	NZSS 1900 Chapter 9.3A also mentioned in the specs for concrete.
Heritage Status	No	
Seismic Risk Area	High risk (Wellington)	
Priority building status	Normal	
Other	N/A	

1.5.1 Building Construction

Block A is an eight-storey building with cast in-situ reinforced concrete shear walls at all levels, with cast-in situ reinforced concrete floor. The overall building dimensions are approximately 27.5m by 20m in an L-shape for an area of 378m^2.

The roof was constructed of timber framing with a light metal decking which appears to have been replaced post construction. The framing consists of 200x50 joists running longitudinally with 50x50 dwangs (blocking) running in the transverse directions with occasional 200x50 dwangs. These are all spaced at 600mm centres.

The ground floor slab is a 150mm thick cast in-situ reinforced concrete slab.

Strip footings were constructed below the walls with reinforced concrete bulb piles below them.

1.6 Geotechnical Site Conditions

AECOM geotechnical engineers conducted a site-specific desktop assessment. Key findings include subsoil class C, a distant fault (1.5km away) and low risk of liquefaction, lateral spreading and slope instability.

Refer to the geotechnical assessment report in Appendix C.

1.7 Previous Assessments

A previous DSA was performed by Romulus Consulting Group in 2008 with the building reported to resist about 80% of the NZS 1170.5:2004 seismic forces. This DSA consisted of equivalent static method (ESM) and modal response spectrum method (MRSM) analysis. Significant implication was performed in the capacity calculations for this DSA including averaging the capacities despite brittle shear failure.

An initial seismic assessment (ISA) was performed by AECOM in 2022 with a potential earthquake rating of 45*%NBS* assigned.

1.8 Structural Systems – Longitudinal and Transverse

1.8.1 Gravity Load Resisting System

The lightweight roof is supported by timber rafters, which carry the gravity loads to the inter-tenancy reinforced concrete walls. All of the floors are reinforced concrete cast in-situ two-way slabs which are supported by reinforced concrete shear walls in both directions. The gravity load in the shear walls is supported by ground beams which transfer loads to the piles into the soil. On the bottom four stories, there are also drying areas which consist of reinforced concrete cast in-situ slabs supported by reinforced concrete beams and columns. The bottom storey drying area is supported by shear walls like the majority of the structure.

1.8.2 Lateral Load Resisting System

This building is arranged irregularly in an L-shape with the lateral load resisting system being similar in both directions. The lateral loads are resisted by reinforced concrete shear walls (internal and external) as well as a reinforced concrete lift core formed of shear walls. The external shear walls have significant quantities of large openings leading to frame like behaviour occurring. The elevations along Grid A and 6 also have vertical discontinuities where walls go “in-and-out” with transfer beams required to continue the load path. All floors are formed of reinforced concrete slabs which will behave as rigid diaphragms transferring seismic loads based on stiffness. The roof, consisting of timber framing, will act as a flexible diaphragm, transferring loads based on tributary area. The shear walls will transfer the lateral loads down the building into the bulb piles through the ground beams. Some shear will also be resisted by sliding friction of the base slab and passive resistance on the ground beams. The lateral load resisting shear walls are highlighted blue in Figure 3 below.

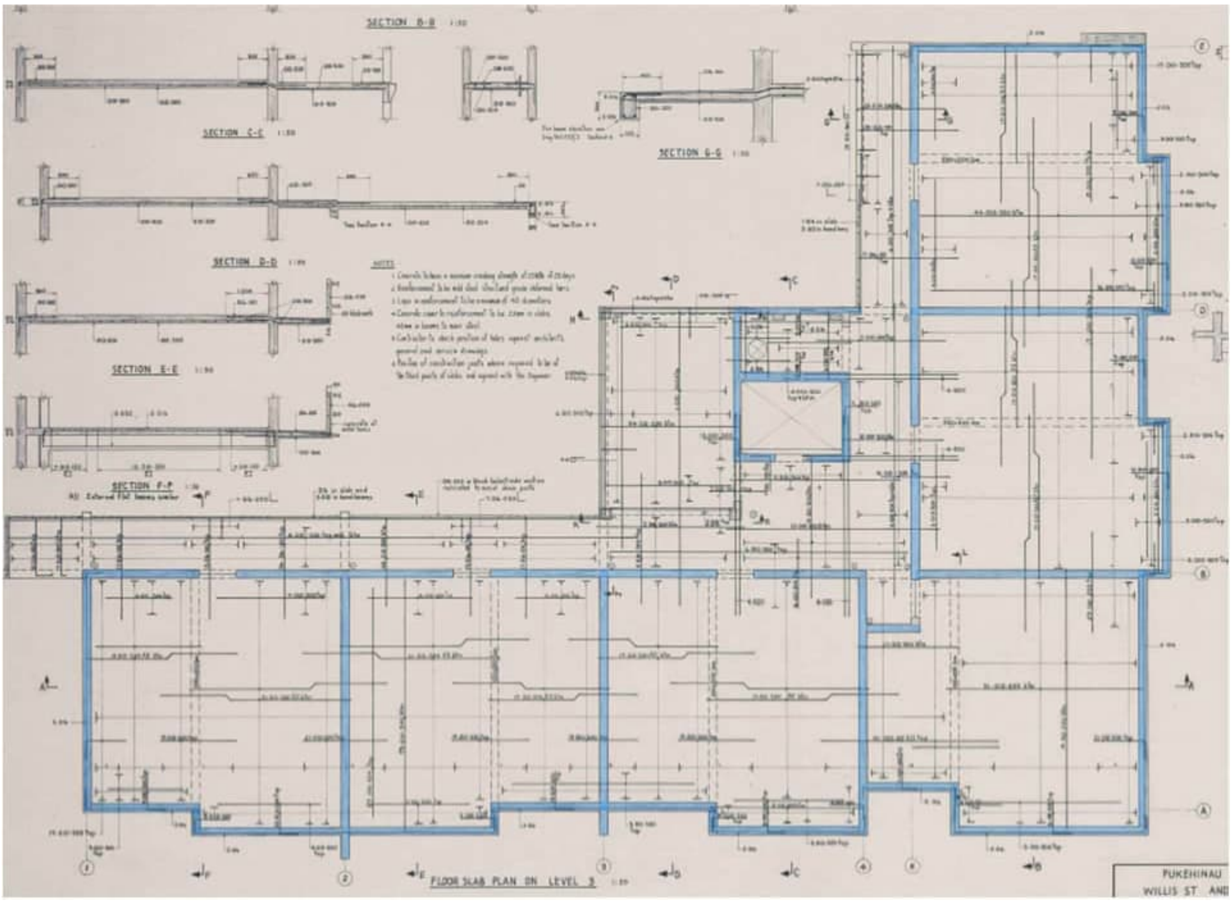


Figure 3 Lateral load resisting system

2.0 Results of Seismic Assessment

The results of the DSA indicate the building's earthquake rating is ***34%NBS (IL2*)** assessed in accordance with the Guidelines. This rating is governed by the shear failure of reinforced concrete shear wall spandrels along external faces of the building. The link bridge is considered separately from the building and has a rating of **15%*NBS* (IL2)**.

The building is therefore categorised as **Grade C** following the MBIE grading scheme. **Grade C** buildings represent a medium risk to occupants of 5-10 times greater than the expected from a new building, indicating a Medium-risk exposure. The link bridge is categorised as **Grade E** and represents a risk to occupants of 25 times greater than the expected from a new building. The following table sets out the performance of structural elements within the building. The lowest score structural weakness is termed Potential Critical Structural Weakness (CSW). Table 4 presents the assessment results for key structural elements.

Table 4 Summary of building seismic performance

System	Direction	Seismic Performance in *%NBS*	Life Safety Risk
Shear walls (piers and spandrels)	X-Direction	34%*NBS*	High
Walls Out-of-Plane	Both Directions	40%*NBS*	Medium
Beams	Both Directions	90%*NBS*	Low
Columns	Both Directions	95%*NBS*	Low
Floor slab (Rigid Diaphragm)	Both Directions	35%*NBS*	Medium
Foundation – Ground beams	Both Directions	35%*NBS*	Medium
Foundation – Piles (axial)	Both Directions	70%*NBS*	Low
Foundation – Global shear resistance	Y-Direction	45%*NBS*	Medium

3.0 Secondary Structural and Non-Structural (SSNS) Elements

The external steel stairs, link bridge and walkways have been assessed as part of the SSNS elements. Of these, the link bridge has the lowest overall score at 15*%NBS* and is considered to be a significant life safety risk.

The timber frame walls are not part of the lateral load resisting elements; hence they are considered as a secondary structural element. These walls are supported (restrained all-along their perimeter as shown in the architectural drawings. These walls are not considered a life-safety hazard.

There are water tanks above the roof shown in the drawings, but they are not existing on site.

Table 5 presents the assessment results for secondary structural and non-structural elements.

Table 5 Summary of secondary structural seismic performance

System	Direction	Seismic Performance in *%NBS*	Life Safety Risk
Parapet (Masonry)	Both Directions	100*%NBS*	No
Walkway Slab	Both Directions	100*%NBS*	No
Stairs (Steel)	Both Directions	100*%NBS*	No
Timber Wall	Both Directions	100*%NBS*	No
Link Bridge	Both Directions	15*%NBS*	High
Water Tanks	Water tanks at the roof level are shown in the drawings but are not present on site as confirmed by the sit visit.		

4.0 Risks From Adjacent Buildings

Block A is not immediately adjacent to any of the other blocks within the same site or any other buildings off-site. A link bridge is present that is integrally connected and supported by Block A which spans to Block B. At the Block B interface, the bridge is not rigidly connected and instead has a sliding joint (SAKB 18F Rod) with a seismic gap. On this end, the bridge is instead supported by steel columns spanning to foundations at the ground level.

5.0 Assessment of Seismic Risk

5.1 Seismic Risk and Performance Levels

The quantitative seismic assessment we have completed of the Block A building at 4 Brooklyn Road, Aro Valley indicates an earthquake rating of 34*%NBS* (IL2) governed by the shear failure of reinforced concrete shear wall spandrels. The building has been assessed in accordance with the guideline document "*The Seismic Assessment of Existing Buildings - Technical Guidelines for Engineering Assessments, dated July 2017 (Engineering Assessment Guidelines)* and the *draft concrete Section C5, 2018*. The earthquake rating is based on an Importance Level 2 (IL2), in accordance with the joint Australian/New Zealand Standard – Structural Design Actions Part 0, AS/NZS 1170/0:2002 as being deemed appropriate for this building. The building is a **Grade C** building following the Engineering Assessment Guidelines grading scheme. **Grade C** buildings represent a medium risk to occupants 5 to 10 times greater than the expected for a similar new building, indicating a relative medium-risk exposure. The new building standard requires an IL2 building to have a low probability of collapse in a 1 in 500-year 'design level' earthquake (i.e. an earthquake with a probability of exceedance of approximately 10% over the assumed 50-year design life of a building).

Table 6 Relative risk description

Percentage of new building standard (*%NBS*)	Alpha rating grade	Approx. risk relative to a new building	Life-safety risk description
> 100	A+	Less than or comparable to	Low risk
80 - 100	A	1-2 times greater	Low risk
67 - 79	B	2-5 times greater	Low to Medium risk
34 - 66	C	5-10 times greater	Medium risk
20 - 33	D	10-25 times greater	High risk
< 20	E	25 times greater	Very high risk

A building with an earthquake rating less than 34*%NBS* fulfils one of the requirements for the Territorial Authority to consider it to be an Earthquake-Prone Building (EPB) in terms of the Building Act 2004. A building rating less than 67*%NBS* is considered as an Earthquake Risk Building (ERB) by the New Zealand Society for Earthquake Engineering. The Block A building at 4 Brooklyn Road, Aro Valley has a rating of ***34%NBS*** as per this assessment. Therefore, this building is categorised as a medium-risk building and is therefore categorised as an Earthquake Risk Building.

6.0 Comment on Future Seismic Hazard

The NZ seismic loading standard in undergoing a review and a draft version of the proposed new standard has been issued by Standards New Zealand for consultation as a Technical Specification *TS 1170.5 Structural Design Actions*. The consultation is said to end on 14 March and the final version of the Technical Specification is expected to be published later in the year 2024.

The draft standard incorporates learnings gained since the publication of both the updated National Seismic Hazard Model 2022 (NSHM) and the existing building code compliant standard NZS 1170.5:2004.

Figure 4 below provides a comparison between the ULS elastic site spectra (seismic loading) for an Importance Level 2 building located in Wellington, calculated considering the current loading standard NZS 1170.5 (black) and the TS 1170.5 Structural Design Actions (red).

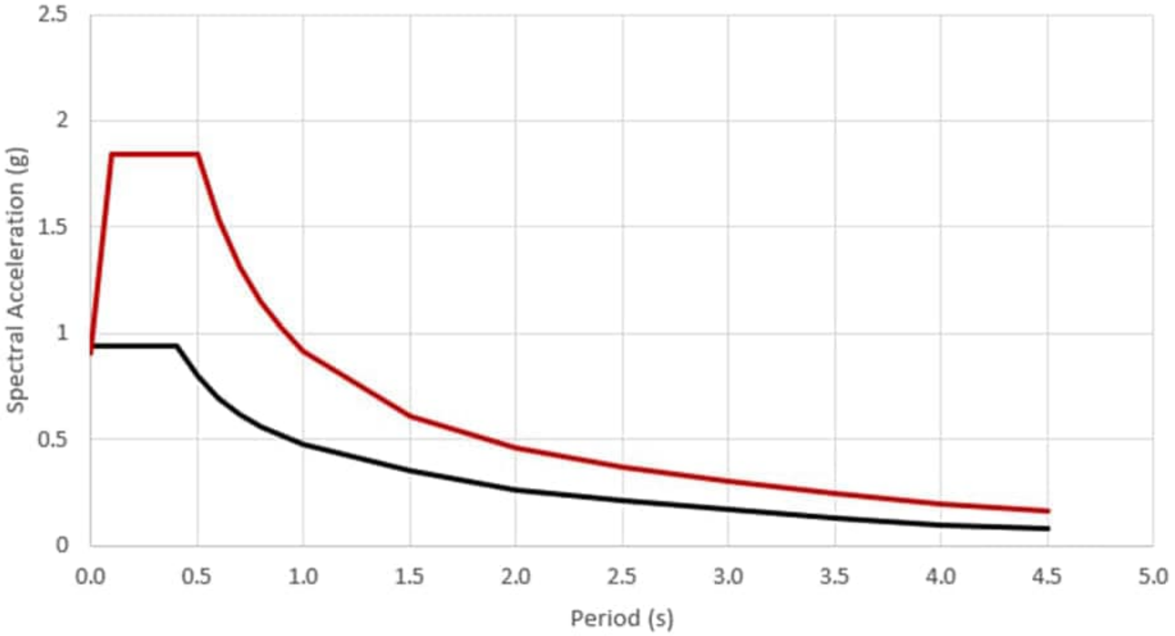


Figure 4 Site spectra in the current code (NZS1170.5) and draft of the new code

Table 7 provides a comparison of key seismic parameters used to calculate the seismic loading in accordance with the two documents. Note this is compared for the x-direction only.

Table 7 Comparison of seismic parameters

Parameter	Soil Class	Site Spectral acceleration	Horizontal design seismic coefficient, Cd (μ=1.25, Sp=0.93)	Horizontal design seismic coefficient – Part and Coefficient	Site Spectral acceleration
Current Code	C	0.40	0.94	0.76	2.71 (roof)
TS draft	III*	0.91	1.84	1.36	4.55
%Change (TS draft/Current code)	N/A	128%	195%	178%	168%

* Subsoil class type C is equivalent to subsoil class type III.

6.1 Effect on Block A Building

Based on the proposed Technical Specification, the seismic demand for Block A building at 4 Brooklyn Road, Aro Valley would be 178% of the current standard. This will likely reduce the earthquake rating of the building below the current rating of 34*%NBS* to approximately 20*%NBS* depending on other new code provisions.

We note that NZS 1170.5:2004 remains the referenced standard for compliance with the New Zealand Building Code. As per what was advised from Standards NZ, the proposed Technical Specification does not change the requirements of the earthquake-prone building (EPB) system. They advise that all seismic assessments, including the voluntary seismic assessments, should adopt the same approach as for the national earthquake-prone building system and use the current seismic loading standard NZS 1170.5:2004.

We also note that the Technical Specification has been issued as a draft document and is subject to change.

7.0 Seismic Concept Strengthening

We note that by law, Earthquake Prone Buildings, when confirmed, are required to be strengthened to at least 34*%NBS* within a prescribed time relative to the seismic zone of the building. Furthermore, WCC's requirement is to strengthen their assets to a minimum of 67*%NBS*.

Block A has an overall rating of 34*%NBS*. Additionally, the link bridge, which is being considered separately, has an overall rating of 15*%NBS.* Therefore, strengthening will be required for the primary structure and link bridge. Our indicative high-level strengthening to 67*%NBS* is summarised below.

The strengthening works will require a building consent and as such section 112 of the Building Act becomes relevant as strengthening works are considered under alterations and additions to the building of the Building Consent Authority. As such, further compliance may be required for:

- Access and facilities for persons with disabilities.
- Means of escape from fire.

7.1 Concept strengthening scheme to 67*%NBS*

Refer to the 67*%NBS* concept strengthening scheme markups in Appendix F.

The strengthening comprises the following key elements:

- The machine room suspended reinforced concrete shear wall is reinforced with two steel PFC members to shorten span lengths and spread loads to support walls.
- Lower-storey external reinforced concrete wall piers are strengthened with reinforced concrete shotcrete to increase their in-plane capacity.
- Reinforced concrete wall spandrels are strengthened using steel PFC members anchored to low-scoring elements to increase flexural and shear capacities.
- Fibre-Reinforced-Polymer (FRP) strips are added to areas of the cast in-situ diaphragm to provide additional tension strength to distribute the seismic load from the diaphragm to the shear walls.
- Supplementary ground beams along Grids 1, 6, A and E. These will transfer loads to new cast-in piles below to improve the global shear resistance performance.
- Steel SHS columns will be added to the existing link bridge columns with braces provided to transfer the loads to the existing foundation. **We highly recommend to carry out strengthening of the link bridge as soon as possible.**

8.0 Explanatory Statement

1. AECOM has prepared this Report in accordance with the usual care and diligence of the consulting profession for the use of our Client. AECOM has used reasonable endeavours to determine the seismic resistance of the subject building. However, in doing so AECOM has made certain assumptions about material strengths, hidden construction details, deterioration, foundations etc. Intrusive investigations and testing, which were outside the scope of work, would be required to verify these assumptions.
2. Except as required by law no third party may use or rely on this Report unless otherwise agreed in writing by AECOM.
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4. This report is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this Report.
5. This report has been prepared in accordance with the scope of work described in *Consultancy Agreement – Structural Engineering Services, WCC Housing Upgrade Programme Phase 2 (HUP2) Seismic Assessment Project* dated 15 December 2023.
6. Where this report indicates that information has been provided to AECOM by third parties, AECOM has made no independent verification of this information except as expressly stated in the Report. AECOM assumes no liability for any inaccuracies in or omissions to that information.
7. This Report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties.
8. Where existing structural documentation is available, it is assumed that all reasonable measures have been taken during construction to erect the building in accordance with these documents. Any reinforcement size/spacing, strength grades and connection details indicated on the existing drawings have been assumed to be correct on-site.
9. This detailed seismic assessment is based on the structure in its current state and no future building modifications or additions have been accounted for.

Appendix A

Technical Summary

Appendix A Technical Summary

Table 8 Technical summary

1. Building Information	
Building name / description	Block A Eight storey residential building
Street address	4 Brooklyn Road
Territorial authority	Wellington City Council
No. of storeys	8 Storeys + Lift machine room
Area of typical floor (approx.)	378 m^2
Year of design (approx.)	1975
NZ standards designed to	NZS 3101: 1970 NZSS 1693: 1962 Ministry of Works Code of Practice: 1968
Structural system including foundations	The roof is a lightweight system comprised of lightweight metal sheeting supported by timber rafters spanning between reinforced concrete shear walls. The flooring comprised of cast in-situ reinforced concrete slab at all levels excluding the roof which consists of flexible timber framing. These are both supported by the shear walls. The reinforced concrete shear walls resist lateral loads in both directions. The shear walls transfer vertical and lateral loads to ground beams which are supported by bulb piles. There are cantilevered walkways along the internal sides of the L-shape of the building supported by cantilever beams. The stairs are primarily steel framed connected back into the building on one end. There are significant vertical discontinuities in both directions (i.e. transfer beams).
Does the building comprise a shared structural form or shares structural elements with any other adjacent titles?	The building supports a steel framed link bridge which spans to the Block B building. At the block B interface, a 50mm seismic gap exists, which is adequate to prevent pounding/compression effects. On the Block B side, bridge lateral loads are supported by a sliding rod joint and gravity loads are transferred to the bridge columns. The bridge is fixed to Block A side from the third floor up.
Key features of ground profile and identified geohazards	Refer to geotechnical report in **Appendix E** Subsoil class C. Lateral spreading – Low. Liquefaction induced settlement – Low. Fault rupture – no risk. Slope instability – Low.
Previous strengthening and/ or significant alteration	None. Appears to have a new lightweight metal decking for the roof.
Heritage issues/ status	No.

1. Building Information	
Other relevant information	Nil.

2. Assessment Information	
Consulting practice	AECOM New Zealand Limited
Structural engineer responsible include:	
Name	
CPEng number	
Statement of experience	With over 28 years' experience with practice area in structural design of low-rise to medium-rise commercial buildings, civil structures, heavy industrial projects, large water retaining structures, railway related buildings and under-ground structures with emphasis on seismic engineering, post-earthquake structural assessment, seismic assessment, and seismic retrofit design of existing buildings. With more than 17years NZ consulting experience.
Documentation reviewed, including: • **Date / version of drawings / calculations** **Previous seismic assessments**	Structural and architectural drawings, 1975 Specifications, 1975 Previous DSA calculations, 2008 Previous ISA calculations, 2022
Geotechnical report(s)	2022 Geotechnical Desktop Study Report by AECOM Report attached in **Appendix E**
Date(s) building inspected and extent of inspection	Visual external and internal inspection with photographs taken conducted on 31 January 2024.
Description of any structural testing undertaken and results summary	No structural testing undertaken.
Previous assessment reports	2008 DSA by Romulus Consulting Group 2022 ISA by AECOM
Other relevant information	Nil.

3. Summary of engineering assessment methodology and key parameters used.	
Occupancy type(s) and importance level (IL)	Residential IL2
Site subsoil class	Class C – NZS 1170.5:2004
For an ISA	
Summary of how Part B was applied, including: • **Key parameters such as u, S_p and F factors** **Supplementary calculations**	N/A.

3. Summary of engineering assessment methodology and key parameters used.	
For the DSA	
Summary of how Part C was applied, including: • **Analysis methodology(s) used from C2** **Other sections of Part C applied**	The assessment procedure used is the forced based elastic analysis using both equivalent static method and modal response spectrum analysis. Modelling is being carried out using ETABS. Sections C5 (Concrete) and C6 (Steel) of MBIE Guidelines were used.
Other relevant information	Nil.

4. Assessment Outcomes		
Assessment status	Final	
Assessed *%NBS* rating	Main Building: *34%NBS* (IL2) Link Bridge: 15*%NBS* (IL2)	
Seismic grade and relative risk	Main Building: Seismic Grade C, Medium risk Link Bridge: Seismic Grade E, Very High risk	
For an ISA		
Describe the potential critical structural weaknesses.	N/A	
Does the result reflect the buildings expected behaviour, or is more information/analysis required?	N/A	
If the results of this ISA are being used for earthquake prone decision purposes, and elements rating <34*%NBS* have been identified:	Engineering statement of structural weaknesses and location	Mode of failure and physical consequence statement(s)
	N/A	N/A
For a DSA		
Comment on the nature of secondary structural and non-structural elements/ parts identified and assessed	The link bridge spanning between Block A and B is considered a secondary structural and non-structural (SSNS) component. The bridge has the lowest score of SSNS of 15*%NBS* due to flexural failure of the columns. This is deemed to pose a significant life safety hazard and is categorised as Seismic Grade E, very high risk.	
Describe the governing critical structural weakness	The governing Critical Structural Weaknesses (CSWs) is the shear failure of reinforced concrete shear wall spandrels.	
If the results of this DSA are being used for earthquake prone decision purposes, and elements rating <34*%NBS* have been identified (including Parts):	Engineering statement of structural weaknesses and location	Mode of failure and physical consequence statement(s)
	The link bridge columns fail in flexure.	The failure is in flexure which while ductile have nowhere to redistribute and upon failure could lead to partial or full collapse of the link bridge.

4. Assessment Outcomes	
Recommendations **(*optional for EPB purposes*)**	Wellington City Council (WCC) to review the engineering assessment undertaken by AECOM. WCC to determine whether the building is earthquake prone accordance with the Building Act 2004. WCC to assign an earthquake rating for the building. The earthquake rating of the building will be the governing *%NBS* specified in engineering assessment report. If the WCC determines the building to be an EPB, then the WCC determine the form of the EPB notice that is to be issued for based on the determined earthquake rating category. Any required strengthening is to take place within a timeframe accordance with section 133AM of the Building Act 2004.

Appendix B

Sources of Information

Appendix B Sources of Information

The following information has been used to undertake the seismic assessment:

- Structural drawings
- Architectural drawings
- Geotechnical report
- Previous DSA report and calculations from Romulus Consulting Group.
- ISA report by AECOM.

The following documents and references have been used to undertake the seismic assessment:

- New Zealand Standard NZS 1170 ‘Structural Design Actions’.
- New Zealand Standard NZS 3101:2006 ‘Concrete Structures Standard’.
- The Seismic Assessment of Existing Buildings - Technical Guidelines for Engineering Assessments, dated July 2017. C5 revised 31 November 2018.
- Ministry of Business Innovation and Employment. (2018). B1-VM4: Acceptable Solutions and Verification Methods for New Zealand Building Code Clause B1 Structure.
- Geonet (2019). Retrieved 10 July 2019 from http://www.geonet.org.nz/
- New Zealand Active Faults Database (2013). Retrieved 2 January 2016 from http://data.gns.cri.nz/af/
- New Zealand Geotechnical Society (2016). Earthquake Geotechnical Engineering Module 3 – Liquefaction Hazards, New Zealand Geotechnical Society, New Zealand.

Appendix C

Initial Review Form - Basis of Seismic Assessment

1 SEISMIC ASSESSMENT – INITIAL REVIEW FORM

The purpose of this document is to provide a record of agreed initial parameters for a seismic assessment project.

Building Name:

PUKA – Block A – 4 Brooklyn Road

Structural Description: Describe the building	
Building Age/Year Constructed	1976
Previously strengthened? Y/N	N
Location	4 Brooklyn Road, Wellington
No. levels	8 + lift machine room
Plan Area (sq.m.)	300 m2
Structural Form	Cast in-situ RC walls
Roof Type	Timber joists, metal decking
Floor Type	Cast in-situ RC
Foundation Type	RC Piles below strip footings
Stair Type (Precast, Steel, etc)	Steel
Seismic Gaps (mm)/Pounding	No
Appendages/Parapets/Canopies	Link Bridge and Machine room. Walkways.
Precast Walls (reo type)	N
Veneers Present	N

Lateral Load-Resisting Mechanism (in each direction - confirm with drawings): Describe the lateral load resisting system in each direction	
Longitudinal:	RC shear walls (some act as frames due to large openings)
Transverse:	RC shear walls (some act as frames due to large openings)

Assessment Methodology

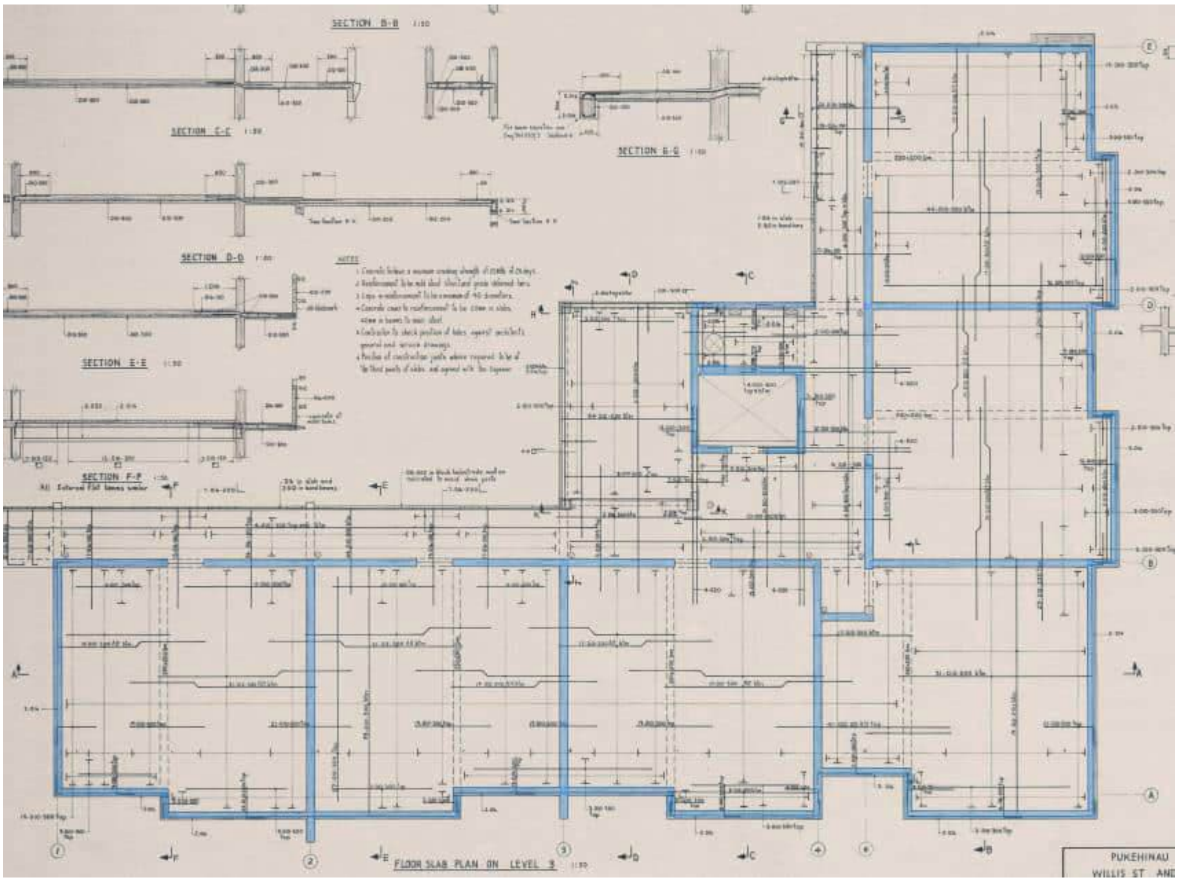
List components and proposed analysis method e.g. eqv Static, pushover, modal analysis, rocking, force based, displacement based, part and portions, tributary area, flexible/rigid diaphragms

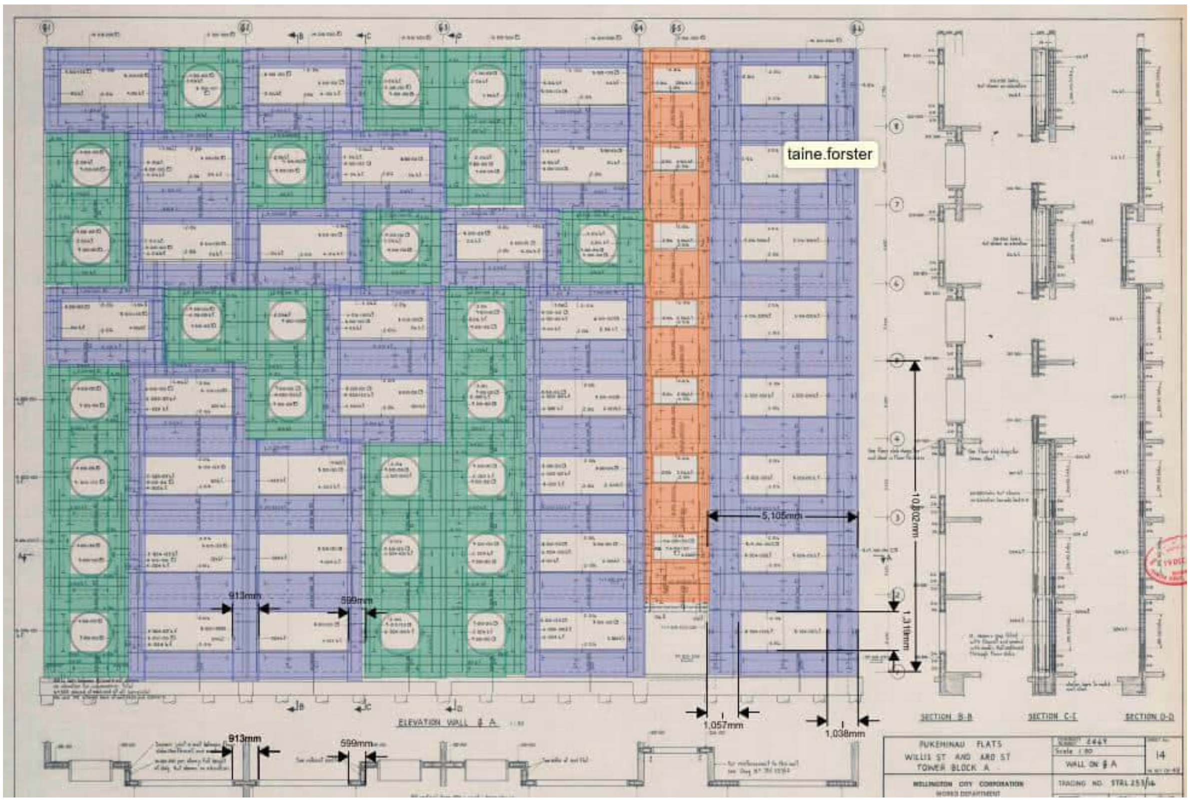
Type of analysis method:

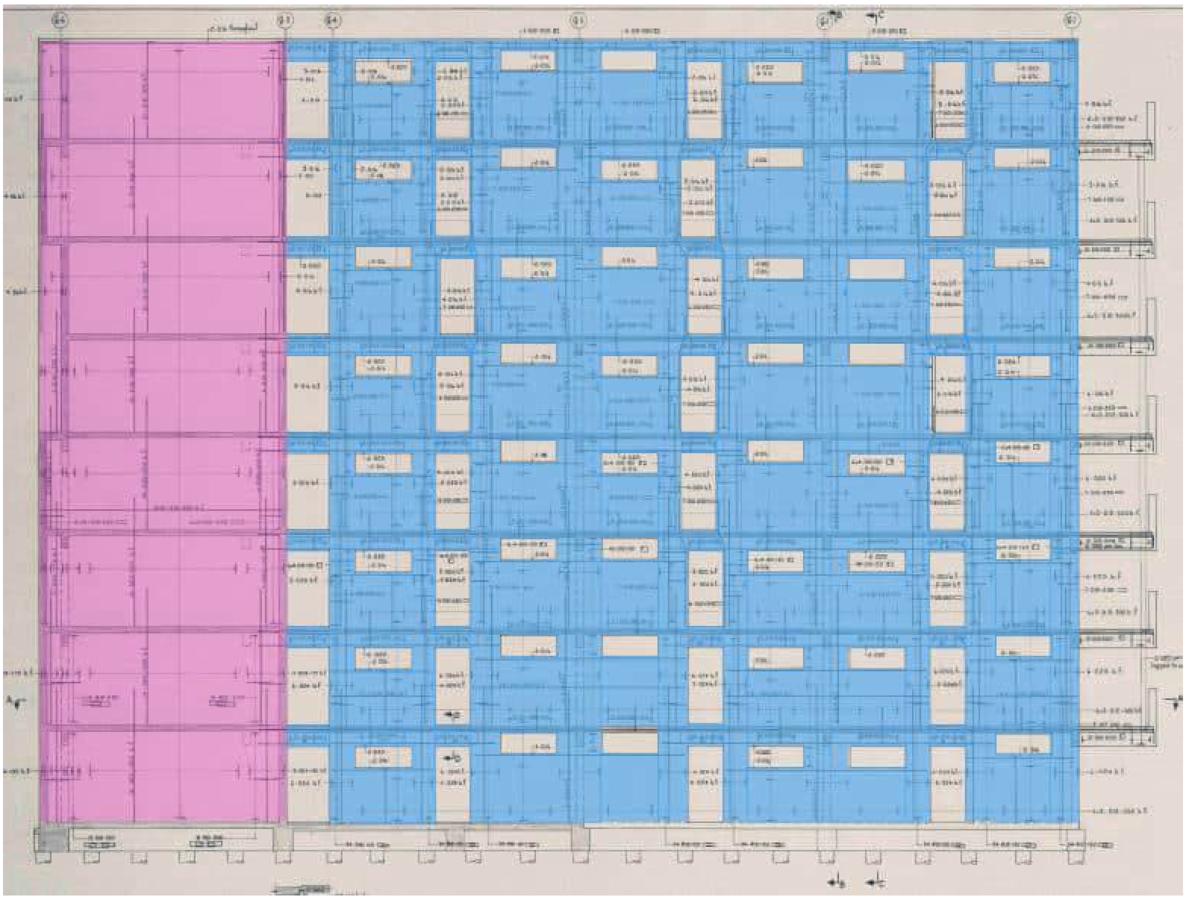
Due to significant plan and vertical irregularities, SlaMA is not applicable. Create an ETABS model which will first be analysed with an ELA and MRSA. If this results in significant pile uplift or other geotechnical failure modes, geotechnical engineers will be engaged, and non-linear springs will be created. If structural failures are observed to be governing a Non-linear static analysis will be performed on targeted elements. The diaphragm will be considered rigid as it is RC cast in-situ. Deformation/rotation capacity of key elements to be sought early for estimates of ductility.

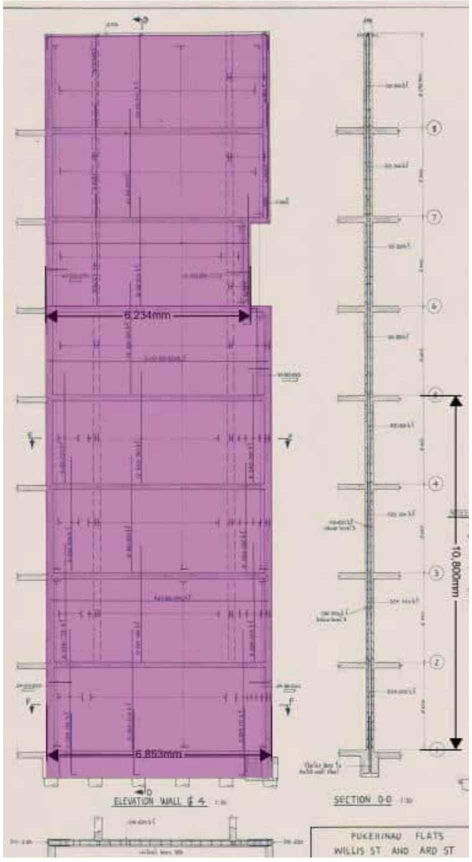
Analysis method of diaphragms:

Grillage method with PESA demands.


SECTION B-B 1:50
SECTION C-C 1:50
SECTION G-G 1:50
SECTION D-D 1:50
SECTION E-E 1:50
SECTION F-F 1:50
NOTES
FLOOR SLAB PLAN ON LEVEL 3 1:50
PUKEHINAU
WILLIS ST AND


taine.forster
5,105mm
10,802mm
1,310mm
913mm
599mm
1,057mm
1,038mm
ELEVATION WALL § A
SECTION B-B
SECTION C-C
SECTION D-D
PUKEHINAU FLATS
WILLIS ST AND ARO ST
TOWER BLOCK A
Scale 1:50
WALL ON § A
14
WELLINGTON CITY CORPORATION
WORKS DEPARTMENT
TRACING NO. STRL 253/14




6,234mm
10,800mm
6,853mm
ELEVATION WALL 4
SECTION D-D
PUKERINAU FLATS
WILLIS ST AND ARD ST

Initial Assessment of Ductility List the components of the structural system and the expected ductility to be achieved from them, eg plain round bar reinforced concrete moment frame ductility 1 – 1.25 or rocking	
1.25-1.5 (initial)	RC shear walls with deformed bars doubly reinforced, some shear failure shown in previous DSA and many transfer structures exist.

Assessment Loadings: Loads to be used as part of assessment:	
Seismic Loadings	
Building Importance Level:	2
Site Subsoil Class:	C
Annual Probability of Exceedance:	1/500
Return Period Factor, Ru:	1.0
Near Fault Factor, N(T,D):	1.0
Hazard Factor, Z:	0.4
Code of the Day:	NZS 1170.5:2004, C5 (Yellow book, 2018), C2 (2017)
S_p	0.925
Design Working Life (yrs):	50
Dead Loads/Superimposed Dead Loads	
Concrete floor	3.12 kPa
Machine Room	5 kPa
Partitions	0.3 kPa
Ceiling load	0.1 kPa
Roof services	0.1 kPa
Live Loads:	
General Area	1.5 kPa
Communal Area	4 kPa
Stairs	4 kPa
Roof	0.25 kPa (0 for seismic combination)
Deflection Criteria	
ULS Deflection Limit (%)	2.5% ULS lateral
Reason for Limit	Based on 1170.5.

Material Properties:				
Material Rename material as appropriate		**Design Strength (MPa)**	**Strength Mod Factor**	**Assessment Strength (MPa)**
Reinforcement	Plain or Deformed bars?	Deformed (with some plain stirrups)		
	High Tensile (HT)			
	Medium Tensile (MT)			

	Mild Steel (MS)	228	1.25	280 (fu = 475)
Concrete	Foundations	25	1.5	40
	Slab on Grade	25	1.5	40
	Shear Walls	25	1.5	40
	Columns	25	1.5	40
	Beams	25	1.5	40
Structural Steel	Beams	247	1.15	284
	Columns	247	1.15	284
	CHS	247	1.15	284
	Plate	247	1.15	284
	Other members	247	1.15	284
Bolts				fy=240, fu=400
Weld Strength				fu=410

Stiffness Reduction Factors in ETABS software:

Columns Lower floors	0.5
Columns Upper floors	0.5
Beams	0.4
Walls	0.35
Diaphragms	0.25

Foundation Assessment Criteria:

Geotechnical Report Available?	Yes, 2022 AECOM desktop study
Foundation type:	Strip footings with RC piles
Soil type:	Class C
Geotechnical Investigation:	None, recommended if strength is limited by piles
Ult. Bearing Pressure:	300 kPa
Sliding Resistance:	The friction angle and sliding will be determined if required (pile failure)

Pending Code/Guideline Changes to Take into Account :

Are there any upcoming code changes to take into account?

Updated parts method may be considered.

Kick-off Meeting:

Record minutes of the kick off meeting here, including key actions for people

Task / Note	Actioned By Who?
SlaMA agreed to be not applicable for this building due to significant irregularities (plan and vertical) and transfer structures.	Taine – Update the initial review form
ETABS model decided to be of high importance, RSA should be run to assess the demands on the piles early in the process.	Taine – Update the initial review form
Deformation/rotation capacity of key elements should be assessed.	Taine – Update the initial review form
PR submittals to be: 1. Initial form, 2. Loading, 3. Model, 4. 90% completion including capacity calculations, 5. Report.	All

Additional Project-Specific Issues to take into account

E.g. Beam elongation, non-ductile mesh connection, minimal flexural steel, fracture issues, eccentric floor plate, bar anchoring, insufficient seating, unusual site characteristics, poor detailing

- Shear wall step change/transfer structures
- Shear wall openings
- Torsion
- External Link Bridge supported by Block A.
- Cast in-situ walls/flange effect.
- Elevator Core wall.

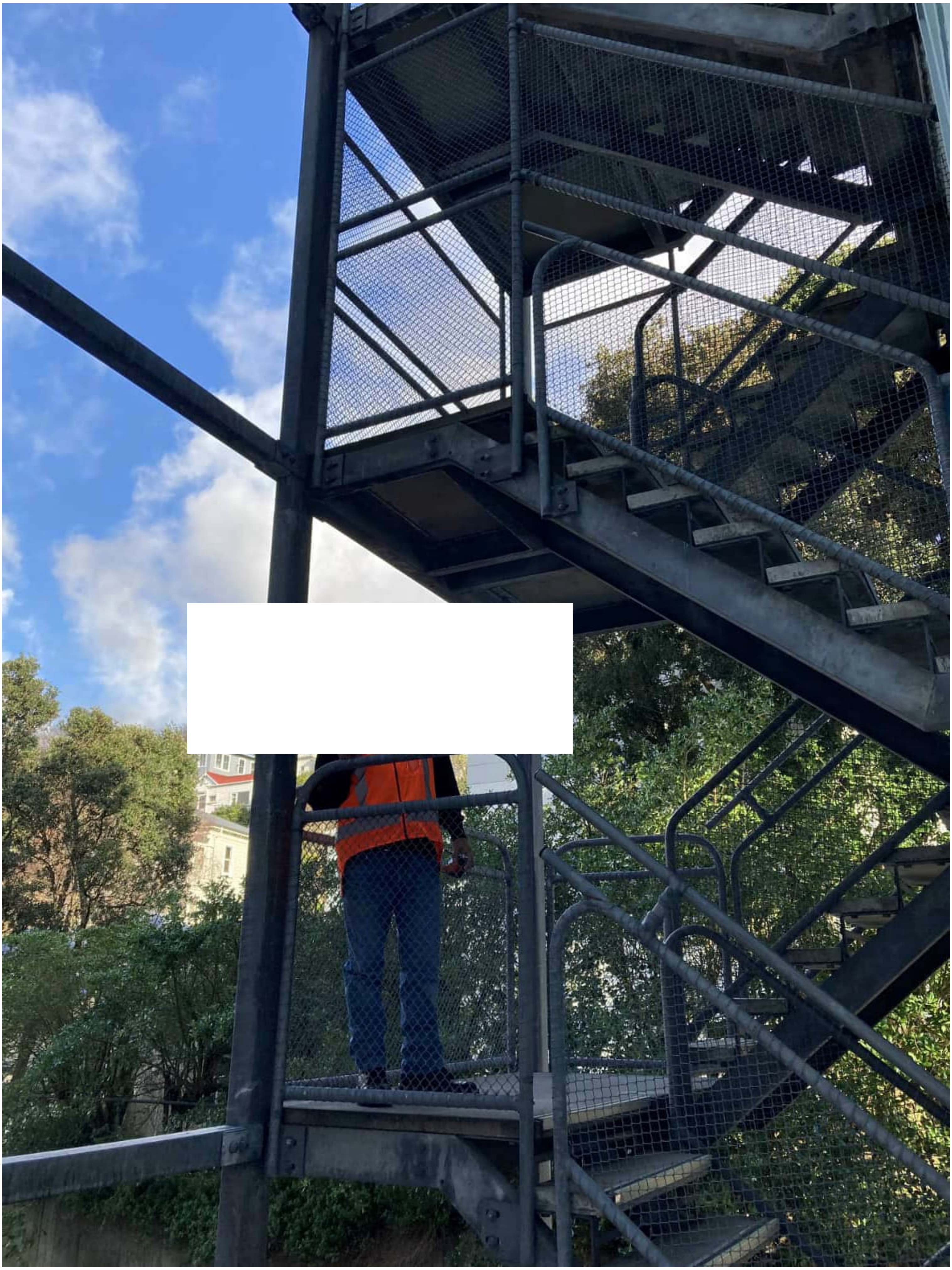
Additional Project-Site Investigation Scope

Issued by	**Date**	**Notes**
AECOM	17/01/2024	Issue for review
AECO<	19/01/2024	Issue for review following kick-off

Appendix D

Photographs from Inspection


Rits



[redacted]


Apartments
A

[redacted]


C

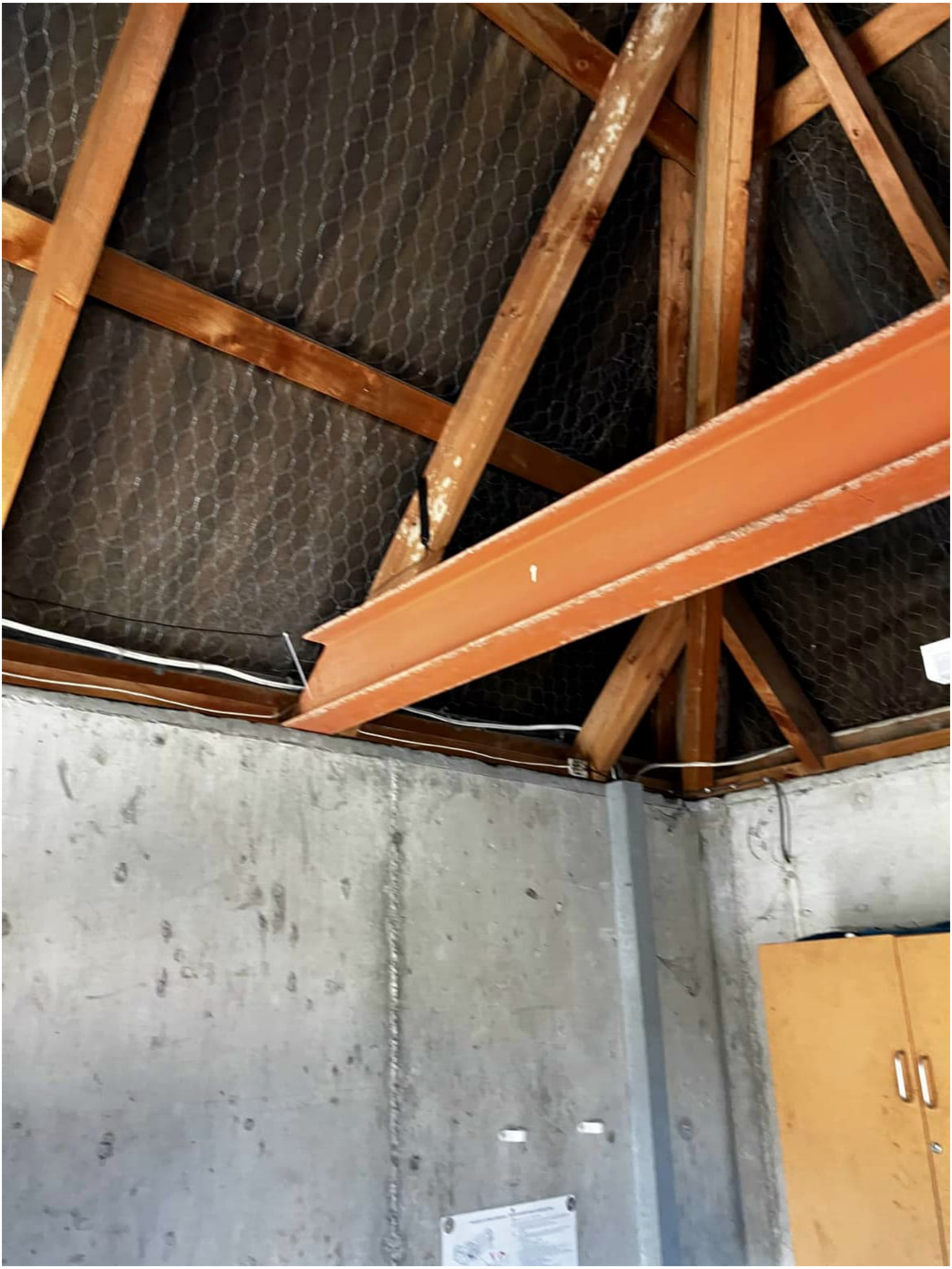

EXIT
EXIT

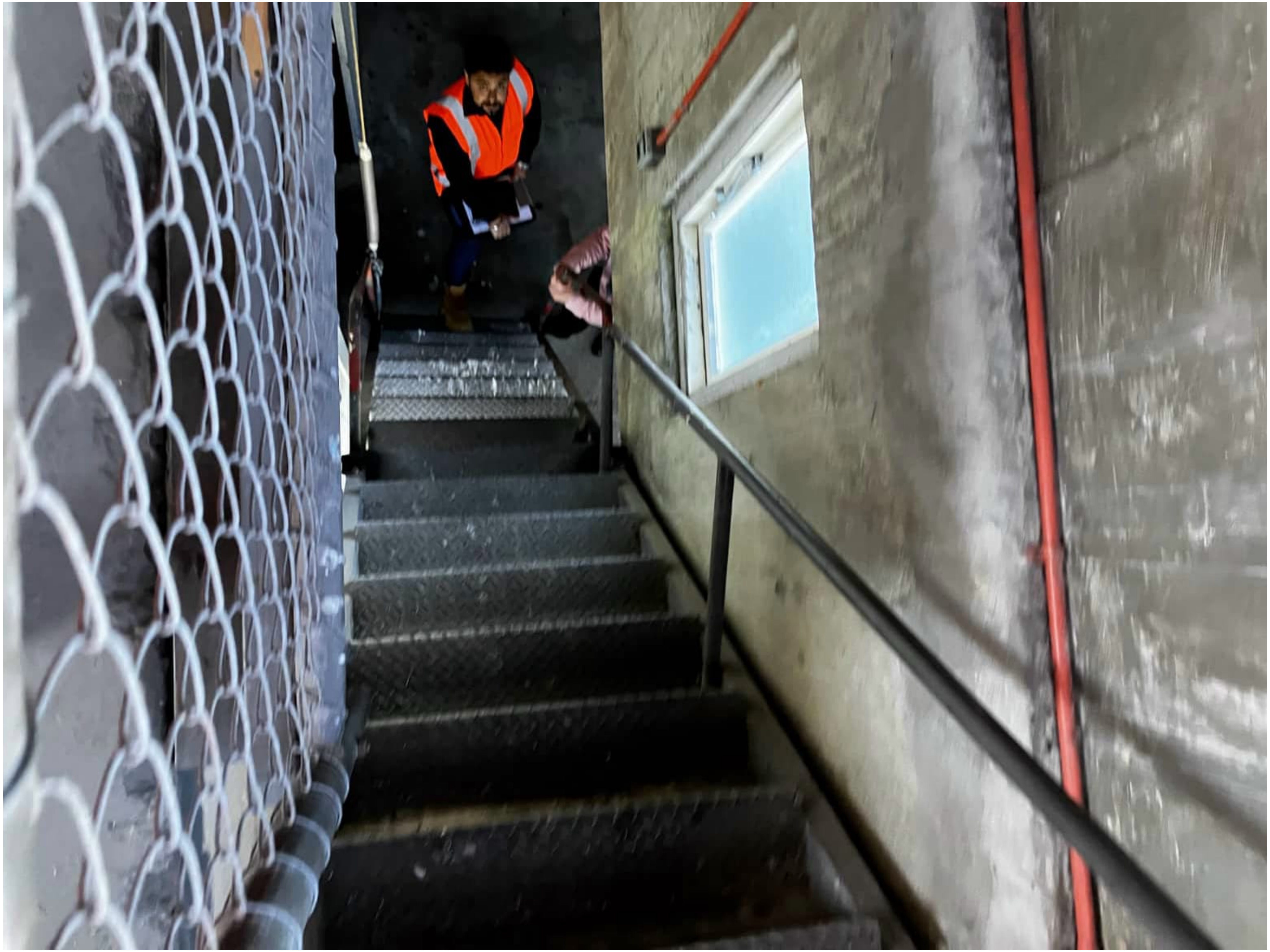
[redacted]

[redacted]

[redacted]


5





Appendix E

Geotechnical Report

AECOM

AECOM New Zealand Limited
121 Rostrevor Street
Kirikiriroa|Hamilton 3204
PO Box 434, Waikato MC
Kirikiriroa|Hamilton 3240
New Zealand
www.aecom.com

+64 7 834 8980 tel
+64 7 834 8981 fax

Memorandum

To

Page 1

CC

Subject Brooklyn Geotechnical Information

From

File/Ref No. 60723635 - WCC HUP2 T0 Seismic

Date 16-Feb-2024

Hi Taine,

Below is a table giving end bearing and skin friction values for the piles Brooklyn Road.

Vsu = Skin Friction

Vb = End Bearing

Groundwater has been assumed to be 2.0m below ground level.

Block A

Depth	ɣ'	ɣ'	c'	Ø'	Undrained		Drained	
					V_{su}	V_{bu}	V_{su}	V_{bu}
m RL	kN/m^3	kN/m^3	kPa	°	kN	kN	kN	kN
0	18	18	1	28	0	0	0	12
1	18	18	1	28	0	0	7	89
2	18	8	1	28	0	0	20	167
3	18	8	3	30	54	88	39	264
4	18	8	3	30	109	88	64	311
5	20	10	5	35	160	176	98	801
6	20	10	5	35	211	176	140	927
7	21	11	10	38	283	338	199	1779
8	23	13	20	38	437	720	285	2071
9	23	13	20	38	591	720	401	2342
10	23	13	20	38	745	720	545	2613
11	23	13	20	38	899	720	717	2884
12	23	13	20	38	1053	720	919	3155
13	23	13	20	38	1207	720	1148	3425
14	23	13	20	38	1361	720	1407	3696
15	23	13	20	38	1515	720	1694	3967

Tension Capacity: 437 kN
Compression Capacity: 1157 kN
Spring (tension) = 17480 kN/m
Spring (compression) = 46280 kN/m

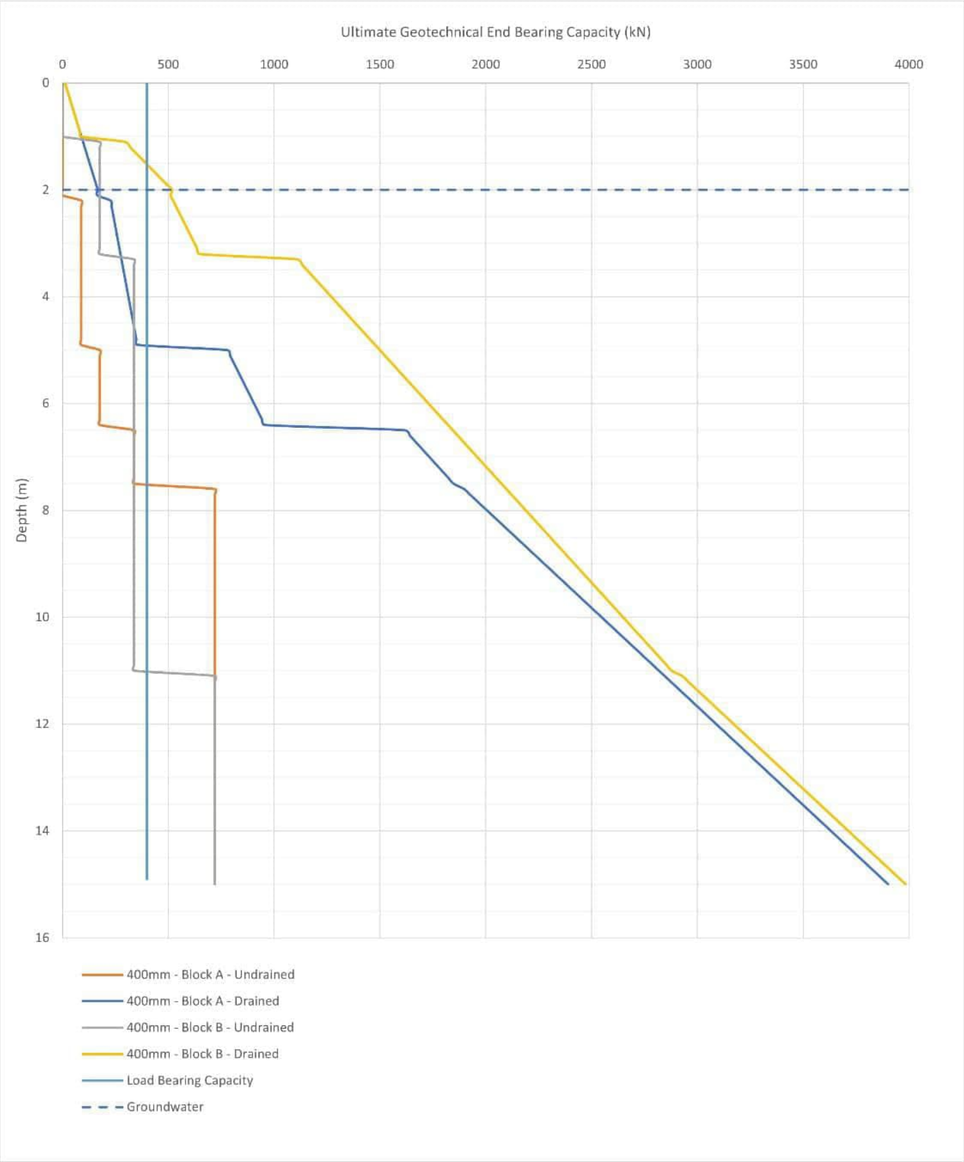
Block B

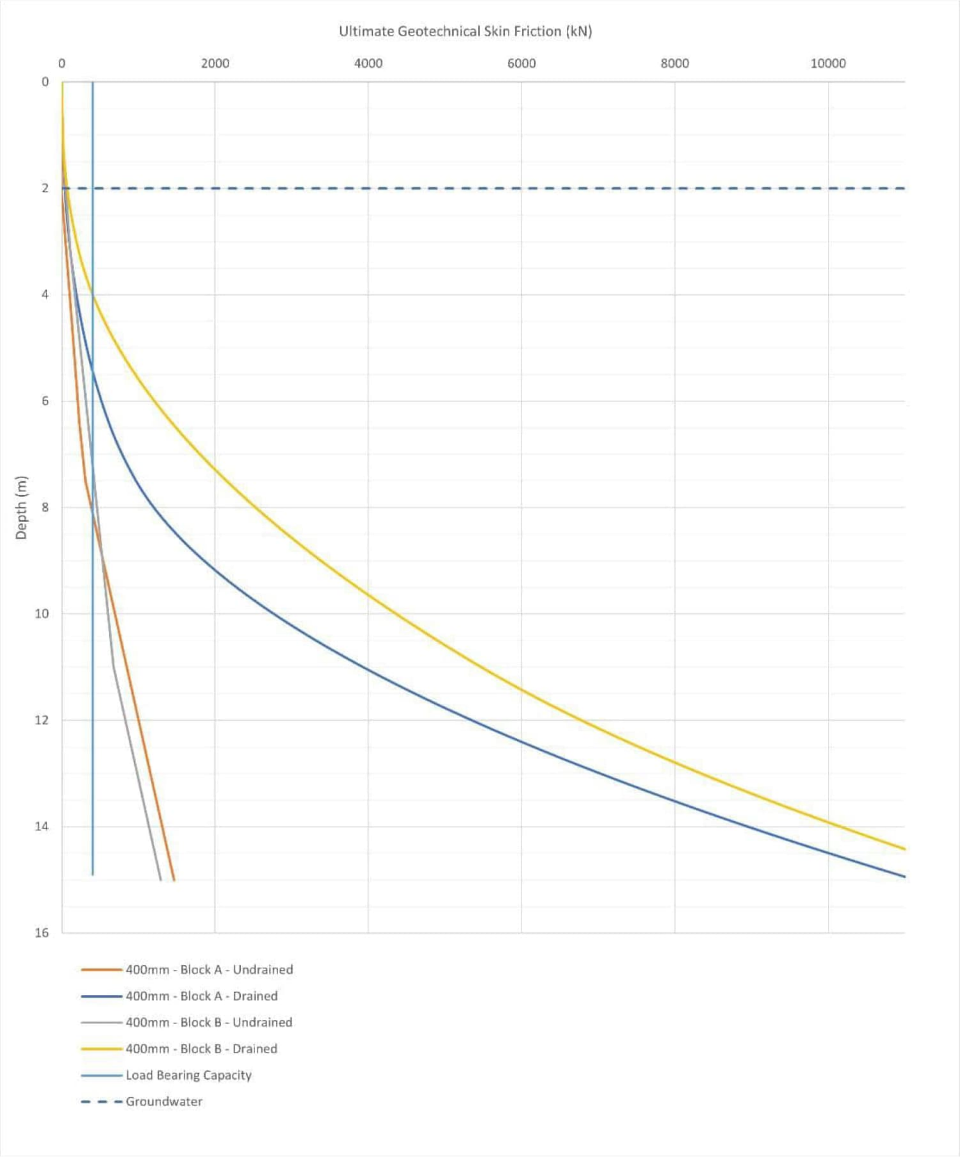
Depth	ɣ'	ɣ'	c'	Ø'	Undrained		Drained	
					V_{su}	V_{bu}	V_{su}	V_{bu}
m RL	kN/m^3	kN/m^3	kPa	°	kN	kN	kN	kN
0	18	18	1	28	0	0	0	12
1	18	18	3	30	54	88	10	122
2	20	10	5	35	106	176	31	518
3	20	10	5	35	157	176	61	623
4	21	11	10	38	229	338	107	1274
5	21	11	10	38	301	338	168	1504
6	21	11	10	38	374	338	245	1734
7	21	11	10	38	446	338	337	1963
8	21	11	10	38	518	338	445	2193
9	21	11	10	38	590	338	568	2423
10	21	11	10	38	663	338	707	2653
11	21	11	10	38	735	338	861	2882
12	23	13	20	38	889	720	1044	3175
13	23	13	20	38	1043	720	1256	3446
14	23	13	20	38	1197	720	1496	3717
15	23	13	20	38	1351	720	1764	3988

A graphical representation of the end bearing and skin friction is provided below.

Given that groundwater is shallow, I recommend using the undrained values.

Tension Capacity: 518 kN
Compression Capacity: 856 kN
Spring (tension) = 20720 kN/m
Spring (compression) = 34240 kN/m


Ultimate Geotechnical End Bearing Capacity (kN)
0
500
1000
1500
2000
2500
3000
3500
4000
Depth (m)
0
2
4
6
8
10
12
14
16
400mm - Block A - Undrained
400mm - Block A - Drained
400mm - Block B - Undrained
400mm - Block B - Drained
Load Bearing Capacity
Groundwater


Ultimate Geotechnical Skin Friction (kN)
0
2000
4000
6000
8000
10000
Depth (m)
0
2
4
6
8
10
12
14
16
400mm - Block A - Undrained
400mm - Block A - Drained
400mm - Block B - Undrained
400mm - Block B - Drained
Load Bearing Capacity
Groundwater

AECOM

60723635-CAL-LC-0001 Calculation Sheet

Ground Engineering and Tunnelling (GET) Team

REFERENCE CALC SHEET: 60723635-CAL-LC-0001

TITLE: Calculation Sheet

PURPOSE: Determination of horizontal and vertical soil springs

SUMMARY RESULTS

Vertical springs have been calculated for all shallow foundations.

The values provided have not been adjusted to take into consideration allowable settlement.

All spring values are unfactored.

Material	Depth (m)		Horizontal Springs; k (kN/m^3 per m)		
	From	To	Static Design; k	Siesmic Design; k	
				Cyclic	Liquefaction
FILL	0.0	2.2	61614	123228	14
PLEISTOCENE ALLUVIUM	2.2	5.0	105624	211249	32
CW GREYWACKE	5.0	6.5	211249	422498	47
HW GREYWACKE	6.5	7.5	404894	809787	57
MW GREYWACKE	7.5	15.0	862599	1725199	124

VERSION HISTORY:

Version	Date	Initiated by	Reviewed by	Approve to Use	Notes
A	7/02/2024	JG	JC		

REFERENCES:

DISCLAIMER:

This spreadsheet should only be "Authorised for Use" after written approval from both the Reviewer and GET Team Manager. The design document register should be updated to the correct version of this spreadsheet along with the name of the reviewer and approving manager. At no point the name of the reviewer or the approval enterered in the sheet regsister prior to "Authorised for Use".

Project :	WCC HUP2 DSA - 4 Brooklyn Rd		Job Number:	60723635	
Filer/Ref No.:	Calc Sheet	Revision: A	Calculated by: JG	Date:	7/01/2024
Subject:	Soil Springs Assessment		Checked by: JC	Date:	

Horizontal Springs

Method	Static Design; k		Siesmic Design; k	
			Cyclic	Liquefaction
1	E_{50}/D	(kN/m^3)	2 x k	(0.05 to 0.01) x k
2	1000 x (56 x N(100 x D)$^{-3/4}$)	(kN/m^3)	2 x k	(0.05 to 0.01) x k
P_{limit}	0.5 x P_u	(kN/m)	P_u	$P_{L\text{-}max}$

E_{50} = 0.5 x E_i E_s = 600 x Cu (kPa) Cohesive Soil (Pender 1993)

D = Pile Diameter = 3000 x N (kPa) Non-cohesive soil

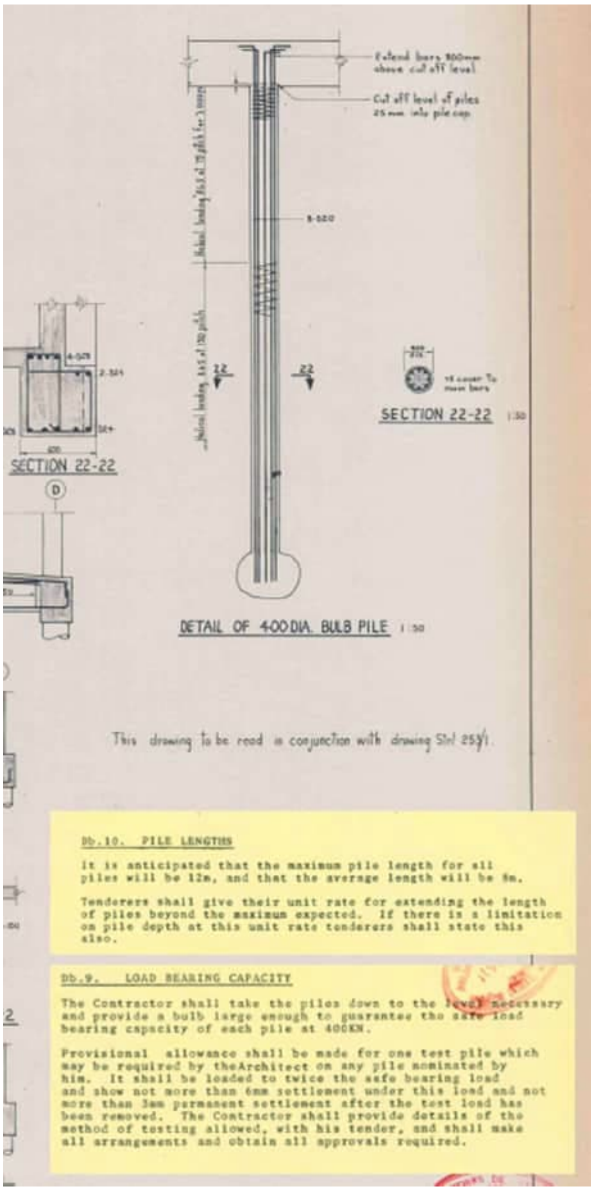
P_u = (6 to 9) x Cu x D (kN/m) Cohesive Soil (Pender 1993)

= (3 to 5) x kp x ɣ x H x D (kN/m) Non-cohesive soil

Cu_{Liq} = 0.09 x σ_v' (kPa) (Olson & Stark 2002)

$P_{L\text{-}max}$ = Cu_{Liq} x D (kN/m)

Site Details



This drawing to be read in conjunction with drawing Str! 25^3/1.

Db.10. PILE LENGTHS

It is anticipated that the maximum pile length for all piles will be 12m, and that the average length will be 8m.

Tenderers shall give their unit rate for extending the length of piles beyond the maximum expected. If there is a limitation on pile depth at this unit rate tenderers shall state this also.

Db.9. LOAD BEARING CAPACITY

The Contractor shall take the piles down to the level necessary and provide a bulb large enough to guarantee the safe load bearing capacity of each pile at 400KN.

Provisional allowance shall be made for one test pile which may be required by theArchitect on any pile nominated by him. It shall be loaded to twice the safe bearing load and show not more than 6mm settlement under this load and not more than 3mm permanent settlement after the test load has been removed. The Contractor shall provide details of the method of testing allowed, with his tender, and shall make all arrangements and obtain all approvals required.

AECOM

60723635-CAL-LC-0001 Calculation Sheet

Ground Engineering and Tunnelling Team

Project : WCC HUP2 DSA - 4 Brooklyn Rd
Filer/Ref No.: Calc Sheet
Revision: A
Subject: Soil Springs Assessment

Job Number: 60723635
Calculated by: JG
Date: 7/01/2024
Checked by: JC
Date: 0/01/1900

Depth (m)	Geological Description	Test Records	Cu (kPa)	Density (kN/m^3)	Phi (deg)	E_s (kPa)	Poissons Ratio
GL GW (m bgl): 2.2	FILL: Sandy gravelly CLAY, soft to firm.	Mean SPT; N = 12	35	18	28	5000	0.30
2.2	Pleistocene Alluvium: Sandy SILT, firm.	Mean SPT; N = 7	60	18	30	15000	0.3
5.0	CW Greywacke: Sandy SILT, very stiff	Mean SPT; N = 27	120	20	35	50000	0.3
6.5	HW Greywacke: Sandy SILT, very stiff	Mean SPT; N = 50	230	21	38	75000	0.3
7.5	MW Greywacke: Sandy SILT, very stiff	Mean SPT; N = >50	490	23	38	100000	0.2
>15							

60723635-CAL-LC-0001 Calculation Sheet

Ground Engineering and Tunnelling Team

Project :	WCC HUP2 DSA - 4 Brooklyn Rd		Job Number:	60723635	
Filer/Ref No.:	Calc Sheet	Revision: A	Calculated by:	JG	Date: 7/01/2024
Subject:	Soil Springs Assessment		Checked by:	JC	Date: 0/01/1900

Horizontal Springs

Material	Static Design; k					Siesmic Design; k	
						Cyclic 2 x k_{static}	Liquefaction (0.05 to 0.01) x k_{Liq}
0.0	**k**	=	1000 x (56 x N(100 x D)$^{-3/4}$)	=	**61614 kN/m^3 per m**	**123228 kN/m^3**	**14 kN/m^3**
	Cu	=	35 kPa				
	N	=	17.5	D =	0.4 m		
	σ_v'	=	ɣ x H = 18 kN/m^3 x 2.2 m	=	40 kPa		
	Cu_{Liq}	=	0.09 x σ_v' kPa	=	3.6 kPa		
FILL	E_{uLiq}	=	400 x Cu_{Liq} KPa	=	1426 kPa		
	P_{limit}	=	0.5 x P_u	=	**12 KN/m**	Siesmic Design; P	
	P_u	=	3 x kp x ɣ x D x B	D =	0.4 m	Cyclic	Liquefaction
	ϕ	=	28 deg	kp =	2.77	P_u	P_{L-max}
	ɣ	=	18 kN/m^3	B =	0.4 m		(Cu_{Liq} x D)
2.2	Cu_{Liq}	=	0.09 x σ_v' kPa	=	3.6 kPa	**24 kPa**	**1.4 kPa**

Material	Static Design; k					Siesmic Design; k	
						Cyclic 2 x k_{static}	Liquefaction (0.05 to 0.01) x k_{Liq}
2.2	**k**	=	1000 x (56 x N(100 x D)$^{-3/4}$)	=	**105624 kN/m^3 per m**	**211249 kN/m^3**	**32 kN/m^3**
	Cu	=	60 kPa				
	N	=	30	D =	0.4 m		
	σ_v'	=	ɣ x H = 18 kN/m^3 x 5.0 m	=	90 kPa		
	Cu_{Liq}	=	0.09 x σ_v' kPa	=	8.1 kPa		
PLEISTOCENE ALLUVIUM	E_{uLiq}	=	400 x Cu_{Liq} KPa	=	3240 kPa		
	P_{limit}	=	0.5 x P_u	=	**13 KN/m**	Siesmic Design; P	
	P_u	=	3 x kp x ɣ x D x B	D =	0.4 m	Cyclic	Liquefaction
	ϕ	=	30 deg	kp =	3.00	P_u	P_{L-max}
	ɣ	=	18 kN/m^3	B =	0.4 m		(Cu_{Liq} x D)
5.0	Cu_{Liq}	=	0.09 x σ_v' kPa	=	8.1 kPa	**26 kPa**	**3.2 kPa**

Material	Static Design; k					Siesmic Design; k	
						Cyclic 2 x k_{static}	Liquefaction (0.05 to 0.01) x k_{Liq}
5.0	**k**	=	1000 x (56 x N(100 x D)$^{-3/4}$)	=	**211249 kN/m^3 per m**	**422498 kN/m^3**	**47 kN/m^3**
	Cu	=	120 kPa				
	N	=	60	D =	0.4 m		
	σ_v'	=	ɣ x H = 20 kN/m^3 x 6.5 m	=	130 kPa		
	Cu_{Liq}	=	0.09 x σ_v' kPa	=	11.7 kPa		
CW GREYWACKE	E_{uLiq}	=	400 x Cu_{Liq} KPa	=	4680 kPa		
	P_{limit}	=	0.5 x P_u	=	**18 KN/m**	Siesmic Design; P	
	P_u	=	3 x kp x ɣ x D x B	D =	0.4 m	Cyclic	Liquefaction
	ϕ	=	35 deg	kp =	3.69	P_u	P_{L-max}
	ɣ	=	20 kN/m^3	B =	0.4 m		(Cu_{Liq} x D)
6.5	Cu_{Liq}	=	0.09 x σ_v' kPa	=	11.7 kPa	**35 kPa**	**4.7 kPa**

Material	Static Design; k					Siesmic Design; k	
						Cyclic 2 x k_{static}	Liquefaction (0.05 to 0.01) x k_{Liq}
6.5	**k**	=	1000 x (56 x N(100 x D)$^{-3/4}$)	=	**404894 kN/m^3 per m**	**809787 kN/m^3**	**57 kN/m^3**
	Cu	=	230 kPa				
	N	=	115	D =	0.4 m		
	σ_v'	=	ɣ x H = 21 kN/m^3 x 7.5 m	=	158 kPa		
	Cu_{Liq}	=	0.09 x σ_v' kPa	=	14.2 kPa		
HW GREYWACKE	E_{uLiq}	=	400 x Cu_{Liq} KPa	=	5670 kPa		
	P_{limit}	=	0.5 x P_u	=	**21 KN/m**	Siesmic Design; P	
	P_u	=	3 x kp x ɣ x D x B	D =	0.4 m	Cyclic	Liquefaction
	ϕ	=	38 deg	kp =	4.20	P_u	P_{L-max}
	ɣ	=	21 kN/m^3	B =	0.4 m		(Cu_{Liq} x D)
7.5	Cu_{Liq}	=	0.09 x σ_v' kPa	=	14.2 kPa	**42 kPa**	**5.7 kPa**

Material	Static Design; k					Siesmic Design; k	
						Cyclic 2 x k_{static}	Liquefaction (0.05 to 0.01) x k_{Liq}
7.5	**k**	=	1000 x (56 x N(100 x D)$^{-3/4}$)	=	**862599 kN/m^3 per m**	**1725199 kN/m^3**	**124 kN/m^3**
	Cu	=	490 kPa				
	N	=	245	D =	0.4 m		
	σ_v'	=	ɣ x H = 23 kN/m^3 x 15.0 m	=	345 kPa		
	Cu_{Liq}	=	0.09 x σ_v' kPa	=	31.1 kPa		
MW GREYWACKE	E_{uLiq}	=	400 x Cu_{Liq} KPa	=	12420 kPa		
	P_{limit}	=	0.5 x P_u	=	**23 KN/m**	Siesmic Design; P	
	P_u	=	3 x kp x ɣ x D x B	D =	0.4 m	Cyclic	Liquefaction
	ϕ	=	38 deg	kp =	4.20	P_u	P_{L-max}
	ɣ	=	23 kN/m^3	B =	0.4 m		(Cu_{Liq} x D)
15.0	Cu_{Liq}	=	0.09 x σ_v' kPa	=	31.1 kPa	**46 kPa**	**12.4 kPa**

Client	WCC HUP2 DSA		
Jon Number	60723635		
Task Number			
Site Location			
Created by		Date	2-Feb-24
Checked by		Date	

Lateral Capacity of Piles in Uniform Clay (Constant Undrained Shear Strength)

Pile Properties

Material Grade		Reinforced Concrete	
Yield Stress	Fy:	240	MPa

Pile Dimension

Pile Head		Restricted	
Diameter of Pile Shaft	Ds:	0.4	m
Wall Thickness	t:	0	m
Cross Section Area	A:	0.13	m^2
Modulus of Section	S:	6.28E-03	m^4
Length of Pile Shaft	L:	8	m
Ultimate Moment Strength of Pile Shaft	M_{ult}:	103.00	kN.m

Important Note: Auto calculated cell. But It should be checked and verified with structural engineers. Directly put what you get from ST engineer into the cell.

Geometry

Distance above Ground	f:	0	m
Unsupported Pile Length	fo:	0.6	m

Soil Properties

Undrained Shear Strength	Cu:	60	kPa

Weighted average based on axial pile design

B1/VM4 Section 4.3.2

SHORT PILE

Ultimate Lateral Strength	H_u:	1598	kN
Maximum Moment	M_{max}:	6873	kN.m

Intermediate/Long Pile - Go to the next stage of the calculation

INTERMEDIATE PILE

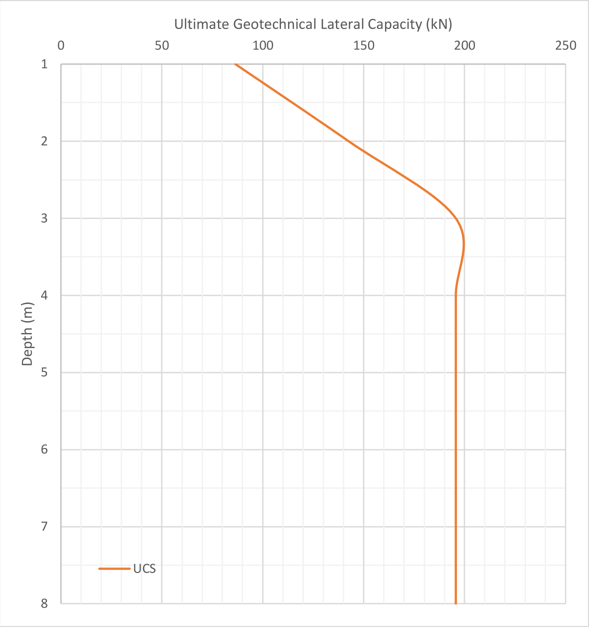
For Restricted Pile Head Only

Ultimate Lateral Strength	H_u:	611	kN
Maximum Moment	M_{max}:	1128	kN.m

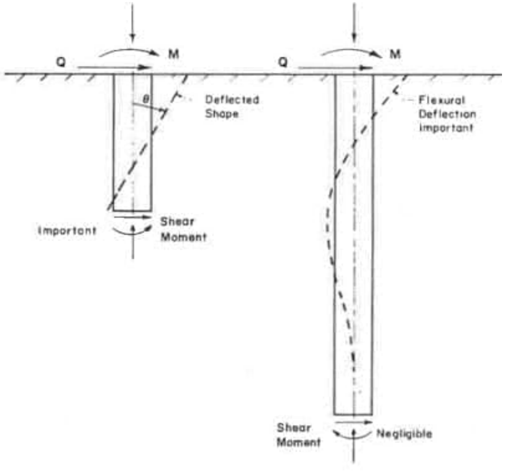
Long Pile - Go to the next stage of the calculation

LONG PILE

Ultimate Lateral Strength	H_u:	196	kN



Pile Length	Ultimate Lateral Capacity
1	86.40
2	142.55
3	195.65
4	195.65
5	195.65
6	195.65
7	195.65
8	195.65



a) Rigid (Short) b) Flexible (Long)

4 Brooklyn Road, Aro Valley

Geotechnical Desktop Study Report

09-Aug-2022

Summary of Geotechnical Findings

Ground Conditions	
Subsoil Classification as per NZS 1170.5:2004	C (shallow soil)
Water Table Depth	2-3 m below existing ground level
Inferred Ultimate Bearing Capacity	N/A (founded on piles)
Indicated Ultimate Pile Capacity (compression)	800 kN
Geotechnical Hazard Risk	
Liquefaction	Low
Lateral Spreading	Low
Slope Instability	Low

The buildings are indicated to be found on strip footings and piles which extend approximately 10 m below existing ground level. Ultimate bearing and pile capacities are based on geological and engineering principals and information presented within the drawings/specification. A site subsoil class of C (shallow soil) is recommended based on the depth to rock >1 MPa.

If analysis shows the indicated pile capacities are insufficient it is recommended site-specific investigations are used to verify likely pile capacities and lengths. Site investigations are also recommended if foundation loads increase as a result of strengthening work. Investigations are recommended to comprise of machine boreholes situated along the buildings' length.

1.0 Introduction

Wellington City Council (WCC) has engaged AECOM New Zealand Limited (AECOM) to undertake structural and geotechnical seismic assessments on a portfolio of buildings across Wellington City as a part of the WCC Housing Upgrade Project 2 programme. A Detailed Seismic Assessments (DSA) was previously undertaken by Romulus Consulting Group (Romulus) in 2008. The objective of a DSA is to assess the likely seismic behaviour of a building in terms of percentage of New Building Standard (%NBS) and provide recommendations for seismic strengthening of the building, if required.

This report summarises the geotechnical desktop study for 4 Brooklyn Road, Aro Valley including potential geotechnical hazards and site subsoil class. This desktop study report is intended to form an appendix to the structural DSA.

1.1 Scope of work

This report serves to summarise the following:

- historical aerial imagery
- published geological maps for the site
- Geological and Nuclear Sciences (GNS) Active Fault database

- assessment of any relevant publicly available ground investigation or geotechnical data within the vicinity of the site
- existing geotechnical assessments
- anticipated ground conditions and bearing capacities
- initial assessment of the site subsoil class based on NZS1170.5:2004 and in accordance with recent technical publications
- initial high-level geological hazard identification including liquefaction, lateral spreading, and slope instability at the site
- recommendation of geotechnical investigations where required.

2.0 Site Information

2.1 Site Layout and Foundation System

The site is located at 4 Brooklyn Road, Aro valley, Wellington on a 6960 m^2 site. The site is bound by Ohiro road to the west, Willis Street to the east, Aro Street to the north and residential dwellings to the South.

Block A is an eight-storey building situated in the south-eastern corner of the site. The lift core which links the two wings of the building is slightly higher having 11 levels. The wings of the building is approximately 26 m long and 6 m wide. The lift core is 6.7 m wide and 8.1 m long.

Block B is predominately a four-storey building, however a fifth storey is present above a small portion of the building. The building and located along the southern perimeter of the site. The building is approximately 24m long and 6 m wide.

Block C comprises of two rectangular three-storey buildings, approximately 20 m long and 6.5 m wide. The buildings are separated by a seismic gap. Block C is connected to Block D which is irregularly shaped and approximately 13.5 m long and 6.5 m wide. Blocks C and D are situated along the eastern perimeter of the site.

Block E is a two-storey building and roughly rectangular. The building is situated along the western perimeter of the site and 39 m long and 7 m wide.

All of the buildings are indicated to be founded on strip footings and 400 mm diameter reinforced concrete piles. Approximately 30% of the site is occupied by buildings, with the remainder comprising of grassed areas and car parking as indicated in Figure 1.

A cantilevered reinforced concrete retaining wall is situated along the southern perimeter of the site and indicated to be up to 5.65 m high. The retaining walls are indicated to have a backslope varying between 0-20° and retain the neighbouring properties.

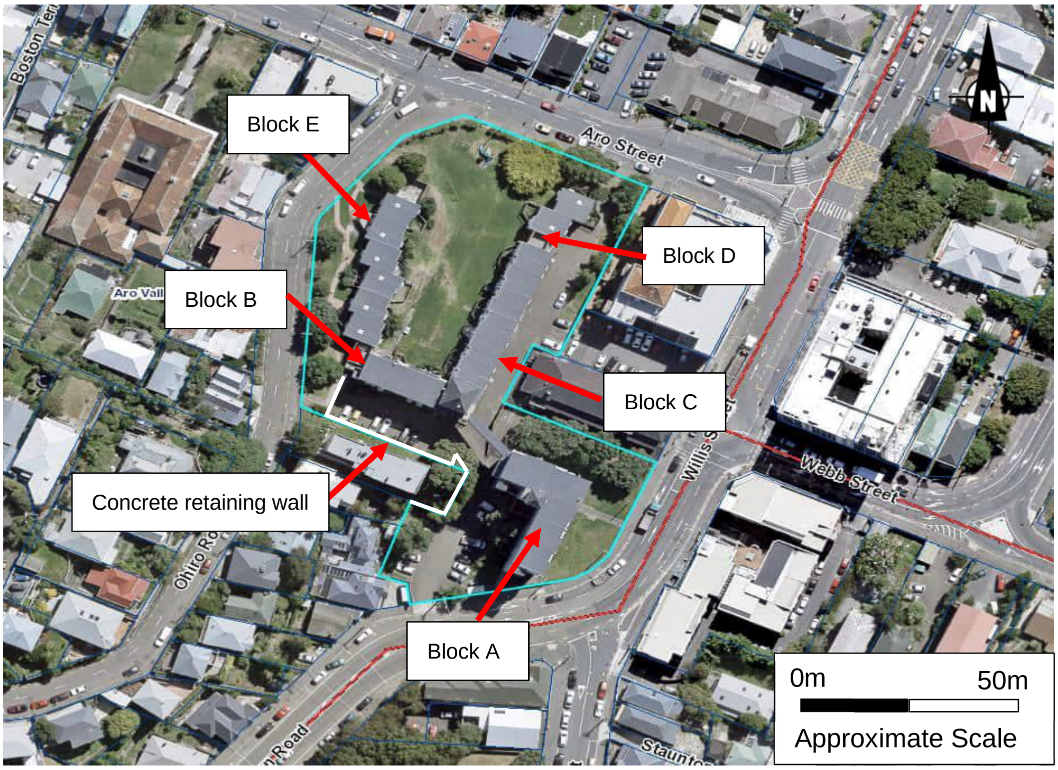
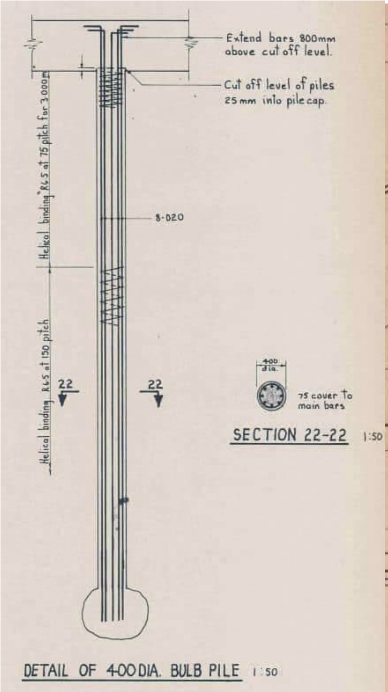
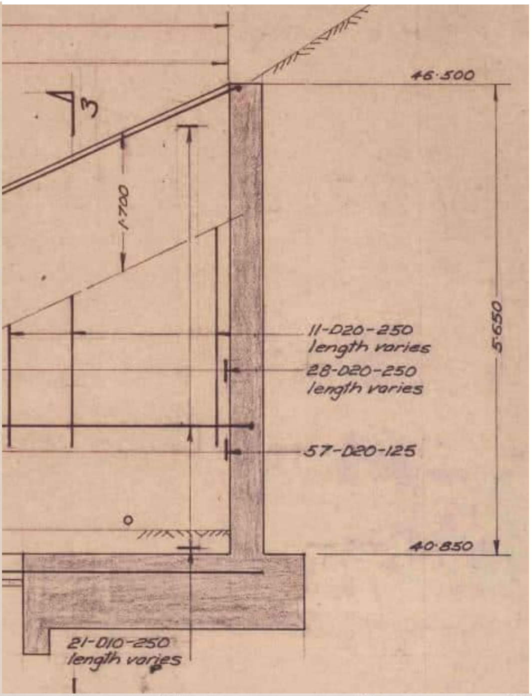
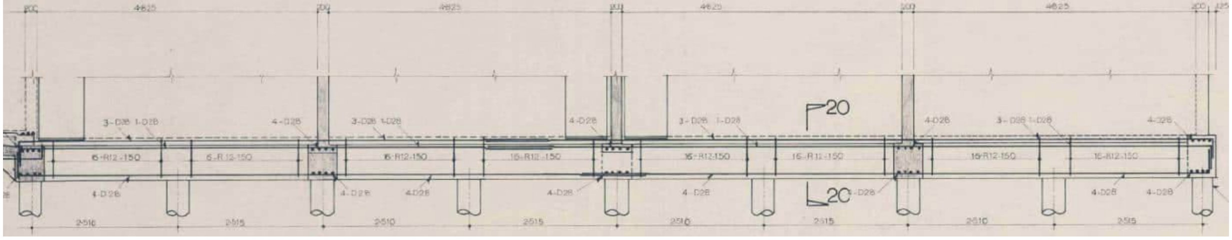


Figure 1 Site and surrounding area







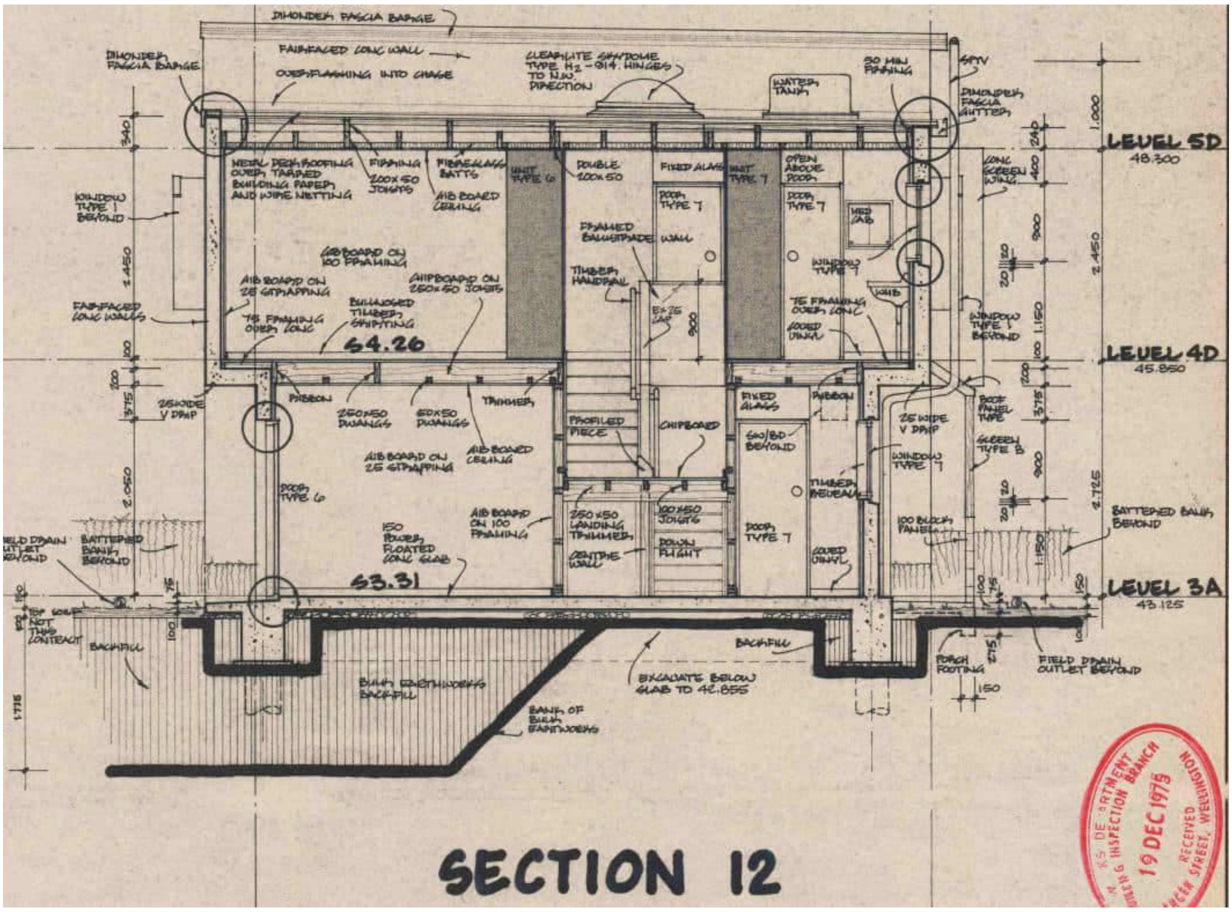


Figure 2 Typical foundation drawings

3.0 Historic Aerial Imagery

Aerial photographs were reviewed from the Retrolens[1] aerial photograph database and recent satellite imagery available on Google Earth[2]. Aerial photographs taken between 1938 and 2022 were reviewed. A summary of the findings is presented in Table 1 below.

Table 1 Aerial photograph review

Aerial Photography Review	
1938	The majority of the site appears to be vacant with small residential dwellings situated along Ohiro Road and Willis Street to the west and east respectively. The vacant area appears to be grassed and used a recreational area.
1945	No significant changes observed within the site area. Another residential building is constructed towards the southern part.
1969-1974	Residential buildings along the Ohiro road are demolished.
1980	Blocks A, B,C,D and E are constructed.
Present	No notable changes to the site are identified since the building's construction.

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[1] Retrolens, 2022. Historical Image Resource. Retrieved August 2022. https://retrolens.co.nz/map/#/4%20Brooklyn%20Road,%20Aro Valley,%20Wellington,%206022

[2] Google Earth Pro, 2022. Google Earth Aerial Imagery, Retrieved August 2022.

4.0 Existing Information

4.1 Geological setting

The published 1:50,000 scale geological map of the area[3] indicates the western part of the site (Blocks B and E) to be underlain by Late Triassic basement rock comprising of interbedded sandstone and mudstone sequences (argillite) and collectively termed greywacke. Greywacke rock is often deeply weathered across the Wellington Region because of its Geological history. The remainder of the site is indicated to be underlain by Holocene alluvium.

An excerpt of the geological map is shown in Figure 3.

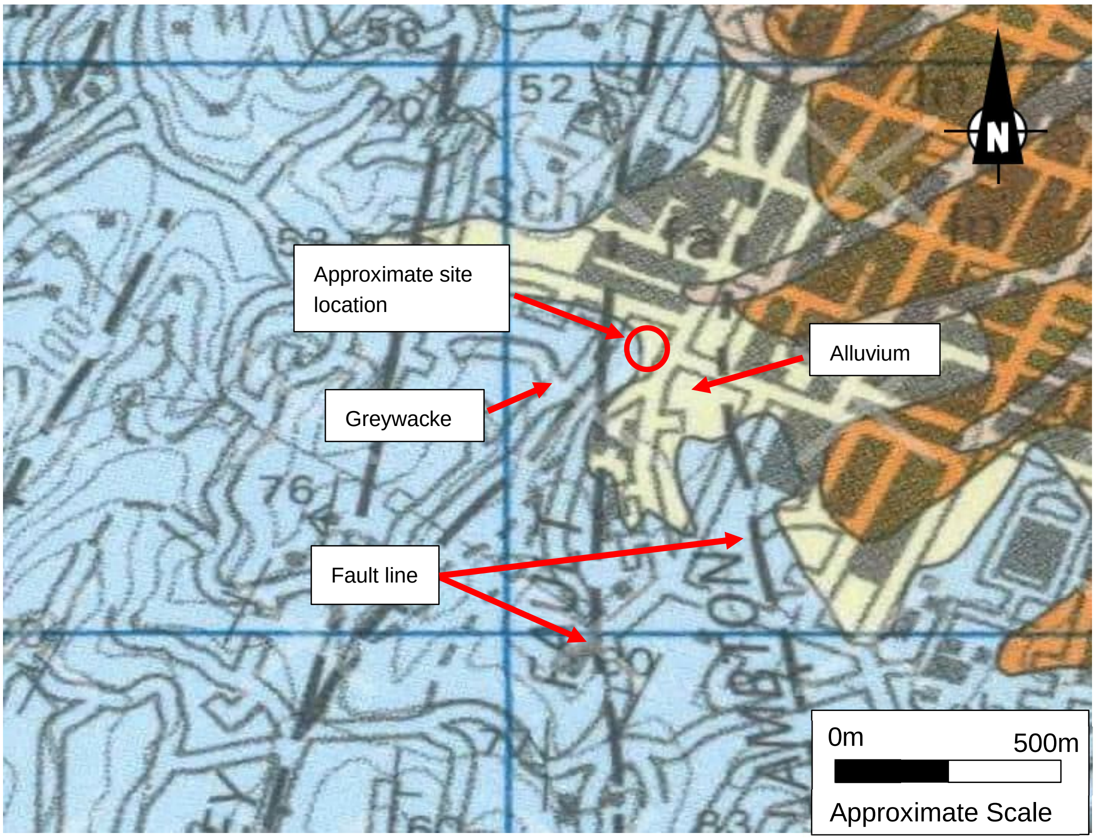

Figure 3 Geological map extract 1:50,000 (Begg & Mazengarb, 1996)

4.1.1 Geomorphological Mapping

GNS and WCC have produced a geomorphological map for the Wellington Region[4]. The map indicates the majority of the site (Blocks B, C, D and E) to be underlain by mixed fill, colluvium and rock. Block A is indicated to be underlain by mixed fill and colluvium. The boundaries indicated are approximate, however, still indicate rockhead to be at shallower depths towards the west. This change in rockhead is in general agreement with the geological map and relief of the surrounding area.

---

[3] Begg, J.G., Mazengarb, C., 1996. Geology of the Wellington area. Scale 1:50,000. Institute of Geological & Nuclear Sciences geological map 22. 1 sheet + 128 p. Institute of Geological & Nuclear Sciences Ltd., Lower Hutt, New Zealand

[4] Institute of Geological and Nuclear Sciences, 2022. GNS SLIDE Geomorphological Map. Retrieved August 2022.

Figure 4 Geomorphological map extract (GNS, 2022)

4.2 Geotechnical Investigations

4.2.1 Existing Nearby Data

Publicly available geotechnical investigations situated within 200 m of the site[5] are summarised below in Table 2. A site location plan and investigations indicated below are provided in Appendix A.

Table 2 Summary of geotechnical investigations within 200m of 4 Brooklyn Road

Investigation Reference	Source	Investigation Type	Depth (m bgl)	Date	Proximity to Site (m)
BH_144271	NZGD	Borehole	13.3	3/12/2008	95 S
BH_144270			11.8		
BH_144269			12.92	1/12/2008	125 SW
BH_174342			9.65	4/11/2021	185 SE
BH_106118			8.0	16/8/2001	200 E
BH_106103			17.3	14/9/2001	135 E
BH_106102			17.2	11/9/2001	140 NE
BH_106127			4.5	4/9/2001	150 NE
BH_106128			4.5	6/9/2001	155 NE
BH_106130			4.5	12/9/2001	140 NE
BH_106104			25.5	19/9/2001	160 ENE
BH_106124			4.0	29/8/2001	180 ENE

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[5] New Zealand Geotechnical Database, 2022. Retrieved August 2022. https://www.nzgd.org.nz/.

Investigation Reference	Source	Investigation Type	Depth (m bgl)	Date	Proximity to Site (m)
BH_106121			5.0	17/8/2001	195 ENE
BH_106123			4.0	27/8/2001	200 ENE
BH_106122			4.0	26/8/2001	200 ENE
Other_160782		Window sample	3.7	1/5/2020	140 W
Other_160781			5.0		140 W
Other_160780			4.0		145 W
DCP_160779		Dynamic cone penetration test[1]	4.6		130 W
Other_180921			4.8		130 W

Notes: 1) NZGD location revised based on relevant site location plan

4.2.2 Existing On-site Data

No site-specific geotechnical information is available for the site.

A bulk earthworks plan is provided in the architectural drawings (177/A/5). Shallow cut batters are indicated around the southern perimeter of Block A. Landscaping and recontouring of grassed areas are also indicated.

‘Major fill’ is indicated to be placed beneath Block E (up to approximately 1.8 m thick) and a shallow cut slope has been formed to the west of the building. Fill is also indicated to be placed to the east of Blocks C and D, however do not coincide with the building footprint.

Clause ca.6. of the specifications indicate over excavated areas were to be backfilled with ‘weak mix concrete.

The 400 mm diameter concrete piles are indicated to have a bulb comprising of compacted granular fill. The founding depths are indicated to have an average length of 8 m and a presumed maximum length of 12 m. The drawings and specification indicate piles were to be constructed to provide a safe working capacity of 400 kN. Axial pile testing (compression) is indicated to have taken place using a load of 800 kN.

5.0 Existing Geotechnical Assessment

Key geotechnical considerations discussed within the existing DSA are summarised below:

- The site was previously assumed to be site subsoil class C (shallow soil).
- No previous geotechnical reports/data is available.
- Pile were assumed to be 9.0 m long, as scaled from the drawings.
- The previous assessment for Block A, B and C indicates the buildings can resist 80% of NZS 1170.5:2004 seismic forces.
- The previous assessment for Block D and E indicates the buildings can resist 87% of NZS 1170.5:2004 seismic forces.

6.0 AECOM Geotechnical Assessment

6.1 Anticipated Ground Conditions

The inferred ground conditions, recommended ultimate bearing capacities and pile capacities are summarised in Table 3. These recommendations are based on the site history, geological map, geomorphological map, drawings, and geotechnical investigation data where available.

Table 3 Anticipated ground conditions beneath the buildings

Geological Unit	Depth to top (m bgl)	Thickness (m)	Soil Type	Ultimate Bearing Capacity (kPa)
Stabilised Fill / Granular Fill	0	0 - 1.8	Silty, sandy GRAVEL . Inferred dense to very dense. Weakly bound with cement beneath foundations where over-excavated.	300
Alluvium / Colluvium	0 – 1.8	5 - 12	Silt, gravel, sand and clay mixtures. Inferred loose to medium dense.	100
Completely to Highly Weathered Greywacke	Typically 8 m	-	Completely to highly weathered SANDSTONE/SILTSTONE. Inferred extremely weak to weak.	N/A Ultimate axial pile capacity (compression) indicated to be 800 kN

Notes: 1) Unsuitable soils are assumed to have been undercut as indicated in the structural foundation drawings

The ultimate bearing and pile capacities presented in Table 3 should be factored in accordance with the New Zealand Building Code B1/VM4 Table 1[6].

Lateral and tensile capacities of piles have not been assessed due to the uncertainties associated with ground conditions and pile lengths.

6.2 Groundwater

No onsite groundwater measurements are available. Based on the low-lying relief, elevation of the site and nearby investigations groundwater is expected to be encountered within 2-3 m depth from the current ground level.

It should be noted that groundwater levels at the site may fluctuate with changes in rainfall. Following heavy and/or prolonged rainfall, it may be possible for a perched groundwater level or transient flow to develop on clay interbeds.

6.3 Site Subsoil Classification

Highly weathered greywacke in the Wellington Region is typically extremely weak to very weak. In-situ testing and soil/rock descriptions from nearby investigations indicate a thick mantle of residual soil and completely weathered rock (extremely weak) on the hills west of the site.

Based on the indicated pile lengths and inferred ground conditions, rock with an unconfined compressive strength (UCS) greater than 1 MPa is expected to be encountered deeper than 3.0 m from existing ground level. This exceeds the class B (rock) requirements stipulated NZS1170.5:2004 clause 3.1.3[7]. Therefore, a site subsoil class of C (shallow soil) is recommended.

We recommend that if analysis indicates that strengthening of the structure is required, site-specific geotechnical investigations should be carried out prior to designing such strengthening works to verify ground conditions and pile capacities.

6.4 Geotechnical Hazards

6.4.1 Faulting

The closest active fault is the Wellington Fault which is a dextral strike slip fault located approximately 1.5 km west of the site[8]. The Wellington Fault is classed as one of the major fault systems of New

---

[6] Ministry of Business, Innovation and Employment, 2016. Acceptable Solutions and Verification Methods For New Zealand Building Code Clause B1 Structure.

[7] New Zealand Standard NZS1170.5, 2004. Structural Design Actions, Part 5: Earthquake Actions - Standards New Zealand, 2004

[8] Institute of Geological and Nuclear Sciences, 2022. New Zealand Active Fault Database. Retrieved August 2022. https://data.gns.cri.nz/af/

Zealand and capable of producing displacements on the order of 5 m horizontally and 1 m vertically during a single event. The fault has an average slip rate of approximately 6.3 mm/yr for the last 100 ka. Ninis et. al. (2013)[9] state that the Wellington Fault has experienced an increase in surface rupture activity between 10-8 ka and the last 4.5 ka. Studies of the fault have indicated the recurrence interval to be between 610-1500 years[10&11], with the last event occurring 300-500 years ago.

Numerous north-south trending faults are identified within 1 km of the site, however inferred to be inactive.

6.4.2 Slope Stability

The site is situated on relatively flat ground. Greater Wellington Regional Council web maps indicate the slope failure risk at the site to be low.

Based on the inferred ground conditions and shallow soil slopes the risk of slope instability affecting the foundation system is low.

6.4.3 Liquefaction

Greater Wellington Regional Council hazard maps indicate a low liquefaction risk for the site. The buildings are indicated to be supported on piles and inferred to be founded on weathered rock. In turn, the liquefaction risk at the site is considered to be low.

6.4.4 Lateral Spreading

Lateral spreading will only occur if both a shallow liquefiable layer exists, and sloping ground or an unsupported free face is within the vicinity of the site. Based on the low risk of liquefaction and shallow relief, lateral spreading is not considered to be a risk.

7.0 Recommended Geotechnical Investigations

Inferences about ground conditions over the site are made using geological principles and engineering judgment. It is recommended that a site subsoil class C (shallow soil) based on the expected rock depth/strength beneath the buildings.

If analysis shows the indicated pile capacities are insufficient it is recommended site-specific investigations are used to verify likely pile capacities and lengths. Site investigations are also recommended if foundation loads increase as a result of strengthening work. Investigations are recommended to comprise of machine boreholes situated along the buildings' length.

---

[9] Ninis, D., Little, T.A., Van Dissen, R.J., Litchfield, N.J., Smith, E.g.c., Wang, N., Rieser, U. & Henderson, M. 2013. Slip Rate on the Wellington Fault, New Zealand, during the Late Quaternary: Evidence for Variable Slip during the Holocene. Bulletin of the Seismological Society of America, Vol. 103, No. 1, pp. 559–579

[10] Little, T. A., R. Van Dissen, U. Rieser, E. G. C. Smith, and R. Langridge, 2010. Coseismic strike-slip at a point during the last four earthquakes on the Wellington fault near Wellington, New Zealand, J. Geophys. Res. 115, B05403

[11] Langridge, R., R. Van Dissen, D. Rhodes, P. Villamor, T. Little, N. Litchfield, K. Clark, and D. Clark, 2011. Five thousand years of surface ruptures on the Wellington fault, New Zealand: Implications for recurrence and fault segmentation, Bull. Seismol. Soc. Am. 101, no. 5, 2088–2107

Prepared by

Reviewed by

Revision History

Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
0	10-Aug-2022	For Issue		

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Appendix A

Site Location Plan and Nearby Logs

ISO A1 594mm x 841mm

Source: NZGD (2022). Retrieved 10/8/2022

PROJECT
WCC Seismic HUP2
4 Brooklyn Road

CLIENT
Absolutely Positively Wellington City Council
Me Heke Ki Pōneke

CONSULTANT
AECOM
L19 171 Featherston Street
Wellington, 6011

REGISTRATION

FOR INFORMATION ONLY

PROJECT MANAGEMENT INITIALS

MR	MR	RA
DESIGNER	CHECKED	APPROVED

ISSUE/REVISION

0	10/8/2022	SITE LOCATION PLAN
I/R	DATE	DESCRIPTION

KEY PLAN

PROJECT NUMBER
60687912

SHEET TITLE
Site Plan

SHEET NUMBER
Figure 1

NZGD ID: BH_106102

LOG OF DRILL HOLE

HOLE NO. BH 304

PROJECT Inner City Bypass LOCATION Wellington
GRID REF. CO-ORD. 700426.60 mN 299557.59 mE DATUM msL
ANGLE FROM HORIZONTAL 90° DIRECTION Vertical H.A.D. GROUND 20.78 H.A.D. COLLAR

DESCRIPTION OF CORE WEATHERING, HARDNESS, STRENGTH, COLOUR, ROCK OR SOIL TYPE, DEFECT SPACING, LITHOLOGICAL FEATURES (bedding, foliation, mineralogy, texture, cement, etc). STRATIGRAPHIC NAME	Sample type	CORE LOSS/ LIFT %	DEPTH HAD m	ROCK DEFECTS PROMINENT JOINTS, BEDDING, SEAMS, VEINS SHATTER, SHEAR, AND CRUSH ZONES, FOLIATION SCHISTOSITY (attitude, width, spacing, smoothness) (OR SOIL DESCRIPTION) (consistency, compactness, water content, group symbol etc)	WATER LEVEL	STANDARD PENETRATION TEST (SPT) 150, 75, 75, 75, 75mm.
Concrete, rock, sand and silt. [FILL]	Tri Core.		0.8	Loose, concrete block fragments rock debris in a matrix of sand and silt.		
Brown, sandy GRAVEL. [FILL]	↓ Lost		1.0	Loose, sand-gravel mixture.		1 1 2 2 2 N=7 (lost)
Light brown and dark brown, gravelly SILT / SAND. [FILL]	Core		1.3 2.0	Loose, gravel in matrix of silt and sand.		
Brown, GRAVEL. [FILL]	↓ Lost		2.2	Medium dense, Gravel.		8 4 7 6 8 N= 25 (lost)
Light brown, clayey, silty, sandy GRAVEL [HOLOCENE DEPOSITS]	Core ↓ Core ↓		3.0 4.0 5.0	Medium dense, very slightly clayey silty sandy Gravel.	▽	10 6 6 6 6 N= 24 9 6 5 5 6 N= 22
Blue/grey, clayey, silty, sandy GRAVEL [HOLOCENE DEPOSITS]	Core	LOST	6.0	medium dense, slightly clayey silty, sandy Gravel.		
Blue/grey, silty SAND. [HOLOCENE DEPOSITS]	Tube		6.25 7.0	Medium dense, silty Sand.		
Dark brown, SILT [HOLOCENE DEPOSITS]	↓		7.3	Medium dense, organic Silt.		
Green/brown with blue/grey, silty sandy GRAVEL. [HOLOCENE DEPOSITS]	Core ↓		7.5 8.0 9.0	Medium dense to dense, Gravel in silt/sand matrix.		1 2 6 7 12 N= 27 30 45 Refusal N=50+
Brown, silty sandy GRAVEL. [HOLOCENE DEPOSITS]	Core ↓ Core ↓		9.55 10.0 11.0 12.0	Dense, gravel in a silt/sand matrix.		12 8 9 9 10 N= 36 14 9 9 12 17 N= 47
Blue/grey silty, sandy GRAVEL. [HOLOCENE DEPOSITS]	Core ↓		12.8 13.0	Dense, Gravel in a silt/sand Matrix.		13 8 10 12 16 N= 46
Blue/grey, SILT / SAND [HOLOCENE DEPOSITS]			13.95 14.0	Dense, Sand/silt with organic traces.		
Grey mottled brown, silty CLAY [HOLOCENE DEPOSITS]			14.6 15.0	Dense, silty Clay, some sandy silty bands with occasional gravel.		

DRILLER: T. Bolton
STARTED: 8/9/01
FINISHED: 11/9/01
DRILL: Triple Tube

ROCK WEATHERING
- UW – Unweathered
- SW – Slightly weathered
- MW – Moderately weathered
- HW – Highly weathered
- CW – Completely weathered

ROCK HARDNESS
- VH – Very hard
- H – Hard
- MH – Moderately hard
- MS – Moderately soft
- S – Soft
- VS – Very soft

FRACTURE LOG (cms) Spacing of natural fractures / Fractures/m of core

EXPLANATION Borehole drilled by Griffiths Drilling Limited.
Core: Denotes Triple Tube drilling.
↓ : Standard Penetration Test.
Piezometers screened between (3.0m to 6.0m) and (9.0m and 12m) depth.

LOGGED: M. Fleming
DATE: 11/9/01
TRACED:
CHECKED:

PROJECT: SC2796.03
HOLE NO. BH 304
LENGTH: 17.20m

OPUS INTERNATIONAL CONSULTANTS

SHEET 1 OF 2 DRG NO. BH 304

NZGD ID: BH_106102

LOG OF DRILL HOLE

HOLE NO. BH 304

PROJECT Inner City Bypass
LOCATION Wellington
GRID REF.
CO-ORD. 700426.60 mN 299557.59 mE
DATUM MSL
ANGLE FROM HORIZONTAL 90°
DIRECTION Vertical
H.A.D. GROUND 20.78
H.A.D. COLLAR

DESCRIPTION OF CORE WEATHERING, HARDNESS, STRENGTH, COLOUR, ROCK OR SOIL TYPE, DEFECT SPACING. LITHOLOGICAL FEATURES (bedding, foliation, mineralogy, texture, cement, etc). STRATIGRAPHIC NAME	ROCK WEATHERING SW MW HW	ROCK HARDNESS H MH MS S	Sample type	CORE LOSS/LIFT % 50 10 50	DEPTH HAD Core size casing	GRAPHIC LOG	FRACTURE LOG (Spacing of natural fractures) 50 10 cms in	ROCK DEFECTS PROMINENT JOINTS, BEDDING, SEAMS, VEINS SHATTER, SHEAR, AND CRUSH ZONES, FOLIATION SCHISTOSITY (attitude, width, spacing, smoothness) (OR SOIL DESCRIPTION) (consistency, compactness, water content, group symbol etc)	DATE/DEPTH	R.Q.D. %	WATER LEVEL Date	DRILL WATER LOSS % 0-100	STANDARD PENETRATION TEST (SPT) 150, 75, 75, 75, 75mm
Grey mottled brown, silty CLAY. [HOLOCENE DEPOSITS]			⊤		16.0			Medium dense, silty Clay with some sandy silty bands, with occasional gravels.					5 3 3 4 5 N=15
Greenish brown mottled blue, silty sandy GRAVEL. [HOLOCENE DEPOSITS]			Core		16.5 17.0			Medium dence, silty sandy GRAVEL.					
End of borehole at 17.2 depth.					17.2								

DRILLER: T. Bolton
STARTED: 8/9/01
FINISHED: 11/9/01
DRILL: Triple Tube

ROCK WEATHERING
UW – Unweathered
SW – Slightly weathered
MW – Moderately weathered
HW – Highly weathered
CW – Completely weathered

ROCK HARDNESS
VH – Very hard
H – Hard
MH – Moderately hard
MS – Moderately soft
S – Soft
VS – Very soft

FRACTURE LOG (cms)
100 50 10 10 1 0.1
– 1 10 20 100 1000
Spacing of natural fractures
Fractures/m of core

EXPLANATION
Core: Denotes Triple Tube drilling.
⊤ : Standard Penetration Test.

LOGGED M. Fleming
DATE 11/9/01
TRACED
CHECKED
PROJECT SC2796.03
HOLE NO BH 304
LENGTH 17.20m

OPUS INTERNATIONAL CONSULTANTS

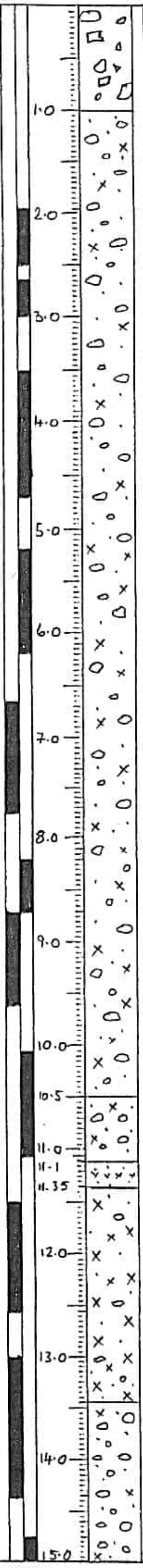
SHEET 2 OF 2
DRG NO BH 304

LOG OF DRILL HOLE

HOLE NO. BH 305

PROJECT Inner City Bypass LOCATION Wellington
GRID REF. CO-ORD. 700381·73mN 299577·99mE DATUM MSL
ANGLE FROM HORIZONTAL 90° DIRECTION Vertical H.A.D. GROUND 23·80 H.A.D. COLLAR

DESCRIPTION OF CORE WEATHERING, HARDNESS, STRENGTH, COLOUR, ROCK OR SOIL TYPE, DEFECT SPACING. LITHOLOGICAL FEATURES (bedding, foliation, mineralogy, texture, cement, etc), STRATIGRAPHIC NAME	Sample type	DEPTH HAD (m)	ROCK DEFECTS PROMINENT JOINTS, BEDDING, SEAMS, VEINS SHATTER, SHEAR, AND CRUSH ZONES, FOLIATION SCHISTOSITY (attitude, width, spacing, smoothness) (OR SOIL DESCRIPTION) (consistency, compactness, water content, group symbol etc)	WATER LEVEL	STANDARD PENETRATION TEST (SPT) 150, 75, 75, 75, 75.
Concrete and Timber [FILL]	Tri Cone	1.0	Very dense Concrete and Timber.		
Brown, silty sandy GRAVEL [HOLOCENE DEPOSITS]	Core Core Core Core Core	10.5	Dense, gravel in matrix of silt and fine sand.	∇	32 9 13 9 8 N=38 7 19 14 14 14 N=50⁺ 12 8 6 7 8 N=29 10 7 8 8 8 N=31 13 9 10 9 10 N=38 11 7 9 9 10 N=35
Blue/grey, silty, sandy GRAVEL. [HOLOCENE DEPOSITS]	Core	11.1	Dense, silty sandy Gravel.		
Blue/grey banded dark brown silty SAND and SILT. [HOLOCENE DEPOSITS]		11.35	Dense, banded silty fine sand and organic stained Silt.		4 4 6 11 12 N=33
Dark brown, sandy, gravelly SILT. [HOLOCENE DEPOSITS]	Core		Dense, slightly sandy, slightly fine gravelly Silt.		11 9 11 12 15 N=47
Blue/grey, silty, sandy GRAVEL.	Core	15.0	Dense, silty, sandy Gravel with trace of organics.		16 12 11 14 11 for 30mm N=50⁺



DRILLER: T. Bolton
STARTED: 12/9/01
FINISHED: 14/9/01
DRILL: Triple Tube

ROCK WEATHERING
UW – Unweathered
SW – Slightly weathered
MW – Moderately weathered
HW – Highly weathered
CW – Completely weathered

ROCK HARDNESS
VH – Very hard
H – Hard
MH – Moderately hard
MS – Moderately soft
S – Soft
VS – Very soft

FRACTURE LOG (cms) Spacing of natural fractures / Fractures/m of core

EXPLANATION Borehole drilled by Griffiths Drilling Ltd.
Core: Denotes Triple Tube drilling.
T : Standard Penetration Test.

Piezometer screened between 2.0m and 8.0m

LOGGED: M. Fleming
DATE: 14/9/01
TRACED:
CHECKED: M. Fleming

PROJECT: SC2796.03
HOLE NO BH305
LENGTH: 17·30m

OPUS INTERNATIONAL CONSULTANTS

SHEET 1 OF 2 DRG NO BH305

LOG OF DRILL HOLE

HOLE NO. BH 305

PROJECT Inner City Bypass LOCATION Wellington
GRID REF. CO-ORD. 700381.73mN 299577.99mE DATUM MSL
ANGLE FROM HORIZONTAL 90° DIRECTION Vertical H.A.D. GROUND 23.80 H.A.D. COLLAR

DESCRIPTION OF CORE WEATHERING, HARDNESS, STRENGTH, COLOUR, ROCK OR SOIL TYPE, DEFECT SPACING, LITHOLOGICAL FEATURES (bedding, foliation, mineralogy, texture, cement, etc), STRATIGRAPHIC NAME	ROCK WEATHERING SW MW HW	ROCK HARDNESS H MH MS S	Sample type	CORE LOSS/ LIFT %	DEPTH HAD m	Core size casing	GRAPHIC LOG	FRACTURE LOG (Spacing of natural fractures) cms	ROCK DEFECTS PROMINENT JOINTS, BEDDING, SEAMS, VEINS SHATTER, SHEAR, AND CRUSH ZONES, FOLIATION SCHISTOSITY (attitude, width, spacing, smoothness) (OR SOIL DESCRIPTION) (consistency, compactness, water content, group symbol etc)	DATE/DEPTH	R.Q.D. %	WATER LEVEL Date	DRILL WATER LOSS % 0-100	STANDARD PENETRATION TEST (SPT) 150, 75, 75, 75, 75mm
Blue/grey, silty sandy Gravel. [HOLOCENE DEPOSITS]					15.0				Dense, silty sandy Gravel, with traces of organics.					
Blue/grey/brown, CLAY. [HOLOCENE DEPOSITS]			Core						Firm, Clay.					
Blue grey, SILT / SAND [HOLOCENE DEPOSITS]					15.75				Medium dense, Silt/fine Sand					
Blue/grey mottled brown CLAY. [HOLOCENE DEPOSITS]			↓		16.0				Firm, Clay.					6 5 6 5 6 N= 22
Blue/grey, clayey, silty, sandy GRAVEL [HOLOCENE DEPOSITS]			Core		17.0 17.3				Medium dense, slightly clayey silty sandy Gravel.					
End of borehole at 17.30m depth.														

DRILLER: T. Bolton
STARTED: 12/9/01
FINISHED: 14/9/01
DRILL: Triple Tube

ROCK WEATHERING
UW - Unweathered
SW - Slightly weathered
MW - Moderately weathered
HW - Highly weathered
CW - Completely weathered

ROCK HARDNESS
VH - Very hard
H - Hard
MH - Moderately hard
MS - Moderately soft
S - Soft
VS - Very soft

FRACTURE LOG (cms)
100 50 10 10 1 0.1
1 10 20 100 1000
Spacing of natural fractures
Fractures/m of core

EXPLANATION
Core: Denotes Triple Tube drilling.
T : Standard Penetration Test.

LOGGED: M. Fleming
DATE: 14/9/01
TRACED:
CHECKED: M. Fleming

PROJECT: SC2796.03
HOLE NO BH 305
LENGTH 17.30m

OPUS
INTERNATIONAL CONSULTANTS

SHEET 2 OF 2 DRG NO BH 305

NZGD ID: BH_106104

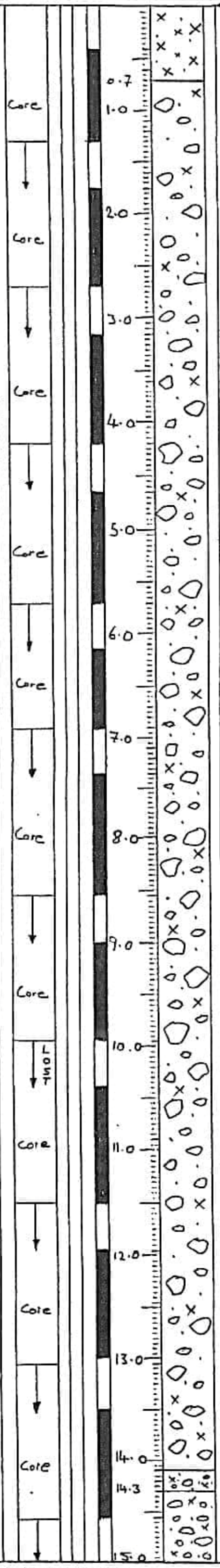
K

LOG OF DRILL HOLE

HOLE NO. BH 306

PROJECT Inner City Bypass
LOCATION Wellington
GRID REF.
CO-ORD. 700532.28 mN 299504.11 mE
DATUM MSL
ANGLE FROM HORIZONTAL 90°
DIRECTION Vertical
H.A.D. GROUND 24.05
H.A.D. COLLAR

DESCRIPTION OF CORE WEATHERING, HARDNESS, STRENGTH, COLOUR, ROCK OR SOIL TYPE, DEFECT SPACING. LITHOLOGICAL FEATURES (bedding, foliation, mineralogy, texture, cement, etc), STRATIGRAPHIC NAME	ROCK WEATHERING SW MW HW	ROCK HARDNESS H MH MS S	Sample type	CORE LOSS/ LIFT %	DEPTH HAD Core size casing (m)	GRAPHIC LOG	FRACTURE LOG (Spacing of natural fractures) cms	ROCK DEFECTS PROMINENT JOINTS, BEDDING, SEAMS, VEINS SHATTER, SHEAR, AND CRUSH ZONES, FOLIATION SCHISTOSITY (attitude, width, spacing, smoothness) (OR SOIL DESCRIPTION) (consistency, compactness, water content, group symbol etc)	DATE/DEPTH	R.Q.D. %	WATER LEVEL Date	DRILL WATER LOSS % 0-100	STANDARD PENETRATION TEST (SPT) 150, 75, 75, 75, 75mm
Dark brown, gravelly sandy SILT. [FILL]								Loose, slightly sandy silt with occasional gravel. Organic stained.					
Brown, silty sandy GRAVEL [HOLOCENE DEPOSITS]								Loose to dense, coarse gravel with occasional cobbles within silt /sand matrix. Gravel and cobbles highly weathered.			▽		2 1 1 1 2 N=5 8 4 4 5 5 N=18 15 7 9 11 10 N= 37 14 9 7 10 11 N= 37 15 9 12 9 9 N=39 13 10 10 10 11 N= 41 11 9 9 10 10 N=38 18 11 10 8 13 N= 42 15 12 9 10 11 N=42
Green/blue, silty Sandy GRAVEL [HOLOCENE DEPOSITS]								Dense, silty sandy Gravel					
Blue/grey, silty Sandy GRAVEL [HOLOCENE DEPOSITS]								Medium dense, silty Sandy Gravel. Traces of clay and organics.					9 5 6 7 10 N=28



DRILLER:
T. Bolton
STARTED:
15/9/01
FINISHED:
19/9/01
DRILL:
Triple Tube

ROCK WEATHERING
UW – Unweathered
SW – Slightly weathered
MW – Moderately weathered
HW – Highly weathered
CW – Completely weathered

ROCK HARDNESS
VH – Very hard
H – Hard
MH – Moderately hard
MS – Moderately soft
S – Soft
VS – Very soft

FRACTURE LOG (cms)
100 50 10 5 1 0.1
10 20 100 0.1
Spacing of natural fractures
Fractures/m of core

EXPLANATION Borehole drilled by Griffiths Drilling Limited.
Core: Denotes Triple Tube drilling.
⊤: Standard Penetration Test.

Piezometers screened between (12m to 16m) and (19m to 22m) depth.

LOGGED M. Fleming
DATE: 19/9/01
TRACED: M. Fleming
CHECKED:

PROJECT: 5C2796.03
HOLE NO BH 306
LENGTH

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SHEET 1 OF 2
DRG NO BH 306

NZGD ID: BH_106104

K

LOG OF DRILL HOLE

HOLE NO. BH 306

PROJECT Inner City Bypass LOCATION Wellington

GRID REF. CO-ORD. 700532.28mN 299504.11mE DATUM MSL

ANGLE FROM HORIZONTAL 90° DIRECTION Vertical H.A.D. GROUND 24.05 H.A.D. COLLAR

DESCRIPTION OF CORE WEATHERING, HARDNESS, STRENGTH, COLOUR, ROCK OR SOIL TYPE, DEFECT SPACING, LITHOLOGICAL FEATURES (bedding, foliation, mineralogy, texture, cement, etc), STRATIGRAPHIC NAME	Sample type	DEPTH HAD	ROCK DEFECTS (OR SOIL DESCRIPTION) (consistency, compactness, water content, group symbol etc)	STANDARD PENETRATION TEST (SPT) 150,75,75,75,75.
Blue/grey, silty, sandy, GRAVEL. [HOLOCENE DEPOSITS]	Core	16.0 16.5	Medium dense, silty, sandy GRAVEL. Traces of clay and organics	10:6:6:10:8:Ref N = 50+
Light brown mottled orange, clayey sandy gravelly SILT. [HOLOCENE DEPOSITS]	Core	17.0	Dense, slightly clayey, slightly sandy silt with occasional gravels.	
Brown, silty sandy GRAVEL [HOLOCENE DEPOSITS]	Core Core	18.0 19.0 20.0	Dense, coarse gravel with occasional cobbles within silt/sand matrix. Gravel and cobbles highly weathered.	25:18:18:Refusal N = 50+ 25:18:18:14 for 30mm N = 50+
Light brown mottled orange sandy SILT. [HOLOCENE DEPOSITS]	Core	20.7	Dense, slightly sandy SILT.	
Brown, silty sandy GRAVEL [HOLOCENE DEPOSITS]	Core Core	21.0 22.0 23.0 24.0 25.0	Dense, coarse gravel with occasional cobbles within silt/sand matrix. Gravel and cobbles highly weathered.	32:21:24 Refusal N = 50+ (Solid Nose SPT) 28:18:18:19 N = 50+ (Solid Nose SPT) 25:21:18:19 N = 50+ (Solid Nose SPT)
End of borehole at 25.5m depth.				

DRILLER: T. Bolton

STARTED: 15/9/01

FINISHED: 19/9/01

DRILL: Triple Tube

ROCK WEATHERING	ROCK HARDNESS
UW - Unweathered	VH - Very hard
SW - Slightly weathered	H - Hard
MW - Moderately weathered	MH - Moderately hard
HW - Highly weathered	MS - Moderately soft
CW - Completely weathered	S - Soft
	VS - Very soft

FRACTURE LOG (cms) Spacing of natural fractures / Fractures/m of core

EXPLANATION

Core: Denotes Triple Tube drilling

⊤ : Standard Penetration Test.

LOGGED: M. Fleming

DATE: 19/9/01

TRACED: M. Fleming

CHECKED:

PROJECT: SC2796.03

HOLE NO BH 306

LENGTH 25.5m

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SHEET 2 OF 2 DRG NO BH 306

EH 12.

12

LOG OF DRILL HOLE

HOLE NO. BH 404

PROJECT Inner City Bypass
LOCATION Wellington
GRID REF.
CO-ORD. 700343 56mN 2996 34.09 mE DATUM MSL
ANGLE FROM HORIZONTAL 90° DIRECTION Vertical H.A.D. GROUND 22.42 H.A.D. COLLAR

DESCRIPTION OF CORE WEATHERING, HARDNESS, STRENGTH, COLOUR, ROCK OR SOIL TYPE, DEFECT SPACING. LITHOLOGICAL FEATURES (bedding, foliation, mineralogy, texture, cement, etc), STRATIGRAPHIC NAME	ROCK DEFECTS PROMINENT JOINTS, BEDDING, SEAMS, VEINS SHATTER, SHEAR, AND CRUSH ZONES, FOLIATION SCHISTOSITY (attitude, width, spacing, smoothness) (OR SOIL DESCRIPTION) (consistency, compactness, water content, group symbol etc)
Brown/grey, silty sandy GRAVEL [FILL]	Loose, silty sandy Gravel.
Dark brown/black, sandy clayey SILT [TOPSOIL]	Soft, slightly sandy clayey silt organic stained.
Light brown, sandy SILT. [FILL]	Loose, sandy silt
Dark brown, clayey SILT. [TOPSOIL]	Soft, clayey silt.
Light brown, gravelly sandy SILT. [FILL]	Loose, slightly sandy silt with occasional gravel.
Dark brown, clayey SILT [TOPSOIL]	Soft, clayey silt
Light brown, clayey SILT [RESIDUAL SOIL]	Soft, clayey Silt
Brown, gravelly sandy SILT. [HOLOCENE DEPOSITS]	Medium dense, gravel in a sandy silt matrix.
Brown, silty sandy GRAVEL. [HOLOCENE DEPOSITS]	Medium dense to dense, silty sandy Gravel.

End of borehole at 8.0m depth.

ROCK WEATHERING: SW MW HW — ROCK HARDNESS: H MH MS S — Sample type — CORE LOSS/LIFT % 5 10 50 — DEPTH H.A.D. Core size casing (m) — GRAPHIC LOG — FRACTURE LOG (Spacing of natural fractures) 50 10 5 cms — DATE/DEPTH — R.Q.D. % — WATER LEVEL Date — DRILL WATER LOSS % 0-100

Sample type: DB, DB, DB, DB, DB, DB, DB, DB

Core loss: LOST

Depth (m): 0.5, 0.65, 0.75, 0.85, 1.0, 1.05, 1.15, 1.30, 2.0, 3.0, 3.25, 4.0, 5.0, 6.0, 7.0, 7.5, 8.0

WATER LEVEL: ∇ 3.9

STANDARD PENETRATION TEST (SPT) 150, 75, 75, 75, 75mm	
1 : 2 : 2 : 2 3	N=9
2 : 3 : 4 : 3 3	N= 13
10 : 6 : 7 : 7 : 7	N= 27
5 5 : 5 : 6 : 6	N=22
6 : 5 : 5 : 5 : 5	N=20
8 : 8 : 7 : 8 9	N=32
13 : 11 : 11 : 8 : 10	N=40
14 10 : 11 : 11 : 12	N=44

DRILLER: M. Griffiths
STARTED: 16-8-01
FINISHED: 16-8-01
DRILL: Dry Barrel

ROCK WEATHERING
UW - Unweathered
SW - Slightly weathered
MW - Moderately weathered
HW - Highly weathered
CW - Completely weathered

ROCK HARDNESS
VH - Very hard
H - Hard
MH - Moderately hard
MS - Moderately soft
S - Soft
VS - Very soft

FRACTURE LOG (cms)
100 50 10 5 1 0.1
Spacing of natural fractures
1 10 20 100 1000
Fractures/m of core

EXPLANATION Borehole drilled by Griffiths Drilling (NZ) Limited.
DB: Denotes dry barrel drilling.
↓: Denotes Standard Penetration Test.

LOGGED M. Fleming
DATE: 16-8-01
TRACED: M. Fleming
CHECKED:

PROJECT: SC1796.03
HOLE NO. BH404
LENGTH 8.0m

OPUS
INTERNATIONAL CONSULTANTS

SHEET 1 OF 1 DRG NO. BH404

B46

6

LOG OF DRILL HOLE

HOLE NO. BH 407

PROJECT Inner City Bypass LOCATION Wellington

GRID REF. CO-ORD. 700542.62mN 299531.11mE DATUM MSL

ANGLE FROM HORIZONTAL 90° DIRECTION Vertical H.A.D. GROUND 23.60 H.A.D. COLLAR

DESCRIPTION OF CORE WEATHERING, HARDNESS, STRENGTH, COLOUR, ROCK OR SOIL TYPE, DEFECT SPACING, LITHOLOGICAL FEATURES (bedding, foliation, mineralogy, texture, cement, etc). STRATIGRAPHIC NAME	Sample type	DEPTH H.A.D. (m)	ROCK DEFECTS PROMINENT JOINTS, BEDDING, SEAMS, VEINS SHATTER, SHEAR, AND CRUSH ZONES, FOLIATION SCHISTOSITY (attitude, width, spacing, smoothness) (OR SOIL DESCRIPTION) (consistency, compactness, water content, group symbol etc)	STANDARD PENETRATION TEST (SPT) 150, 75, 75, 75, 75mm
Grey, sandy GRAVEL. [FILL]	DB	0.5	Loose, sandy Gravel.	
Dark grey brown, gravelly sandy SILT [FILL]		0.75	Loose, sandy silt with occasional building debris.	
Brown, sandy SILT [FILL]		1.0 1.2	Loose, sandy silt.	3 2 2 2 3 N=9
Brown, gravelly sandy SILT. [FILL]			Loose, sandy Silt with occasional gravel.	5 4 2 2 2 N=10
Brown, silty sandy GRAVEL. [HOLOCENE DEPOSITS]	DB	2.0	Loose, silty sandy Gravel.	
Brown, sandy SILT. [HOLOCENE DEPOSITS]		2.8	Loose, sandy silt.	1 2 2 3 3 N=10
Brown, silty sandy GRAVEL [HOLOCENE DEPOSITS]	DB	2.9	Loose, silty sandy Gravel.	
Brown speckled dark brown, silty SAND. [ASH]		3.0	Loose, silty fine sand.	
Brown mottled blue grey, sandy SILT. [HOLOCENE DEPOSITS]	DB	3.15 4.0	Loose, sandy silt.	2 2 2 3 3 N=10
Brown, silty sandy GRAVEL [HOLOCENE DEPOSITS]	DB	5.0	Dense, silty sandy Gravel.	8 8 12 13 15 N=48
End of borehole at 5.0m depth.				16 16 15 11 10 N=50+

DRILLER: M Griffiths

STARTED: 17-8-01

FINISHED: 17-8-01

DRILL: Dry barrel

ROCK WEATHERING
UW – Unweathered
SW – Slightly weathered
MW – Moderately weathered
HW – Highly weathered
CW – Completely weathered

ROCK HARDNESS
VH – Very hard
H – Hard
MH – Moderately hard
MS – Moderately soft
S – Soft
VS – Very soft

FRACTURE LOG (cms) Spacing of natural fractures / Fractures/m of core

EXPLANATION Borehole drilled by Griffiths Drilling (NZ) Limited.
DB: Denotes dry barrel drilling
⊥ : Denotes Standard Penetration Test.

Borehole dry.

LOGGED M. Fleming
DATE 17-8-01
TRACED M. Fleming
CHECKED

PROJECT SC2796.03
HOLE NO BH407
LENGTH 5.0m

OPUS
INTERNATIONAL CONSULTANTS

SHEET 1 OF 1 DRG NO BH407

4

LOG OF DRILL HOLE

HOLE NO. BH 408

PROJECT Inner City Bypass
LOCATION Wellington
GRID REF.
CO-ORD. 700552.66 mN 299510.78 mE
DATUM MSL
ANGLE FROM HORIZONTAL 90°
DIRECTION Vertical
H.A.D. GROUND 24.12
H.A.D. COLLAR

DESCRIPTION OF CORE WEATHERING, HARDNESS, STRENGTH, COLOUR, ROCK OR SOIL TYPE, DEFECT SPACING, LITHOLOGICAL FEATURES (bedding, foliation, mineralogy, texture, cement, etc). STRATIGRAPHIC NAME	Sample type	DEPTH (m)	ROCK DEFECTS PROMINENT JOINTS, BEDDING, SEAMS, VEINS SHATTER, SHEAR, AND CRUSH ZONES, FOLIATION SCHISTOSITY (attitude, width, spacing, smoothness) (OR SOIL DESCRIPTION) (consistency, compactness, water content, group symbol etc)	WATER LEVEL	STANDARD PENETRATION TEST (SPT) 150, 75, 75, 75, 75mm
Dark grey/brown/black, gravelly silty SAND [FILL]		0.3	Loose, slightly gravelly silty Sand		
Light brown mottled dark grey, Sandy gravelly SILT. [FILL]	DB	0.85	Loose, fine sandy gravelly Silt.		3 2 2 1 2 N=7
Brown mottled black and grey, sandy SILT [Possibly ASH]		1.0 1.25	Medium dense, fine Sandy Silt.		2 2 3 3 3 N=11
Brown, gravelly sandy SILT [ASH]		1.6	Medium dense, slightly fine gravelly, fine sandy SILT.		
Brown, sandy SILT [ASH]		1.75	Medium dense, fine sandy silt.		
Brown, gravelly sandy SILT [ASH]	DB	1.90	medium dense, fine gravelly fine sandy Silt.		
Grey brown, silty sandy GRAVEL. [Possibly ASH]		2.0 2.35	Medium dense, slightly silty sandy Gravel.	∇	10 6 6 4 3 N=19
Brown mottled dark brown, silty sandy GRAVEL. [HOLOCENE DEPOSITS]	DB	3.0	Medium dense, silty sandy Gravel.		
Light grey/brown silty CLAY.		3.3	Firm, silty Clay		3 3 6 8 10 N=27
Grey/brown, silty sandy GRAVEL	DB	3.75	Medium dense, silty sandy Gravel.		
Darkish brown, silty sandy GRAVEL.		4.0	Medium dense, silty sandy Gravel.		
End of borehole at 4.0m depth.					13 7 6 6 8 N=27

DRILLER: M Griffiths
STARTED: 27-8-01
FINISHED: 27-8-01
DRILL: Dry Barrel

ROCK WEATHERING
UW – Unweathered
SW – Slightly weathered
MW – Moderately weathered
HW – Highly weathered
CW – Completely weathered

ROCK HARDNESS
VH – Very hard
H – Hard
MH – Moderately hard
MS – Moderately soft
S – Soft
VS – Very soft

FRACTURE LOG (cms)
Spacing of natural fractures
Fractures/m of core

EXPLANATION Borehole drilled by Griffiths Drilling (NZ) Ltd.
DB: Dry Barrel
⊤: Standard Penetration Test

LOGGED M Fleming
DATE
TRACED M Fleming
CHECKED

PROJECT 5C2796.03
HOLE NO BH 408
LENGTH 4.0m

OPUS INTERNATIONAL CONSULTANTS

SHEET 1 OF 1
DRG NO BH408

NZGD ID: BH_106123

5

LOG OF DRILL HOLE

HOLE NO. BH409

PROJECT Inner City Bypass. LOCATION Wellington

GRID REF. CO-ORD. 700546.22mN 299543.48mE DATUM MSL

ANGLE FROM HORIZONTAL 90° DIRECTION Vertical H.A.D. GROUND 23.12 H.A.D. COLLAR

DESCRIPTION OF CORE (weathering, hardness, strength, colour, rock or soil type, defect spacing, lithological features (bedding, foliation, mineralogy, texture, cement, etc), stratigraphic name)	Sample type	Depth	ROCK DEFECTS ... (OR SOIL DESCRIPTION) (consistency, compactness, water content, group symbol etc)	Water level	STANDARD PENETRATION TEST (SPT) 150,75,75,75,75mm
Brown, silty sandy GRAVEL. [FILL]	DB		Loose, silty sandy Gravel.		3 1 2 2 1 N= 6
Dark brown, gravelly sandy SILT. [TOPSOIL]		0.65	Loose, slightly gravelly sandy silt.		
Brown/orange sandy CLAY [FILL]		0.85	Soft, sandy Clay.		
Brown mottled dark brown, silty sandy GRAVEL. [HOLOCENE DEPOSITS]	DB	1.0	Medium dense, silty sandy Gravel.	∇	5 3 4 4 5 N=16 5 3 3 3 3 N= 12
Dark brown, gravelly sandy SILT. [ASH]	DB	2.8	Medium dense, slightly fine gravelly sandy silt.		
Brown, gravelly silty SAND. [POSSIBLY ASH]		2.9	medium dense, slightly fine gravelly silty Sand.		4 5 8 8 9 N=30
Brown, silty sandy GRAVEL. [HOLOCENE DEPOSITS]	DB	3.2	Medium dense, silty sandy Gravel.		
End of borehole at 4.0m depth.		4.0			10 7 6 6 8 N= 27

DRILLER: M Griffiths

STARTED: 27/8/01

FINISHED: 27/8/01

DRILL: Dry Barrel

ROCK WEATHERING	ROCK HARDNESS
UW – Unweathered	VH – Very hard
SW – Slightly weathered	H – Hard
MW – Moderately weathered	MH – Moderately hard
HW – Highly weathered	MS – Moderately soft
CW – Completely weathered	S – Soft
	VS – Very soft

FRACTURE LOG (cms) Spacing of natural fractures / Fractures/m of core

EXPLANATION Borehole drilled by Griffiths Drilling (NZ) Ltd.

DB: Dry Barrel

T: Standard Penetration Test.

LOGGED M Fleming

DATE

TRACED M Fleming

CHECKED

PROJECT: SC2796.03

HOLE NO BH409

LENGTH 4.0m

OPUS INTERNATIONAL CONSULTANTS

SHEET 1 OF 1 DRG NO BH409

NZGD ID: BH_106123

7

LOG OF DRILL HOLE

HOLE NO. BH 410

PROJECT Inner City Bypass
LOCATION Wellington
GRID REF.
CO-ORD. 700523.21 mN 299543.47 mE
DATUM MSL
ANGLE FROM HORIZONTAL 90°
DIRECTION Vertical
H.A.D. GROUND 22.78
H.A.D. COLLAR

DESCRIPTION OF CORE WEATHERING, HARDNESS, STRENGTH, COLOUR, ROCK OR SOIL TYPE, DEFECT SPACING, LITHOLOGICAL FEATURES (bedding, foliation, mineralogy, texture, cement, etc), STRATIGRAPHIC NAME	Sample type	DEPTH HAD (m)	ROCK DEFECTS (OR SOIL DESCRIPTION)	WATER LEVEL	STANDARD PENETRATION TEST (SPT) 150, 75, 75, 75, 75.
Brown, sandy GRAVEL [FILL]			Loose, Sandy Gravel.		
Dark brown, silty sandy GRAVEL [FILL]		0.1	Loose, silty, sandy Gravel.		
Brown, silty sandy GRAVEL [Probably FILL]	DB	0.2 1.0	Medium dense, silty sandy Gravel.		5 4 4 5 5 N=18
Brown mottled dark brown, silty SAND. [TOPSOIL]		1.2	Medium dense, silty fine Sand.		5 3 5 7 10 N=26
Brown, silty sandy GRAVEL. [HOLOCENE DEPOSITS]		1.3	Medium dense, silty Sandy fine Gravel		
Brown, silty sandy GRAVEL [HOLOCENE DEPOSITS]	DB	1.5	Medium dense, silty, sandy coarse Gravel		
Dark brown mottled brown, gravelly silty SAND.		1.9 2.0	Medium dense, fine gravelly, silty fine sand. (possibly Ash)	∇	3 2 3 5 5 N=15
Dark brown mottled brown, silty sandy GRAVEL		2.25	Medium dense silty Sandy GRAVEL.		
Blue/grey, silty sandy GRAVEL.	DB	2.5	Medium dense, silty sandy Gravel.		
Brown mottled dark brown, silty sandy GRAVEL.	DB	3.0	Medium dense, silty sandy Gravel.		4 3 4 4 4 N=15
End of borehole at 4.0m depth.		4.0			7 5 7 8 8 N=28

DRILLER: M. Griffiths
STARTED: 29/8/01
FINISHED: 29/8/01
DRILL: Dry Barrel

ROCK WEATHERING
UW – Unweathered
SW – Slightly weathered
MW – Moderately weathered
HW – Highly weathered
CW – Completely weathered

ROCK HARDNESS
VH – Very hard
H – Hard
MH – Moderately hard
MS – Moderately soft
S – Soft
VS – Very soft

FRACTURE LOG (cms)
Spacing of natural fractures
Fractures/m of core

EXPLANATION Borehole drilled by Griffiths Drilling (NZ) Ltd.
T : denotes Standard Penetration Test
DB : denotes Dry barrel drilling

LOGGED: M. Fleming
DATE: 29/8/01
TRACED: M. Fleming
CHECKED:
PROJECT: 5C2796.03
HOLE NO: BH410
LENGTH: 4.0m

OPUS INTERNATIONAL CONSULTANTS

SHEET 1 OF 1
DRG NO. BH410

NZGD ID: BH_106127

4

HOLE NO. BH 414

LOG OF DRILL HOLE

PROJECT Inner City Bypass LOCATION Wellington
GRID REF. CO-ORD. 700435.48mN 299565.95mE DATUM MSL
ANGLE FROM HORIZONTAL 90° DIRECTION Vertical H.A.D. GROUND 20.70 H.A.D. COLLAR

DESCRIPTION OF CORE WEATHERING, HARDNESS, STRENGTH, COLOUR, ROCK OR SOIL TYPE, DEFECT SPACING, LITHOLOGICAL FEATURES (bedding, foliation, mineralogy, texture, cement, etc), STRATIGRAPHIC NAME	Sample type	DEPTH HAD m	ROCK DEFECTS PROMINENT JOINTS, BEDDING, SEAMS, VEINS SHATTER, SHEAR, AND CRUSH ZONES, FOLIATION SCHISTOSITY (attitude, width, spacing, smoothness) (OR SOIL DESCRIPTION) (consistency, compactness, water content, group symbol etc)	WATER LEVEL	STANDARD PENETRATION TEST (SPT) 150,75,75,75,75.
Brown, silty sandy GRAVEL [FILL]	DB		Loose, silty sandy Gravel.		
Red and brown, sandy silt with building debris. [FILL]	DB	0.5 1.0	Loose, sandy silt with broken bricks and building debris.		2 1 1 1 2 N=5
Brown, sandy SILT [FILL]		1.4	Loose, sandy silt with some organic staining.		2 1 1 2 2 N=6
Brown, silty GRAVEL. [HOLOCENE DEPOSITS]	DB	1.9 2.0	Loose, silty Gravel.		
Brown, silty, sandy GRAVEL [HOLOCENE DEPOSITS]	DB DB	2.2 3.0 4.0	Dense, silty fine sandy Gravel.	▽	11 8 7 8 9 N=32 13 7 9 11 8 N=35
End of Borehole at 4.5m depth.		4.5			12 8 7 10 10 N=35

DRILLER: M Griffiths
STARTED: 6-9-01
FINISHED: 6-9-01
DRILL: Dry Barrel

ROCK WEATHERING
UW - Unweathered
SW - Slightly weathered
MW - Moderately weathered
HW - Highly weathered
CW - Completely weathered

ROCK HARDNESS
VH - Very hard
H - Hard
MH - Moderately hard
MS - Moderately soft
S - Soft
VS - Very soft

FRACTURE LOG (cms) Spacing of natural fractures; Fractures/m of core

EXPLANATION Borehole drilling by Griffiths Drilling (NZ) Ltd.
DB: Dry Barrel.
T: Standard Penetration Test.

LOGGED M. Fleming
DATE:
TRACED: M. Fleming
CHECKED:

PROJECT: 5C2796.03
HOLE NO BH414
LENGTH: 4.5m

OPUS INTERNATIONAL CONSULTANTS

SHEET 1 OF 1 DRG NO BH414

NZGD ID: BH_106127

10

LOG OF DRILL HOLE

HOLE NO. BH 415

PROJECT Inner City Bypass LOCATION Wellington
GRID REF. CO-ORD. 700428.17 mN 299577.00 mE DATUM MSL
ANGLE FROM HORIZONTAL 90° DIRECTION Vertical H.A.D. GROUND 20.28 H.A.D. COLLAR

Depth (m)	DESCRIPTION OF CORE	Sample type	ROCK DEFECTS (OR SOIL DESCRIPTION)	WATER LEVEL	STANDARD PENETRATION TEST (SPT) 150,75,75,75,75mm
0.0–0.5	Dark grey, SILT / SAND and building debris. [FILL]	DB	Loose, silt/sand and building debris.		
0.5–0.6	Concrete		Concrete		2 2 4 4 4 N= 14
0.6–0.7	Brown, silty sandy GRAVEL [FILL]	↓	medium dense, silty sandy Gravel.		
0.7–0.8	Grey, silty gravelly SAND [FILL]		Medium dense, silty gravelly fine Sand.		
0.8–1.9	Brown, silty sandy GRAVEL. [HOLOCENE DEPOSITS]	DB ↓	Loose, silty sandy Gravel.		4 2 1 1 2 N= 6
1.9–2.0	Brown, silty SAND [HOLOCENE DEPOSITS]		Loose, silty Sand.		
2.0–5.5	Dark brown mottled light brown, silty sandy GRAVEL [HOLOCENE DEPOSITS]	DB ↓ LOST DB ↓ LOST DB ↓ LOST DB	Loose to medium dense, silty sandy Gravel.	▽ (3.0)	1 1 1 1 2 N= 5 2 3 4 4 5 N= 16 6 5 5 6 8 N= 24
5.5	End of Borehole at 5.5m depth.				

DRILLER: M. Griffiths
STARTED: 8-9-01
FINISHED: 8-9-01
DRILL: Dry barrel

ROCK WEATHERING	ROCK HARDNESS
UW – Unweathered	VH – Very hard
SW – Slightly weathered	H – Hard
MW – Moderately weathered	MH – Moderately hard
HW – Highly weathered	MS – Moderately soft
CW – Completely weathered	S – Soft
	VS – Very soft

FRACTURE LOG (cms) Spacing of natural fractures / Fractures/m of core

EXPLANATION Borehole drilled by Griffiths Drilling (NZ) Ltd.
DB: Dry barrel drilling
↓ : Standard Penetration Test.

LOGGED M. Fleming
DATE
TRACED: M. Fleming
CHECKED:

PROJECT: SC2796.03
HOLE NO. BH 415
LENGTH: 5.5m

OPUS INTERNATIONAL CONSULTANTS

SHEET 1 OF 1 DRG NO BH415

LOG OF DRILL HOLE

HOLE NO. BH 417

PROJECT Inner City Bypass LOCATION Wellington
GRID REF. CO-ORD. 700 463 . 86mN 299537 . 76 mE DATUM MSL
ANGLE FROM HORIZONTAL 90° DIRECTION Vertical H.A.D. GROUND 22.68 H.A.D. COLLAR

DESCRIPTION OF CORE WEATHERING, HARDNESS, STRENGTH, COLOUR, ROCK OR SOIL TYPE, DEFECT SPACING, LITHOLOGICAL FEATURES (bedding, foliation, mineralogy, texture, cement, etc), STRATIGRAPHIC NAME	ROCK WEATHERING SW MW HW	ROCK HARDNESS H MH MS S	Sample type	CORE LOSS/LIFT % 5 10 50	DEPTH HAD Core size casing	GRAPHIC LOG	FRACTURE LOG (Spacing of natural fractures) 50 10 5 cms	ROCK DEFECTS PROMINENT JOINTS, BEDDING, SEAMS, VEINS SHATTER, SHEAR, AND CRUSH ZONES, FOLIATION SCHISTOSITY (attitude, width, spacing, smoothness) (OR SOIL DESCRIPTION) (consistency, compactness, water content, group symbol etc)	DATE/DEPTH	R.Q.D. %	WATER LEVEL Date	DRILL WATER LOSS % 0-100	STANDARD PENETRATION TEST (SPT) 150, 75, 75, 75, 75.
Brown, silty sandy GRAVEL [FILL]			DB DB		1.0			Loose to medium dense, silty sandy Gravel.					2 1 1 1 1 N= 4
Brown mottled dark brown, silty sandy GRAVEL [HOLOCENE DEPOSITS]			DB	LOST T	1.65 2.0			Medium dense to dense, silty sandy Gravel.					5 4 4 5 4 N= 17 11 8 7 8 10 N= 33
Brown mottled light grey and orange silty, gravelly Sand. [HOLOCENE DEPOSITS]			DB		2.8 3.0			Dense, silty, fine gravelly fine Sand. Probably ash deposits.					
Brown, Silty Sandy GRAVEL [HOLOCENE DEPOSITS]					3.3			Dense, silty, fine sandy fine Gravel Probably ash deposits			∇		
Brown mottled grey, silty sandy GRAVEL. [HOLOCENE DEPOSITS]			DB		3.4 4.0			Dense, silty sandy Gravel.					13 10 10 11 12 N= 43
End of borehole at 4.5m depth.					4.5								

DRILLER: M. Griffith
STARTED: 20-9-01
FINISHED: 20-9-01
DRILL: Dry Barrel

ROCK WEATHERING
UW - Unweathered
SW - Slightly weathered
MW - Moderately weathered
HW - Highly weathered
CW - Completely weathered

ROCK HARDNESS
VH - Very hard
H - Hard
MH - Moderately hard
MS - Moderately soft
S - Soft
VS - Very soft

FRACTURE LOG (cms) 100 50 10 10 1 — Spacing of natural fractures; 1 2 10 20 100 — Fractures/m of core

EXPLANATION Borehole drilled by Griffiths Drilling (NZ) Ltd
T : Standard Penetration Test
DB : Dry barrel.

LOGGED M. Fleming
DATE 20-9-01
TRACED M. Fleming
CHECKED

PROJECT 5c2796.03
HOLE NO BH 417
LENGTH 4.5m

OPUS INTERNATIONAL CONSULTANTS

SHEET 1 OF 1 DRG NO BH417

TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No: 1
Hole Location: Grass verge adjacent to Brooklyn Rd
SHEET 1 OF 2

PROJECT: WCC Central Park Flats
LOCATION: Brooklyn Road
JOB No: 84427.001

CO-ORDINATES mN
mE
Refer to air photograph on page 2 of BH3
R.L. m
DATUM

DRILL TYPE:
DRILL METHOD: Wash/SPT/HQ Core
DRILL FLUID: Bentonite & CR650

HOLE STARTED: 1/12/08
HOLE FINISHED: 2/12/08
DRILLED BY: Griffiths
LOGGED BY: SBS
CHECKED: TRJJ

GEOLOGICAL: GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.

ENGINEERING DESCRIPTION: SOIL DESCRIPTION — Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION — Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.

Columns: FLUID LOSS, WATER, CORE RECOVERY (%), METHOD, CASING, TESTS, SAMPLES, R.L. (m), DEPTH (m), GRAPHIC LOG, CLASSIFICATION SYMBOL, MOISTURE CONDITION / WEATHERING, STRENGTH/DENSITY CLASSIFICATION, SHEAR STRENGTH (kPa) 10 25 50 100 200, COMPRESSIVE STRENGTH (MPa) 1 5 20 50 100 250, DEFECT SPACING (mm) 50 250 1000 2000

GEOLOGICAL	CORE RECOVERY (%)	METHOD	TESTS	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SOIL / ROCK DESCRIPTION
Topsoil				OL	M	S	Fine gravelly SILT, brown with organics
Fill	0	Jet-Vac		GM	M	L	Silty, GRAVEL with a trace of coarse sand, brown grey matrix with brown clasts. Loose, moist, poorly graded, angular to sub angular, MW sandstone gravels (up to 0.25m in diameter), minor Fe staining
	40	SPT	8//3/3/2/2 N=10		D	L-MD	Fine sandy, silty GRAVEL, light grey brown. Loose to Med. dense, dry (no drill fluid used), poorly graded, angular to sub-angular, coarse gravel (dominant), MW sandstone. Silt brown, non plastic.
Alluvium	56	SPT	5//2/2/2/2 N=8		M	L	Becomes medium sandy, silty fine GRAVEL with minor lenses of brown mod. plastic silt, trace of low plasticity clay.
	73	SPT	5//3/4/4/4 N=15			MD	Same as previous but mottled orange brown. Minor lenses of fine sandy, low plasticity clay.
	71	SPT	6//4/4/4/6 N=18	CL		S-F	Fine sandy CLAY with some fine sub-angular gravel, light yellow brown to orange brown. Soft to firm, moist, low plasticity clay, lenses of yellow brown fine to medium sand.
	89	SPT	6//2/2/4/5 N=13	GC		MD	Clayey GRAVEL with some fine sand, light yellow brown to orange brown with some mottling and Fe staining. Mod. dense, moist, moderately graded, clay low plasticity, gravel fine, sub-angular to sub-rounded, HW sandstone
	78	SPT	5//3/4/4/5 N=16	GM			Clayey, silty GRAVEL, light yellow brown to orange brown, mottled with some Fe staining. Mod. dense, moist, mod. graded, fine to coarse (fine dominant), subangular to sub-rounded HW sandstone, silt low plasticity, lenses of low plasticity green brown fine sandy clay.
	91	SPT	8//5/4/6/6 N=21				Becomes more silty with some fine sand.
	91	SPT	8//6/7/9/15 N=37			D	Same as previous, but with increased density and lenses of black brown, low plasticity Silt.
Greywacke Bedrock	85	SPT	16//19/22/9 (25mm) N=>50	Rock	CW-HW	VD	SANDSTONE, light yellow brown to orange brown. HW-CW, weak, highly fractured.

WATER: 9:30am 2/12/2008

Slow loss of fluid 4.9-5.1m

CASING: Uncased

DEPTH (m): 1 2 3 4 5 6 7 8 9 10

grh

Log Scale 1:50

TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No: 1
Hole Location: Grass verge adjacent to Brooklyn Rd
SHEET 2 OF 2

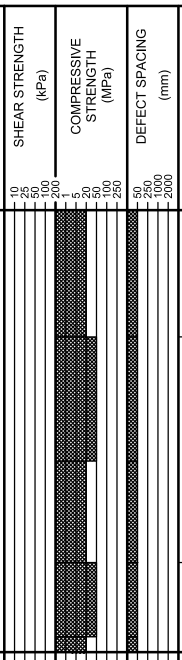
PROJECT: WCC Central Park Flats
LOCATION: Brooklyn Road
JOB No: 84427.001

CO-ORDINATES mN mE
R.L. m
DATUM
Refer to air photograph on page 2 of BH3

DRILL TYPE:
DRILL METHOD: Wash/SPT/HQ Core
DRILL FLUID: Bentonite & CR650

HOLE STARTED: 1/12/08
HOLE FINISHED: 2/12/08
DRILLED BY: Griffiths
LOGGED BY: SBS
CHECKED: TRJJ

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SOIL DESCRIPTION / ROCK DESCRIPTION
Greywacke Bedrock			100	HQ Core	Uncased									SANDSTONE, Same as previous with relic structures. Med. sandy silt, green grey, occasional clay veins. J@10.5m, 87, Pl, Sm, T, CV & FeSt.
									11			HW-MW		SANDSTONE, dark orange brown to yellow brown. HW-MW, weak (weaker towards base), Jointed (dark stained defect surfaces) highly fractured. J@11m, 46, Pl, Sm, T, FeSt. J@11.1m, 45, Pl, Sm, T, FeSt. J@12m, 90, Pl, Sm, T, FeSt.
												HW		
									12			HW-MW		SANDSTONE, dark brown to grey brown. HW-MW, weak, joints Fe stained, minor clay veneer (low plasticity), highly fractured towards base. J 52 & 88.
												HW		
									13					Borehole terminated at 12.92m (Target depth).
									14					
									15					
									16					
									17					
									18					
									19					
									20					



Defects: Type, inclination, thickness, roughness, filling.
Substance: Rock type, particle size, colour, minor components.
Soil type, minor components, plasticity or particle size, colour.

grh
Log Scale 1:50

TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No: 2
Hole Location: Carpark adjacent to block V
SHEET 1 OF 2

PROJECT: WCC Central Park Flats
LOCATION: Narrin St Carpark
JOB No: 84427.001

CO-ORDINATES mN
mE
R.L. m
DATUM
Refer to air photograph on page 2 of BH3

DRILL TYPE:
DRILL METHOD: Wash/SPT/HQ Core
DRILL FLUID: Bentonite & CR650

HOLE STARTED: 2/12/08
HOLE FINISHED: 3/12/08
DRILLED BY: Griffiths
LOGGED BY: SBS
CHECKED: TRJJ

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SOIL DESCRIPTION Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.
Fill		0	Jet-Vac			GP	M	L	ASPHALT
						GC			GRAVEL, basecoarse, angular sandstone gravels.
									Clayey Gravel with some silt and minor med. sand, dark grey brown. Gravel is angular, med. pebble-cobble (up to 0.25m), SW-MW, some Fe staining present. Matrix consist of low plasticity silty clay with trace fine-med. sand.
Alluvium		89	SPT		2//1/1/2/1 N=5	ML		S	Clayey SILT with traces of coarse sand and organics, light brown orange. Soft, Moist, low plasticity, sub-angular sand, occasional fine gravel.
	3/12/2008	98	SPT		2//2/2/2/3 N=9				Some as previous but more yellow in colour
		93	SPT	Uncased	3//3/3/3/5 N=14				Same as previous but with lenses of light green grey low plasticity fine sandy clay.
		93	SPT		3//3/5/5/4 N=17				As above, mottled with some Fe staining, occasional brown silt (ML) lenses.
		96	SPT		4//4/4/5/7 N=20				As above with a trace of green grey low plasticity fine sandy clay lenses.
Residual Soil		89	SPT		8//4/6/7/8 N=25			F	As above with some relic structures.
		78	SPT		9//7/7/8/11 N=33				As above with some dark staing along relic surfaces.
Greywacke Sandstone		79	SPT		14//11/13/16/10 (45mm) N>50	Rock	CW	VD	SANDSTONE, light orange brown.CW, Fine sandy silt, some gravel lenses, relic structures with dark surface staining.

Log Scale 1:50

TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No: 2
Hole Location: Carpark adjacent to block V
SHEET 2 OF 2

PROJECT: WCC Central Park Flats
LOCATION: Narrin St Carpark
JOB No: 84427.001

CO-ORDINATES mN
mE
R.L. m
DATUM
Refer to air photograph on page 2 of BH3

DRILL TYPE:
DRILL METHOD: Wash/SPT/HQ Core
DRILL FLUID: Bentonite & CR650

HOLE STARTED: 2/12/08
HOLE FINISHED: 3/12/08
DRILLED BY: Griffiths
LOGGED BY: SBS
CHECKED: TRJJ

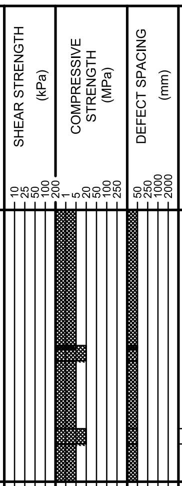
GEOLOGICAL / ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.

SOIL DESCRIPTION
Soil type, minor components, plasticity or particle size, colour.

ROCK DESCRIPTION
Substance: Rock type, particle size, colour, minor components.
Defects: Type, inclination, thickness, roughness, filling.

GEOLOGICAL UNIT	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ENGINEERING DESCRIPTION
Greywacke Sandstone			100	HQ Core	Uncased				10–11.5			CW		Same as previous but darker, multiple fractures. J@10.4m, 45, Pl, Sm, T, FeSt. J@10.5m, 90, Pl, Sm, T, FeSt.
									11.5			CW-HW		Same as previous but less weathered.
									11.5–11.8			CW		Fine SANDSTONE, light orange brown, highly fractured.
									11.8					Borehole terminated at 11.8m (target depth reached).



DEPTH (m): 11 12 13 14 15 16 17 18 19 20

TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No: 3
Hole Location: Adjacent to Narrin St
SHEET 1 OF 2

PROJECT: WCC Central Park Flats	LOCATION: Entrance (of Narrin St)	JOB No: 84427.001
CO-ORDINATES mN mE	DRILL TYPE:	HOLE STARTED: 3/12/08
Refer to air photograph on page 2	DRILL METHOD: Wash/SPT/HQ Core	HOLE FINISHED: 3/12/08
R.L. m		DRILLED BY: Griffiths
DATUM	DRILL FLUID: Bentonite & CR650	LOGGED BY: SBS CHECKED: TRJJ

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SOIL DESCRIPTION
Fill							GP	M	L-MD	ASPHALT
										GRAVEL, basecoarse gravel, angular (50mm)
		0	Jet-Vac			○	GC			Clayey GRAVEL with some silt, brown grey with some Fe staining on clasts. Gravel is angular to sub-angular, cobble to pebble, SW-MW sandstone. Matrix is silty clay with some sand.
Alluvium		71	SPT		1//1/1/2/2 N=6		CL		S	Clayey SILT, bright brown orange with yellow mottling. Soft, Moist, moderate plasticity, trace amounts of med. to fine sand.
		78	SPT		2//1/2/2/3 N=8					Same as previous wth brown silty lenses, low plasticity.
	08/12/2008	91	SPT		2//1/1/2/2 N=6					Same as previous with mod. plasticity, occasional dark silt mottling, trace of fine sub-rounded gravel, some organic matter.
		100	SPT	Uncased	2//2/3/2/3 N=10					Same as previous with low plasticity.
		100	SPT		3//3/3/3/5 N=14					As above, moderate plasticity.
Residual Soil		89	SPT		5//5/6/7/10 N=28		ML		F	Gravelly sandy SILT, light yellow brown with dark brown staining on relic structures. Firm, moist, sand med. to coarse, gravel fine, angular geywacke sandstone, low plasticity silt. CW sandstone.
		100	SPT		4//3/5/5/7 N=20					As above with occasional low plasticity clay seam.
		100	SPT		8//6/7/7/9 N=29					Sandy SILT with traces of clay, light yellow brown with dark brown staining on relic structures. Firm, moist, lenses of yellow grey mod. plasticity clay, sand med. to coarse, gravel fine, angular geywacke sandstone, low plasticity silt. CW sandstone.
		98	SPT		9//8/8/10/15 N=41				St	Same as previous

Log Scale 1:50

TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No: 3
Hole Location: Adjacent to Narrin St

SHEET 2 OF 2

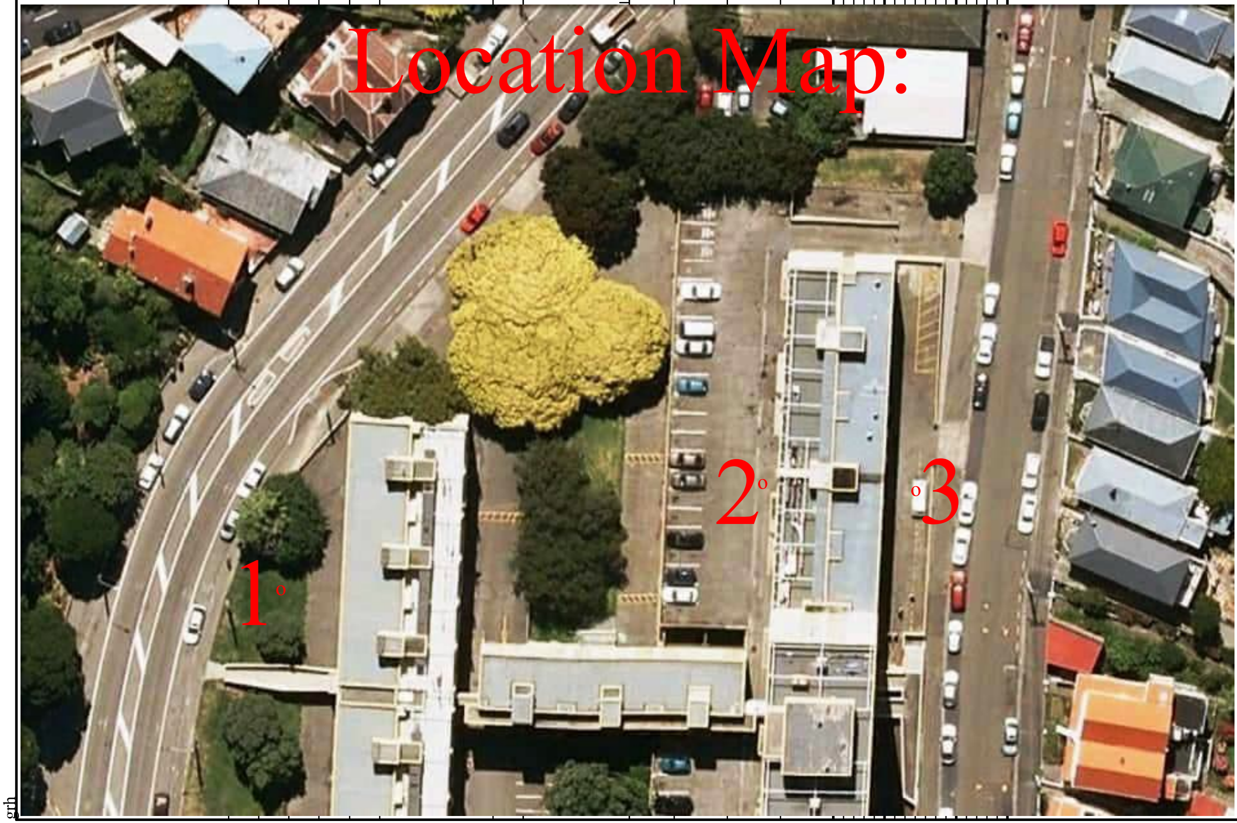
PROJECT: WCC Central Park Flats
LOCATION: Entrance (of Narrin St)
JOB No: 84427.001

CO-ORDINATES mN mE
Refer to air photograph below
R.L. m
DATUM

DRILL TYPE:
DRILL METHOD: Wash/SPT/HQ Core
DRILL FLUID: Bentonite & CR650

HOLE STARTED: 3/12/08
HOLE FINISHED: 3/12/08
DRILLED BY: Griffiths
LOGGED BY: SBS
CHECKED: TRJJ

GEOLOGICAL										ENGINEERING DESCRIPTION							
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	COMPRESSIVE STRENGTH (MPa) 1 5 20 50 100 250	DEFECT SPACING (mm) 50 250 1000 2000	SOIL DESCRIPTION Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.
Greywacke Sandstone			100	HQ Core							Rock	RW					SANDSTONE, light orange brown to yellow brown. CW, fine sandy silt with some clay, trace angular gravel, relic structure (joints), highly fractured. J@10.2m, 97, Pl, Sm, T, FeSt.
			0														Lost Core
			100	HQ Core	Uncased				11			RW-CW					Same as previous, J@11m, 45 & 88, Pl, Sm, T, FeSt.
			0						12								Lost Core
			100	HQ Core								RW-CW					Same as previous but darker.
									13			CW-HW					As above but less weathered, J@12.5m, 45, Pl, Sm, T, FeSt. J@13m, 48, Pl, Sm, T, FeSt.
									14								Borehole terminated at 13.3m (Target depth reached), hole finished as piezometer.



15
16
17
18
19

grh

Log Scale 1:50

ENGEO

LOG OF BORING BH01

Geotechnical Investigation
27 Thompson Street
Mt Cook, Wellington
19520.000.000
N/A

Client : Stratum Management Ltd.
Date : 04/11/2021
Hole Depth : 9.65 m
Drilling Method : HQ Coring
Drilling Contractor : Griffiths Drilling
Core Diameter : 83 mm
Energy Transfer Ratio : 89.9 %
Logged By/Reviewed By : CW / CC
Latitude : -41.298417
Longitude : 174.77153

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%) 25 50 75	Notes
	-	NR		ASPHALT									
	FILL		AB	Hydro excavation: [BASE COARSE] Fine to coarse GRAVEL with minor sand; grey. Well graded; angular to subangular, greywacke; sand is fine to coarse.									
	RESIDUAL SOIL		ML										
0.5			ML	Hydro excavation: SILT with minor sand; brown. Low plasticity; sand is medium to coarse.									
				Hydro excavation: SILT; orange. Low plasticity.					-				
1.0						43							
1.5	Rakaia Terrane SANDSTONE		ML	Completely weathered rock recovered as: SILT with trace sand and trace gravel; reddish brown. Low plasticity; sand is fine to coarse; gravel is fine to coarse, angular to subangular, greywacke.			▼		Very soft	1/0//0/1/0/0 N=1			
2.0			ML	Completely weathered rock recovered as: SILT with some sand; reddish brown. Low plasticity; sand is fine to medium. 2.4 m - Contains trace gravel, angular to subangular, greywacke. 2.6 m - Gravel is lost; colour becomes reddish brown with brown mottles. 2.7 m - Sand fraction becomes minor.		42			-				
2.5													
3.0			ML	Completely weathered rock recovered as: SILT with minor sand and trace gravel; yellow brown with grey mottles. Low plasticity; sand is fine to medium; gravel is fine to medium, angular to subangular, greywacke.		41			Firm	1/0//2/1/2/2 N=7			
3.5			ML	Completely weathered rock recovered as: SILT with minor sand and trace gravel; light brown with black veins. Low plasticity, sand is fine to medium; gravel is fine to medium, angular to subangular, greywacke.					-				
4.0						40							
			-	Core loss.	NR								
4.5			ML	Completely weathered rock recovered as: SILT with minor sand; light brown with black veins. Low plasticity, sand is fine to medium.					Stiff	1/1//3/2/3/2 N=10			
5.0						39							

Borehole met target depth at 9.65 m.

32 mm piezometer installed. Ground water dipped at 1.82 m on 18/11/2021 and 1.92 m on 25/11/2021.

ENGEO

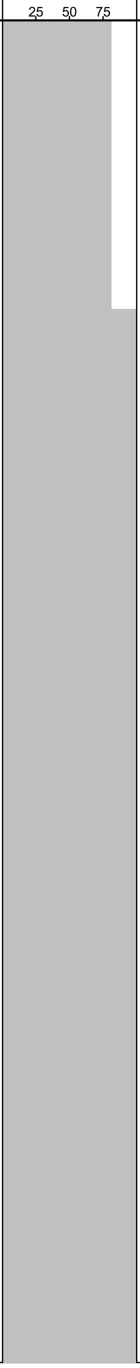
LOG OF BORING BH01

Geotechnical Investigation
27 Thompson Street
Mt Cook, Wellington
19520.000.000
N/A

Client : Stratum Management Ltd.
Date : 04/11/2021
Hole Depth : 9.65 m
Drilling Method : HQ Coring
Drilling Contractor : Griffiths Drilling
Core Diameter : 83 mm
Energy Transfer Ratio : 89.9 %
Logged By/Reviewed By : CW / CC
Latitude : -41.298417
Longitude : 174.77153

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Consistency/ Density Index	SPT N-Value
	Rakaia Terrane SANDSTONE	ML	Completely weathered rock recovered as: SILT with trace sand and trace gravel; reddish brown. Low plasticity; sand is fine to coarse; gravel is fine to medium, angular to subangular, greywacke.			-	
5.5		ML	Completely weathered rock recovered as: SILT with minor sand; light brown with black veins. Low plasticity, sand is fine to medium. 5.45 m - Sand fraction becomes some.			-	
		-	Core loss.	NR			
6.0 6.5		ML	Completely weathered rock recovered as: SILT with some sand and trace gravel; light brown with black veins. Low plasticity, sand is fine to medium; gravel is fine to medium, angular to subangular, greywacke.		38	Very stiff	2/2//3/4/5/6 N=18
7.0 7.5 8.0		ML	Completely weathered rock recovered as: Sandy SILT with trace gravel; light brown with black veins. Low plasticity; sand is fine to coarse; gravel is fine, angular to subangular.		37 36	Hard	5/8//9/9/10/12 N=50+ for 25mm
8.5 9.0		-	Highly weathered, brown with black and grey veins, greywacke SANDSTONE; very weak.		35	-	
		ML	Completely weathered rock recovered as: Sandy SILT; light brown. Low plasticity; sand is fine to medium.				
9.5		-	Highly weathered, brown with black and grey veins, greywacke SANDSTONE; very weak.				

Total Core Recovery (%)



End of Hole Depth: 9.65 m
Termination: Target depth

Borehole met target depth at 9.65 m.

32 mm piezometer installed. Ground water dipped at 1.82 m on 18/11/2021 and 1.92 m on 25/11/2021.

ENGEO

LOG OF WINDOW SAMPLE WS01

Geotechnical Investigation
6 Maarama Crescent
Te Aro, Wellington
17188.000.000

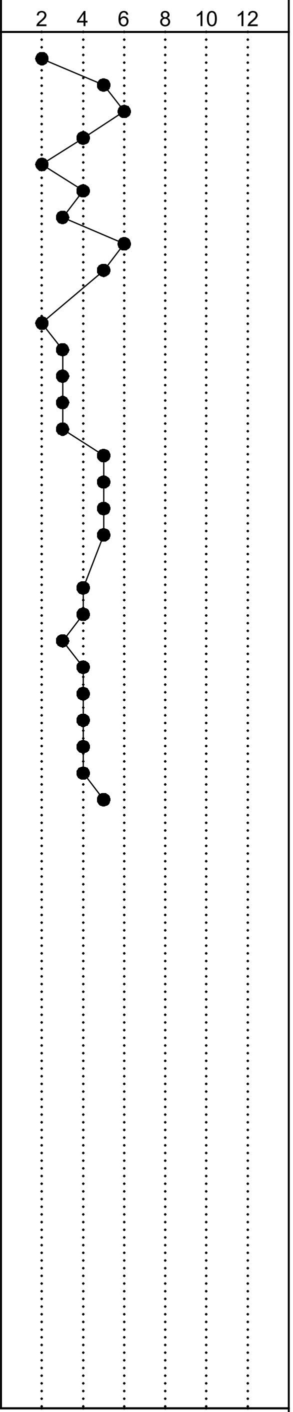
Client : T Irrcher & C Tremblay
Client Ref. : -
Date : 01/05/2020
Hole Depth : 3.7 m
Hole Diameter : 80 mm

Shear Vane No : 2036
Logged By : CC
Reviewed By : CM
Latitude : -41.296766
Longitude : 174.768545

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.5	FILL	ML	Sandy SILT with trace gravel; brown. Low plasticity; sand is fine to coarse; gravel is fine to medium, angular to subangular. Contains rootlets, brick and porcelain. 0.45 m - sand content decreases to minor.				D	Soft Stiff to Very Stiff Soft Firm to Stiff	
		SW	Fine to coarse SAND with minor silt and trace gravel; dark grey. Well graded; gravel is fine to medium, angular. Contains brick and mortar.					Medium Dense	
1.0		ML	Sandy SILT with trace gravel; brown. Low plasticity; sand is fine to coarse; gravel is fine to medium, angular to subangular. Contains rootlets, brick and porcelain.					Firm to Stiff	
1.5	RESIDUAL SOIL	ML	SILT with minor sand; light brown. Low plasticity; sand is fine. 1.5 m - sand content increases to some.				M	Stiff to Very Stiff	
2.0		ML	Sandy SILT; light brown mottled white. Low plasticity.					Very Stiff to Hard	217+
2.5	GW	ML	Completely weathered rock recovered as sandy SILT; light brown mottled orange and white. Low plasticity; sand is fine to coarse. Contains parent rock fabric.					Hard	
3.0	NR		No recovery.	NR				-	
3.5	GW	ML	Completely weathered rock recovered as sandy SILT; light brown mottled orange and white. Low plasticity; sand is fine to coarse. Contains parent rock fabric.						
4.0 4.5 5.0			End of Hole Depth: 3.7 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm



Window sampler met practical refusal at 3.7 m depth on inferred bedrock.
Scala Penetrometer met target depth at 2.9 m.
Standing groundwater was not encountered.
GW = RAKAIA TERRANE GREYWACKE, NR = NO RECOVERY

ENGEO

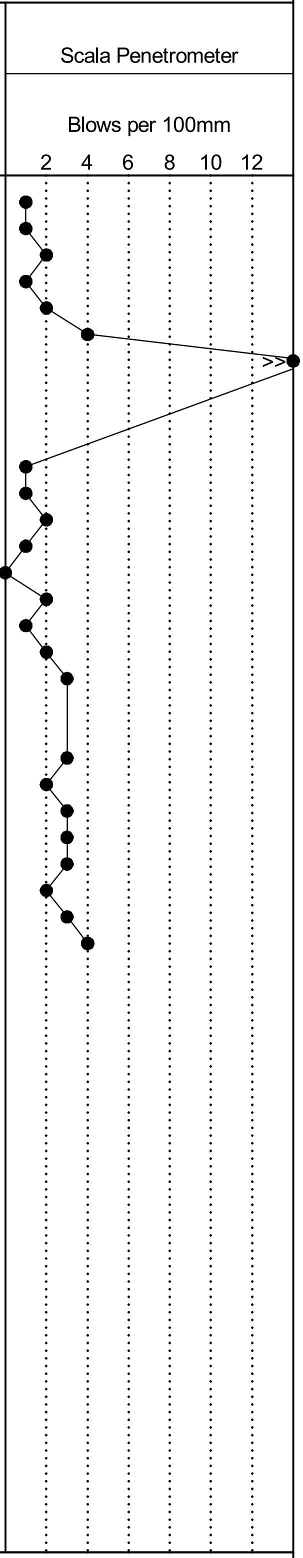
LOG OF WINDOW SAMPLE WS02

Geotechnical Investigation
6 Maarama Crescent
Te Aro, Wellington
17188.000.000

Client : T Irrcher & C Tremblay
Client Ref. : -
Date : 01/05/2020
Hole Depth : 5 m
Hole Diameter : 80 mm

Shear Vane No : 2036
Logged By : CC
Reviewed By : CM
Latitude : -41.296698
Longitude : 174.768582

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.5	FILL	ML	SILT with some sand; dark brown. Low plasticity; sand is fine to medium; gravel is fine, angular to subangular.					Soft Stiff Hard	
1.0 1.5	RESIDUAL SOIL	ML	Sandy SILT; light brown mottled orange and white. Low plasticity; sand is fine to medium.					- Stiff	127/12
		ML	SILT with trace sand; light brown mottled brown. Low plasticity; sand is fine.						
2.0	NR		No recovery.	NR				-	217+
	RS	ML	Clayey SILT; light brown mottled orange. Moderate plasticity.				M	Hard	
2.5		ML	SILT with some sand; light brown mottled brown. Low plasticity; sand is fine.						
3.0	NR		No recovery.	NR				-	217+
3.5	RS	ML	SILT with some sand; light brown mottled brown. Low plasticity; sand is fine.					Hard	
4.0	NR		No recovery.	NR					
4.5	GW	ML	Completely weathered rock recovered as sandy SILT; light brown mottled white with black veins; sand is fine to medium. Contains parent rock fabric.				D	-	
5.0			End of Hole Depth: 5 m Termination Condition: Practical refusal						



Window sampler met practical refusal at 5 m depth on inferred bedrock.
Scala Penetrometer met target depth at 2.9 m.
Standing groundwater was not encountered.
NR = NO RECOVERY, RS = RESIDUAL SOIL, GW = RAKAIA TERRANE GREYWACKE

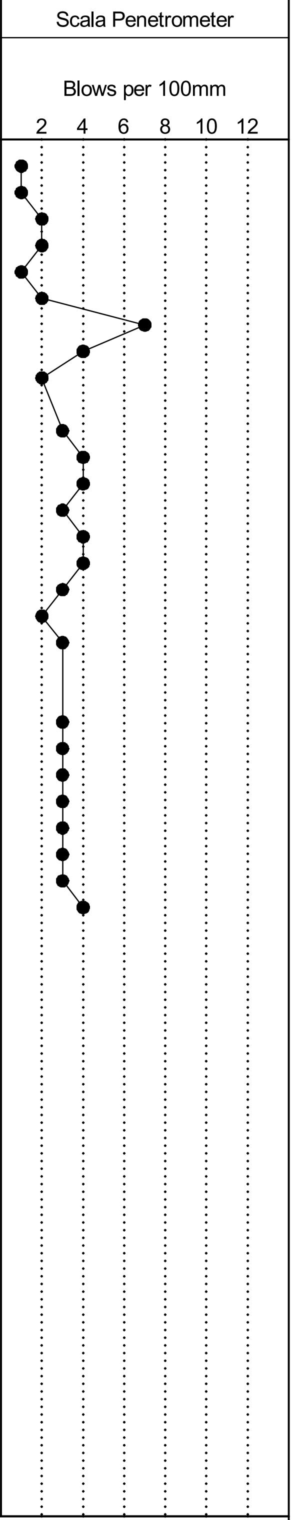
ENGEO

LOG OF WINDOW SAMPLE WS03

Geotechnical Investigation
6 Maarama Crescent
Te Aro, Wellington
17188.000.000

Client : T Irrcher & C Tremblay
Client Ref. : -
Date : 01/05/2020
Hole Depth : 4 m
Hole Diameter : 80 mm
Shear Vane No : 2036
Logged By : CC
Reviewed By : CM
Latitude : -41.296716
Longitude : 174.768619

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.5	FILL	ML	SILT with minor sand and trace gravel; dark brown mottled light brown. Low plasticity; sand is fine to coarse; gravel is fine to medium, angular to subangular. Contains organics and rootlets.	▨				Soft to Stiff	
		SW	Gravelly fine to coarse SAND with trace silt; grey. Well graded; gravel is fine to medium, angular to subrounded.	▨					
		ML	SILT with some sand and trace gravel; dark brown mottled light brown. Low plasticity; sand is fine to coarse; gravel is fine to medium, angular to subangular.	▨				-	
1.0	RESIDUAL SOIL	ML	SILT with some sand; light brown mottled white. Low plasticity; sand is fine to medium.	▥					217+
1.5		ML	Sandy SILT; light brown mottled white and black. Low plasticity; sand is fine to medium.	▥					
2.0 2.5		ML	Clayey SILT with trace sand; light brown mottled orange. Moderate plasticity; sand is fine.	▥			M	Hard	217+
3.0	NR		No recovery.	NR				-	217+
3.5	RS	ML	Sandy SILT; light brown mottled white and black. Low plasticity; sand is fine to medium.	▥				Hard	
4.0	GW	ML	Completeley weathered rock recovered as sandy SILT; light brown mottled orange with black veins. Low plasticity; sand is fine to coarse. Contains parent rock fabric.	▦				-	
4.5 5.0			End of Hole Depth: 4 m Termination Condition: Practical refusal						



Window sampler met practical refusal at 4 m depth on inferred bedrock.
Scala Penetrometer met target depth at 2.9 m.
Standing groundwater was not encountered.
NR = NO RECOVERY, RS = RESIDUAL SOIL, GW = RAKAIA TERRANE GREYWACKE

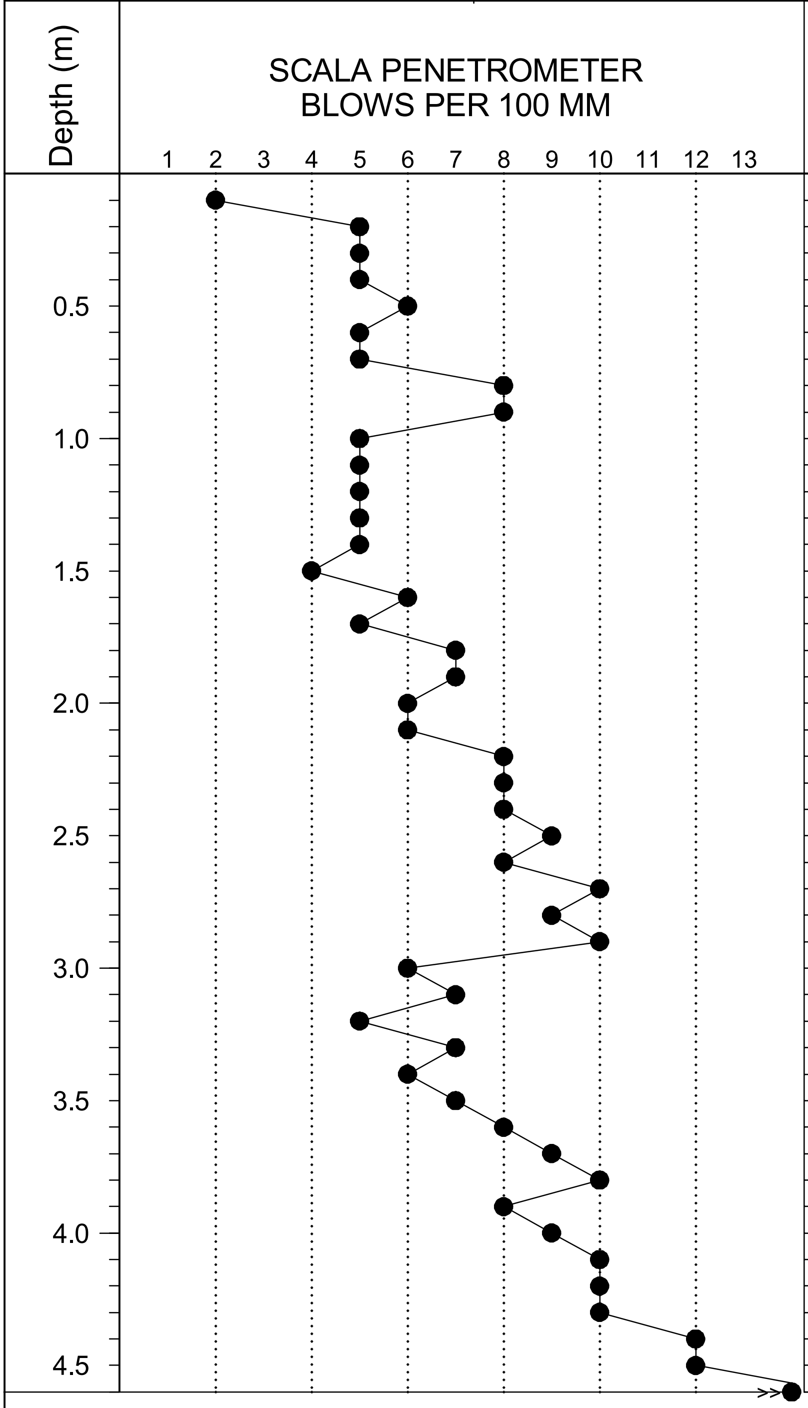
GEOTECH HAND AUGER WINDOW SAMPLER LOGS.GPJ NZ DATA TEMPLATE 2.GDT 6/5/20

LOG OF SCALA SP04

Geotechnical Investigation
6 Maarama Crescent
Te Aro, Wellington
17188.000.000

Client : T Irrcher & C Tremblay
Client Ref. : -
Date : 01/05/2020
Scala Depth : 4.6 m

Logged By : CC
Reviewed By : CM
Latitude : -41.296937
Longitude : 174.768566



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Scala Penetrometer met practical refusal at 4.6 m.

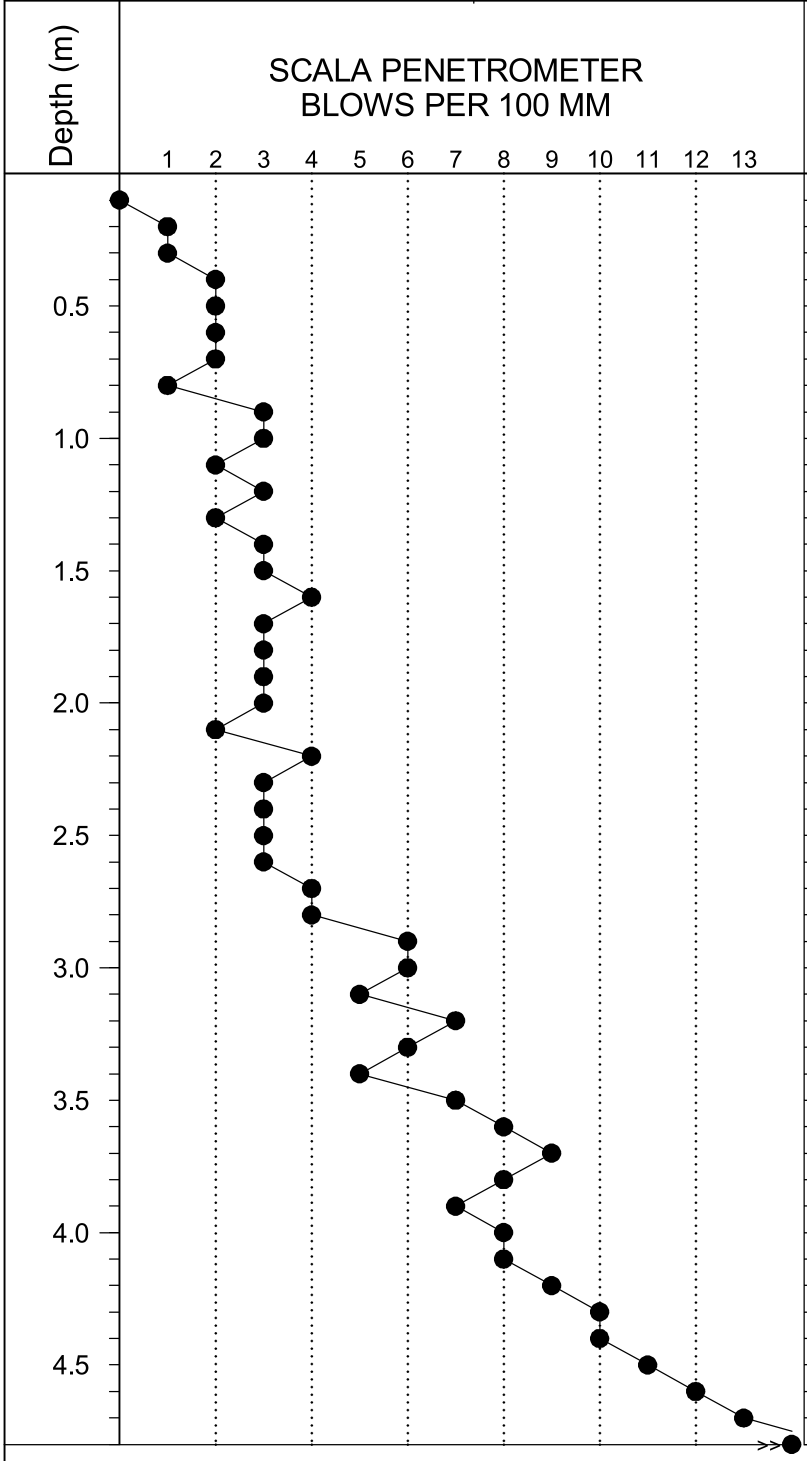
ENGEO

LOG OF SCALA SP05

Geotechnical Investigation
6 Maarama Crescent
Te Aro, Wellington
17188.000.000

Client : T Irrcher & C Tremblay
Client Ref. : -
Date : 01/05/2020
Scala Depth : 4.8 m

Logged By : CC
Reviewed By : CM
Latitude : -41.297004
Longitude : 174.768528



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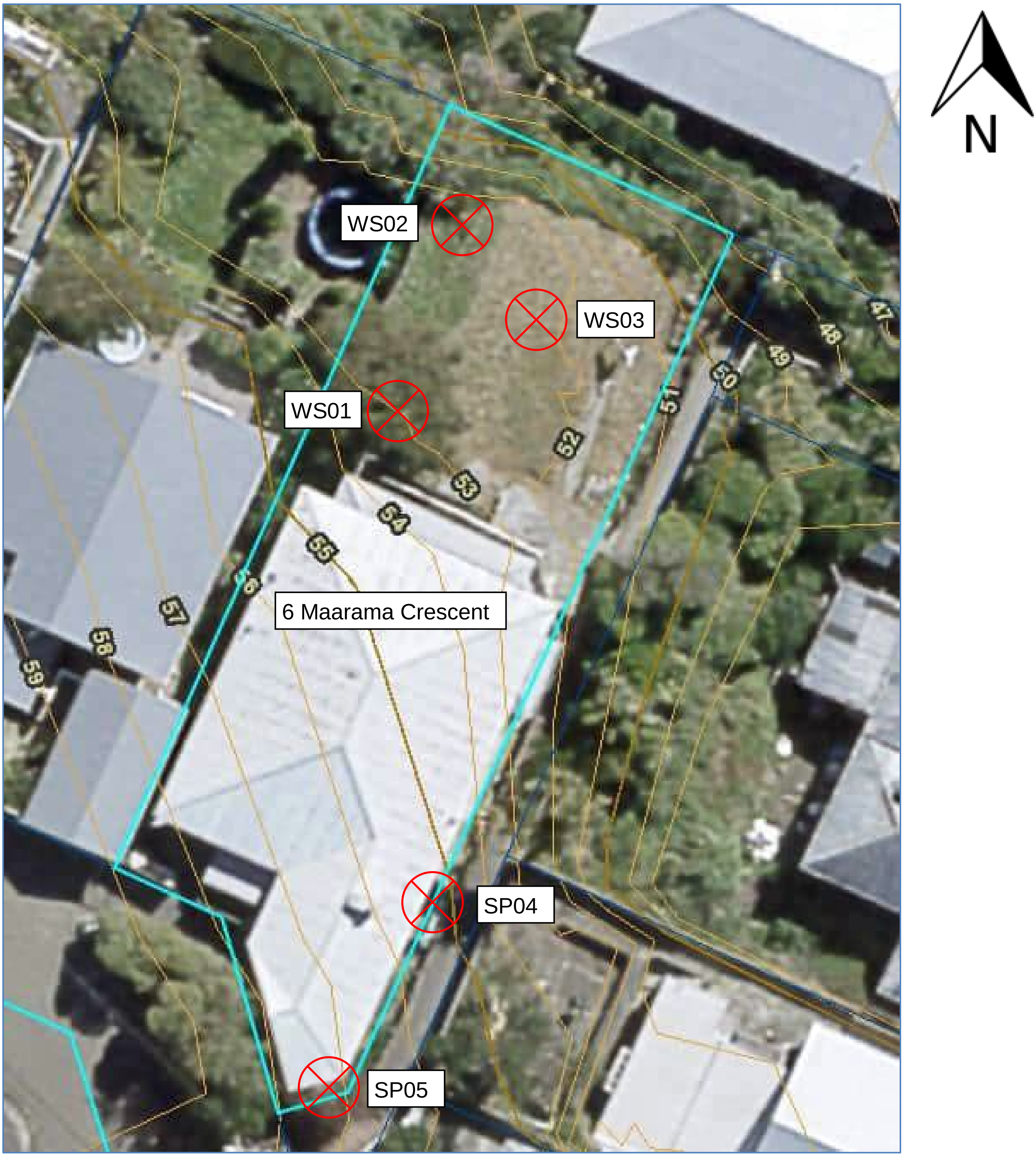
Scala Penetrometer met practical refusal at 4.8 m.



KEY

Test Locations ⊗

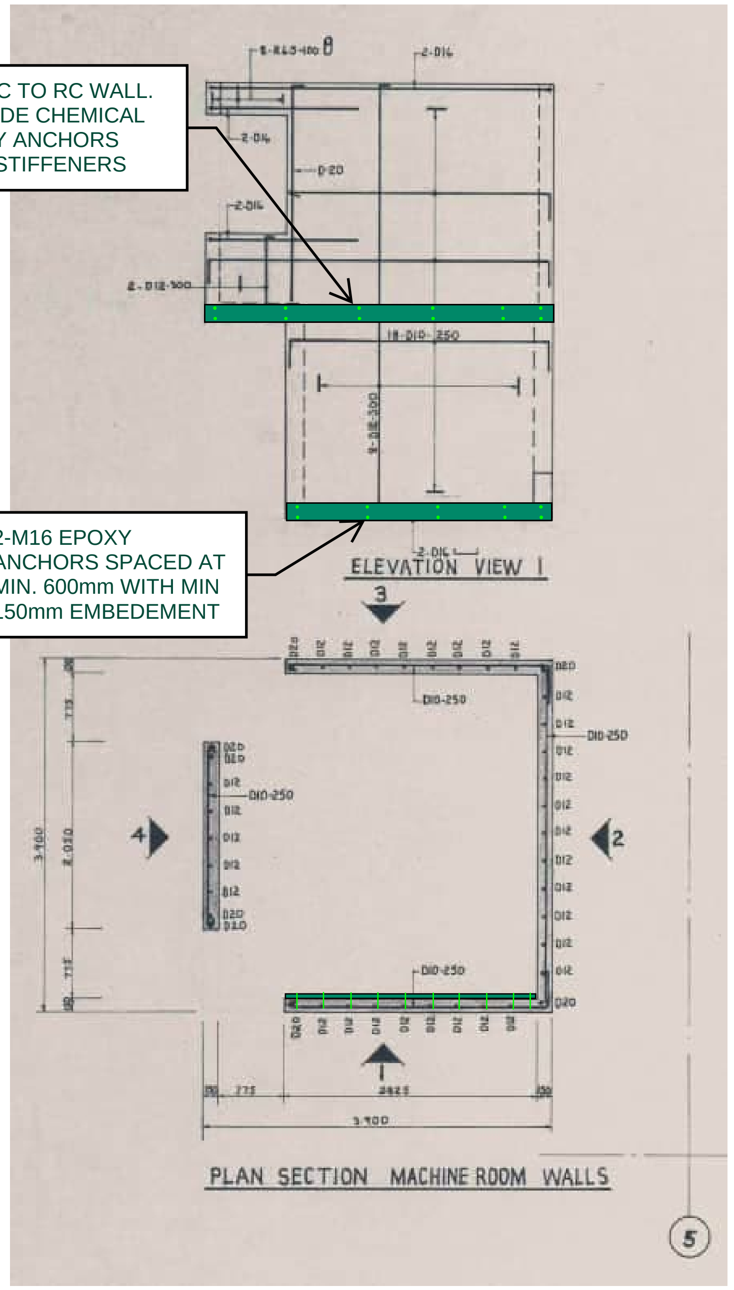
Date	01/05/2020	**Client**	T Irrcher & C Tremblay
Drawn by	CC	**Project**	6 Maarama Crescent
Approved by	PB	**Description**	Site Plan
Scale (approx.)	NTS	**ENGEO Ref.**	17188.000.000

Appendix F

Seismic Retrofit Concepts

NOTES

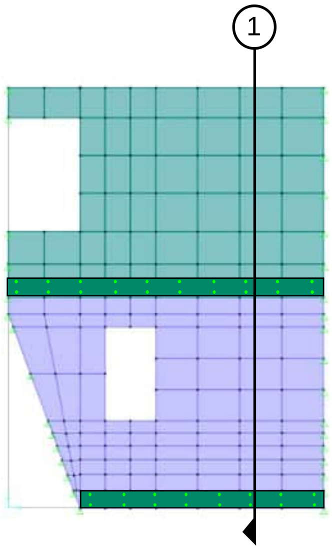
1. A NUMBER OF NON-STRUCTURAL ITEMS MAY REQUIRE DEMOLITION TO EFFECT STRENGTHENING WORKS.
2. ALLOW FOR ACCESSIBILITY AND FIRE ENGINEERING REPORTS FOR COST ESTIMATE.
3. QUANTITY SURVEYOR TO REFER TO ARCHITECTURAL DRAWINGS FOR NON-STRUCTURAL ELEMENTS TO UNDERSTAND EXTENT OF DEMOLITION OF EXISTING FITOUT AND RECONSTRUCTION (WHERE APPLICABLE).
4. EXISTING DRAWINGS HAVE BEEN OVER-MARKED.
5. SITE SPECIFIC GEOTECHNICAL INVESTIGATION TO BE COMPLETED PRIOR TO STRENGTHENING WORKS
6. OTHER WALLS SCORE APPROX 61%*NBS* AND DO NOT REQUIRE STRENGTHENING DUE TO LOW LIFE SAFETY RISK AND LIKELY HIGHER DUCTILITY AVAILABLE.
7. ALL SIZES ARE INDICATIVE, ONLY USED FOR COSTING.
8. ALL EPOXY ANCHOR BOLTS SHALL BE GRADE 830MPa.
9. ALL EPOXY SHALL BE RAMSET EPCON C8 Xtrem OR EQUIVALENT.



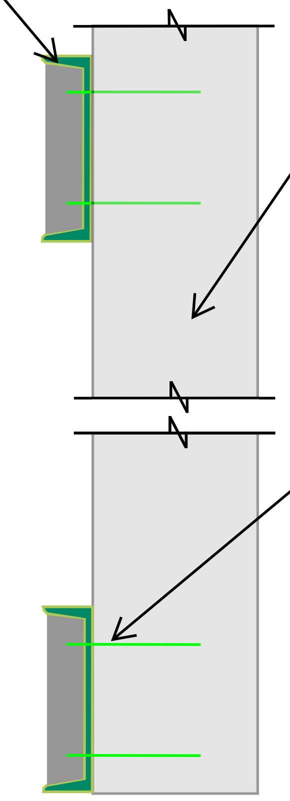
200PFC TO RC WALL. PROVIDE CHEMICAL EPOXY ANCHORS WITH STIFFENERS

2-M16 EPOXY ANCHORS SPACED AT MIN. 600mm WITH MIN 150mm EMBEDEMENT

MACHINE ROOM SUSPENDED WALL ELEVATION + PLAN



ACTUAL ARRANGEMENT FROM SITE VISIT SECTION



200PFC TO RC WALL. PROVIDE CHEMICAL EPOXY ANCHORS WITH STIFFENERS

EXISTING MACHINE ROOM RC WALL

2-M16 EPOXY ANCHORS SPACED AT MIN. 600mm WITH MIN 150mm EMBEDEMEN

DETAIL 1 - PFC SUPPORT SECTION

CONCEPT ONLY
NOT FOR CONSTRUCTION

67%NBS(IL2) PRIMARY STRUCTURE STRENGTHENING

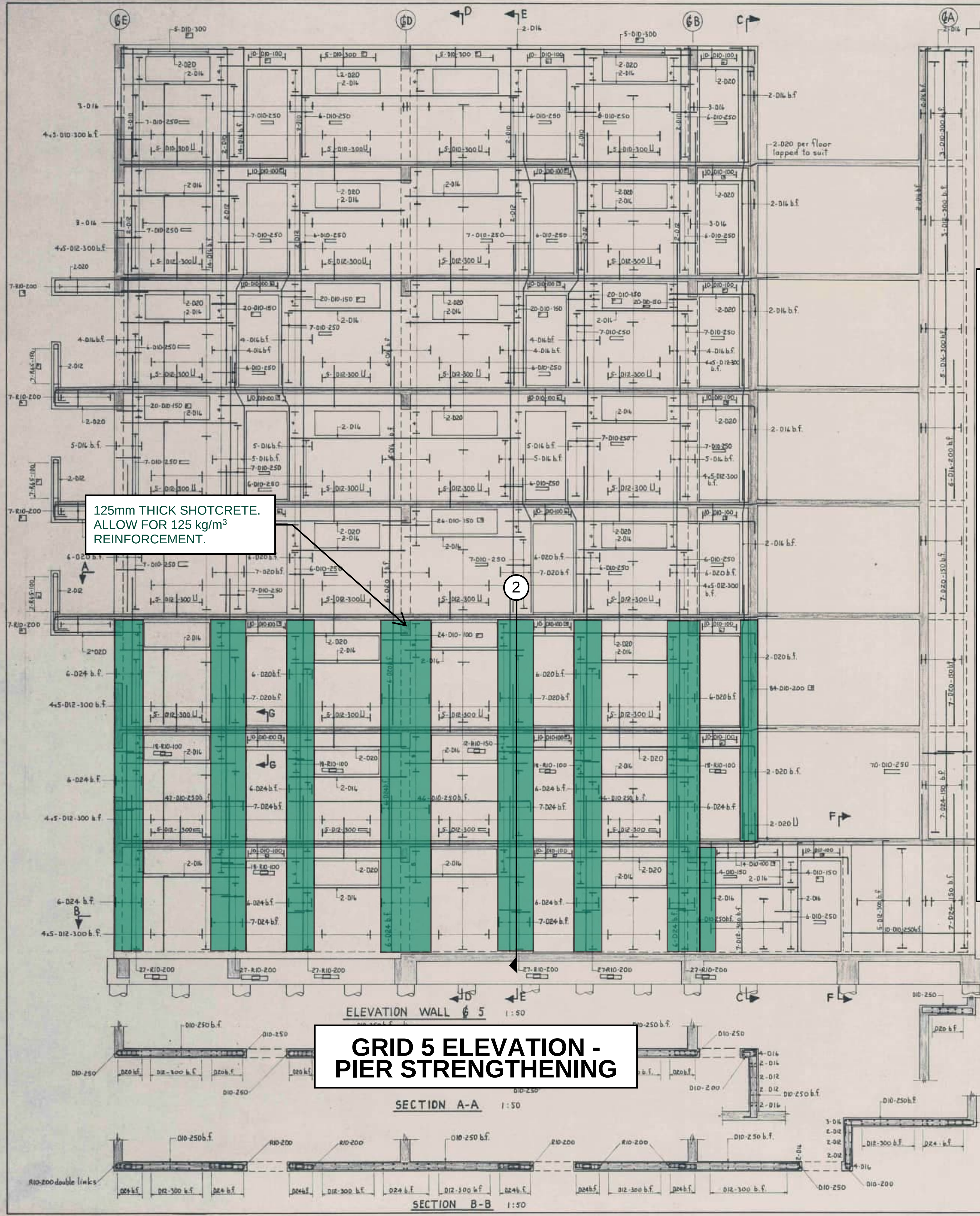
PROJECT TITLE:	4 Brooklyn Road, Block A (PUKA)
PROJECT NO:	60723635
DATE:	19/04/24

SKT-001
67% CONCEPT STRENGTHENING SCHEME
WALLS OUT-OF-PLANE - PFC STRENGTHENING
REV A

DRAWN: VERIFIED: APPROVED:

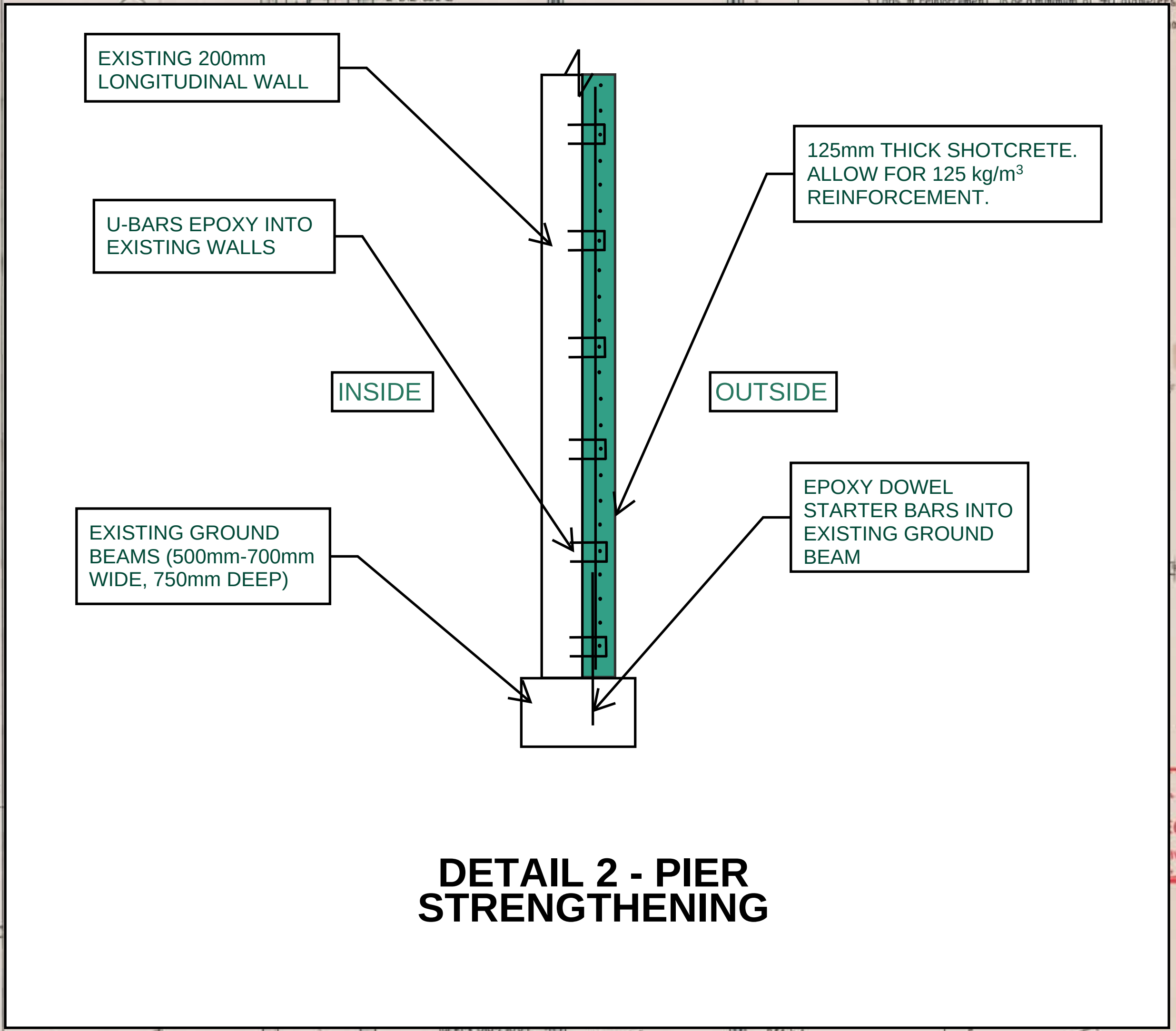
NOTES

1. A NUMBER OF NON-STRUCTURAL ITEMS MAY REQUIRE DEMOLITION TO EFFECT STRENGTHENING WORKS.
2. ALLOW FOR ACCESSIBILITY AND FIRE ENGINEERING REPORTS FOR COST ESTIMATE.
3. QUANTITY SURVEYOR TO REFER TO ARCHITECTURAL DRAWINGS FOR NON-STRUCTURAL ELEMENTS TO UNDERSTAND EXTENT OF DEMOLITION OF EXISTING FITOUT AND RECONSTRUCTION (WHERE APPLICABLE).
4. EXISTING DRAWINGS HAVE BEEN OVER-MARKED.
5. SITE SPECIFIC GEOTECHNICAL INVESTIGATION TO BE COMPLETED PRIOR TO STRENGTHENING WORKS
6. ALL SIZES ARE INDICATIVE, ONLY USED FOR COSTING.
7. SHOTCRETE TO BE 40 MPA.



125mm THICK SHOTCRETE. ALLOW FOR 125 kg/m^3 REINFORCEMENT.

GRID 5 ELEVATION - PIER STRENGTHENING



EXISTING 200mm LONGITUDINAL WALL

U-BARS EPOXY INTO EXISTING WALLS

EXISTING GROUND BEAMS (500mm-700mm WIDE, 750mm DEEP)

125mm THICK SHOTCRETE. ALLOW FOR 125 kg/m^3 REINFORCEMENT.

EPOXY DOWEL STARTER BARS INTO EXISTING GROUND BEAM

DETAIL 2 - PIER STRENGTHENING

CONCEPT ONLY
NOT FOR CONSTRUCTION

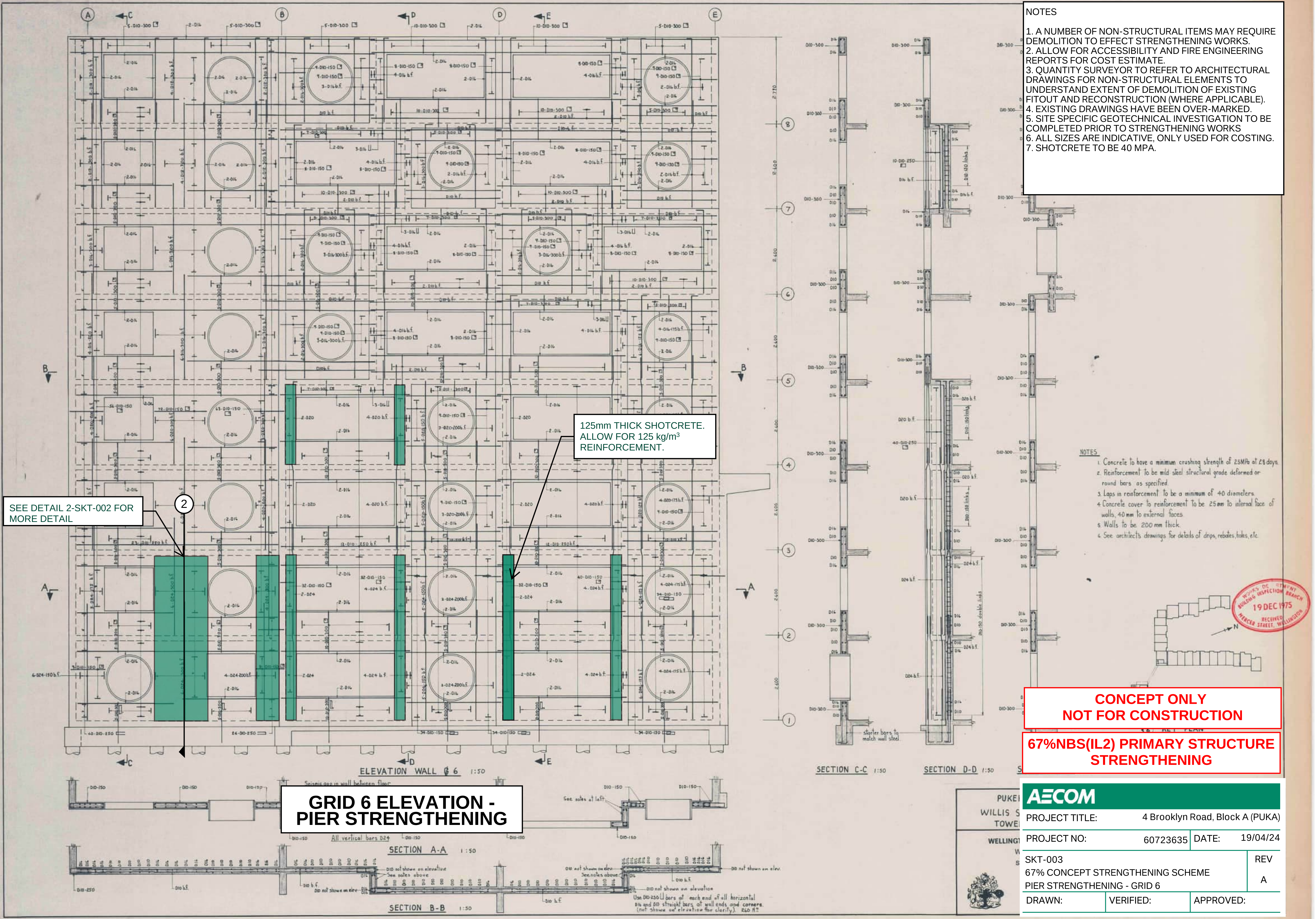
67%NBS(IL2) PRIMARY STRUCTURE STRENGTHENING

AECOM

PROJECT TITLE:	4 Brooklyn Road, Block A (PUKA)		
PROJECT NO:	60723635	DATE:	19/04/24
SKT-002 67% CONCEPT STRENGTHENING SCHEME PIER STRENGTHENING - GRID 5		REV	A
DRAWN:	VERIFIED:	APPROVED:	

NOTES

1. A NUMBER OF NON-STRUCTURAL ITEMS MAY REQUIRE DEMOLITION TO EFFECT STRENGTHENING WORKS.
2. ALLOW FOR ACCESSIBILITY AND FIRE ENGINEERING REPORTS FOR COST ESTIMATE.
3. QUANTITY SURVEYOR TO REFER TO ARCHITECTURAL DRAWINGS FOR NON-STRUCTURAL ELEMENTS TO UNDERSTAND EXTENT OF DEMOLITION OF EXISTING FITOUT AND RECONSTRUCTION (WHERE APPLICABLE).
4. EXISTING DRAWINGS HAVE BEEN OVER-MARKED.
5. SITE SPECIFIC GEOTECHNICAL INVESTIGATION TO BE COMPLETED PRIOR TO STRENGTHENING WORKS
6. ALL SIZES ARE INDICATIVE, ONLY USED FOR COSTING.
7. SHOTCRETE TO BE 40 MPA.



125mm THICK SHOTCRETE. ALLOW FOR 125 kg/m^3 REINFORCEMENT.

SEE DETAIL 2-SKT-002 FOR MORE DETAIL

NOTES
1. Concrete to have a minimum crushing strength of 25MPa at 28 days
2. Reinforcement to be mild steel structural grade deformed or round bars as specified
3. Laps in reinforcement to be a minimum of 40 diameters.
4. Concrete cover to reinforcement to be 25mm to internal face of walls, 40 mm to external faces
5. Walls to be 200 mm thick
6. See architects drawings for details of drips, rebates, holes, etc.

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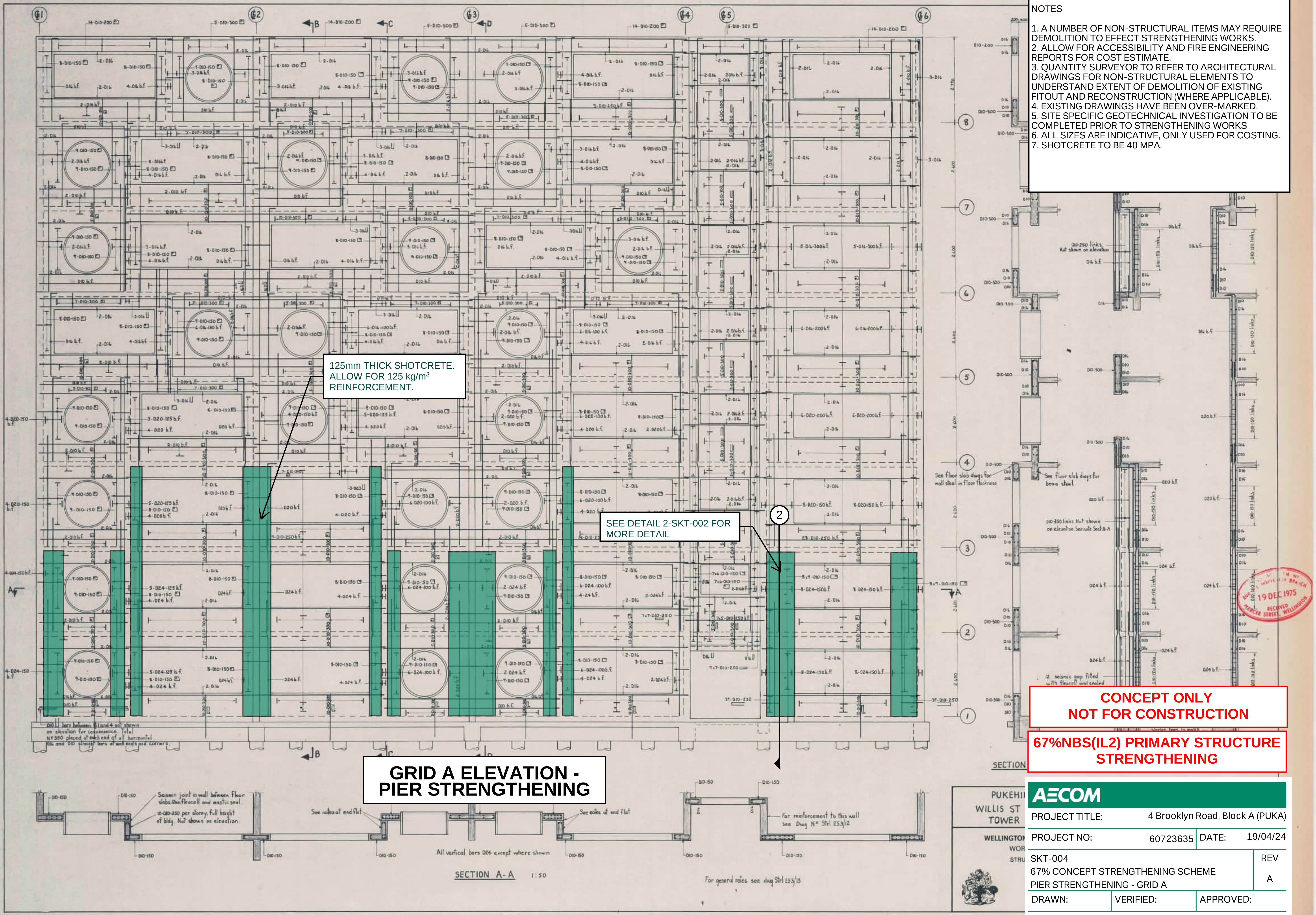
GRID 6 ELEVATION - PIER STRENGTHENING

CONCEPT ONLY
NOT FOR CONSTRUCTION

67%NBS(IL2) PRIMARY STRUCTURE STRENGTHENING

AECOM

PROJECT TITLE:	4 Brooklyn Road, Block A (PUKA)		
PROJECT NO:	60723635	DATE:	19/04/24
SKT-003 67% CONCEPT STRENGTHENING SCHEME PIER STRENGTHENING - GRID 6		REV	A
DRAWN:	VERIFIED:	APPROVED:	



NOTES

1. A NUMBER OF NON-STRUCTURAL ITEMS MAY REQUIRE DEMOLITION TO EFFECT STRENGTHENING WORKS.
2. ALLOW FOR ACCESSIBILITY AND FIRE ENGINEERING REPORTS FOR COST ESTIMATE.
3. QUANTITY SURVEYOR TO REFER TO ARCHITECTURAL DRAWINGS FOR NON-STRUCTURAL ELEMENTS TO UNDERSTAND EXTENT OF DEMOLITION OF EXISTING FITOUT AND RECONSTRUCTION (WHERE APPLICABLE).
4. EXISTING DRAWINGS HAVE BEEN OVER-MARKED.
5. SITE SPECIFIC GEOTECHNICAL INVESTIGATION TO BE COMPLETED PRIOR TO STRENGTHENING WORKS
6. ALL SIZES ARE INDICATIVE, ONLY USED FOR COSTING.
7. SHOTCRETE TO BE 40 MPA.

125mm THICK SHOTCRETE. ALLOW FOR 125 kg/m^3 REINFORCEMENT.

SEE DETAIL 2-SKT-002 FOR MORE DETAIL

②

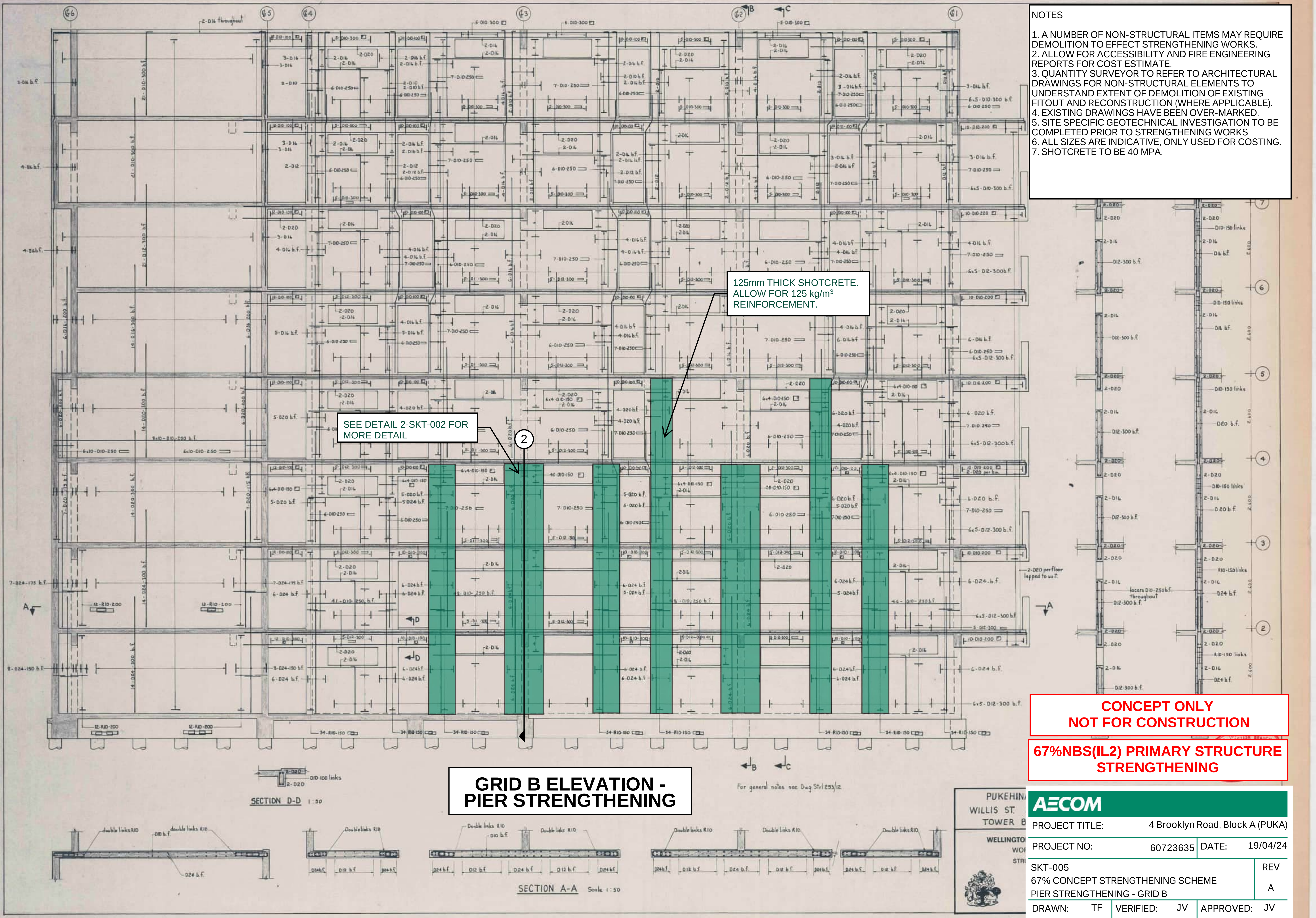
GRID A ELEVATION - PIER STRENGTHENING

CONCEPT ONLY
NOT FOR CONSTRUCTION

67%NBS(IL2) PRIMARY STRUCTURE STRENGTHENING

AECOM

PROJECT TITLE:	4 Brooklyn Road, Block A (PUKA)		
PROJECT NO:	60723635	DATE:	19/04/24
SKT-004 67% CONCEPT STRENGTHENING SCHEME PIER STRENGTHENING - GRID A			REV A
DRAWN:	VERIFIED:	APPROVED:	



125mm THICK SHOTCRETE. ALLOW FOR 125 kg/m^3 REINFORCEMENT.

SEE DETAIL 2-SKT-002 FOR MORE DETAIL

GRID B ELEVATION - PIER STRENGTHENING

NOTES

1. A NUMBER OF NON-STRUCTURAL ITEMS MAY REQUIRE DEMOLITION TO EFFECT STRENGTHENING WORKS.
2. ALLOW FOR ACCESSIBILITY AND FIRE ENGINEERING REPORTS FOR COST ESTIMATE.
3. QUANTITY SURVEYOR TO REFER TO ARCHITECTURAL DRAWINGS FOR NON-STRUCTURAL ELEMENTS TO UNDERSTAND EXTENT OF DEMOLITION OF EXISTING FITOUT AND RECONSTRUCTION (WHERE APPLICABLE).
4. EXISTING DRAWINGS HAVE BEEN OVER-MARKED.
5. SITE SPECIFIC GEOTECHNICAL INVESTIGATION TO BE COMPLETED PRIOR TO STRENGTHENING WORKS
6. ALL SIZES ARE INDICATIVE, ONLY USED FOR COSTING.
7. SHOTCRETE TO BE 40 MPA.

CONCEPT ONLY
NOT FOR CONSTRUCTION

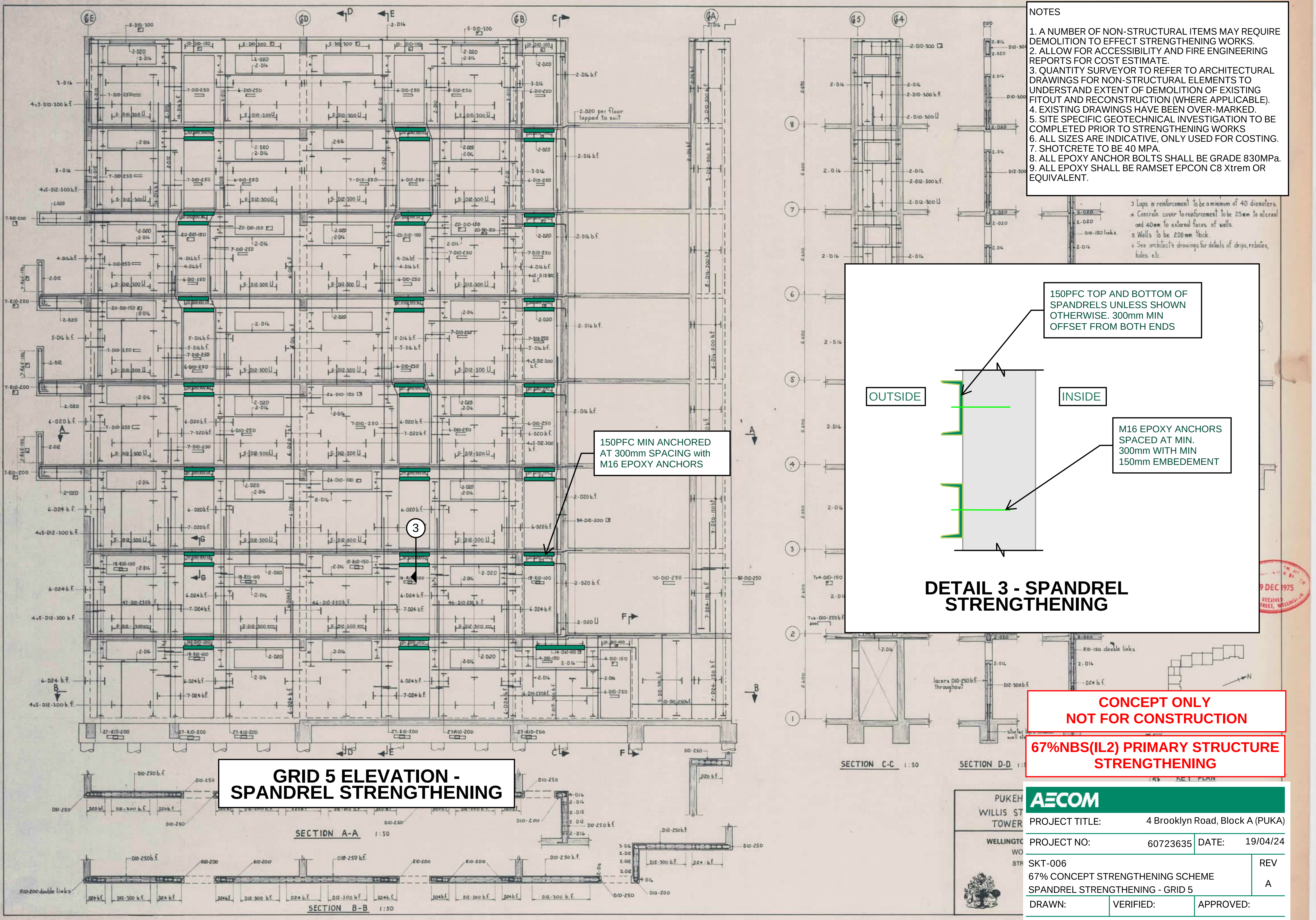
67%NBS(IL2) PRIMARY STRUCTURE STRENGTHENING

AECOM

PROJECT TITLE:	4 Brooklyn Road, Block A (PUKA)		
PROJECT NO:	60723635	DATE:	19/04/24
SKT-005 67% CONCEPT STRENGTHENING SCHEME PIER STRENGTHENING - GRID B		REV	A
DRAWN: TF	VERIFIED: JV	APPROVED: JV	

NOTES

1. A NUMBER OF NON-STRUCTURAL ITEMS MAY REQUIRE DEMOLITION TO EFFECT STRENGTHENING WORKS.
2. ALLOW FOR ACCESSIBILITY AND FIRE ENGINEERING REPORTS FOR COST ESTIMATE.
3. QUANTITY SURVEYOR TO REFER TO ARCHITECTURAL DRAWINGS FOR NON-STRUCTURAL ELEMENTS TO UNDERSTAND EXTENT OF DEMOLITION OF EXISTING FITOUT AND RECONSTRUCTION (WHERE APPLICABLE).
4. EXISTING DRAWINGS HAVE BEEN OVER-MARKED.
5. SITE SPECIFIC GEOTECHNICAL INVESTIGATION TO BE COMPLETED PRIOR TO STRENGTHENING WORKS
6. ALL SIZES ARE INDICATIVE, ONLY USED FOR COSTING.
7. SHOTCRETE TO BE 40 MPA.
8. ALL EPOXY ANCHOR BOLTS SHALL BE GRADE 830MPa.
9. ALL EPOXY SHALL BE RAMSET EPCON C8 Xtrem OR EQUIVALENT.



GRID 5 ELEVATION - SPANDREL STRENGTHENING

DETAIL 3 - SPANDREL STRENGTHENING

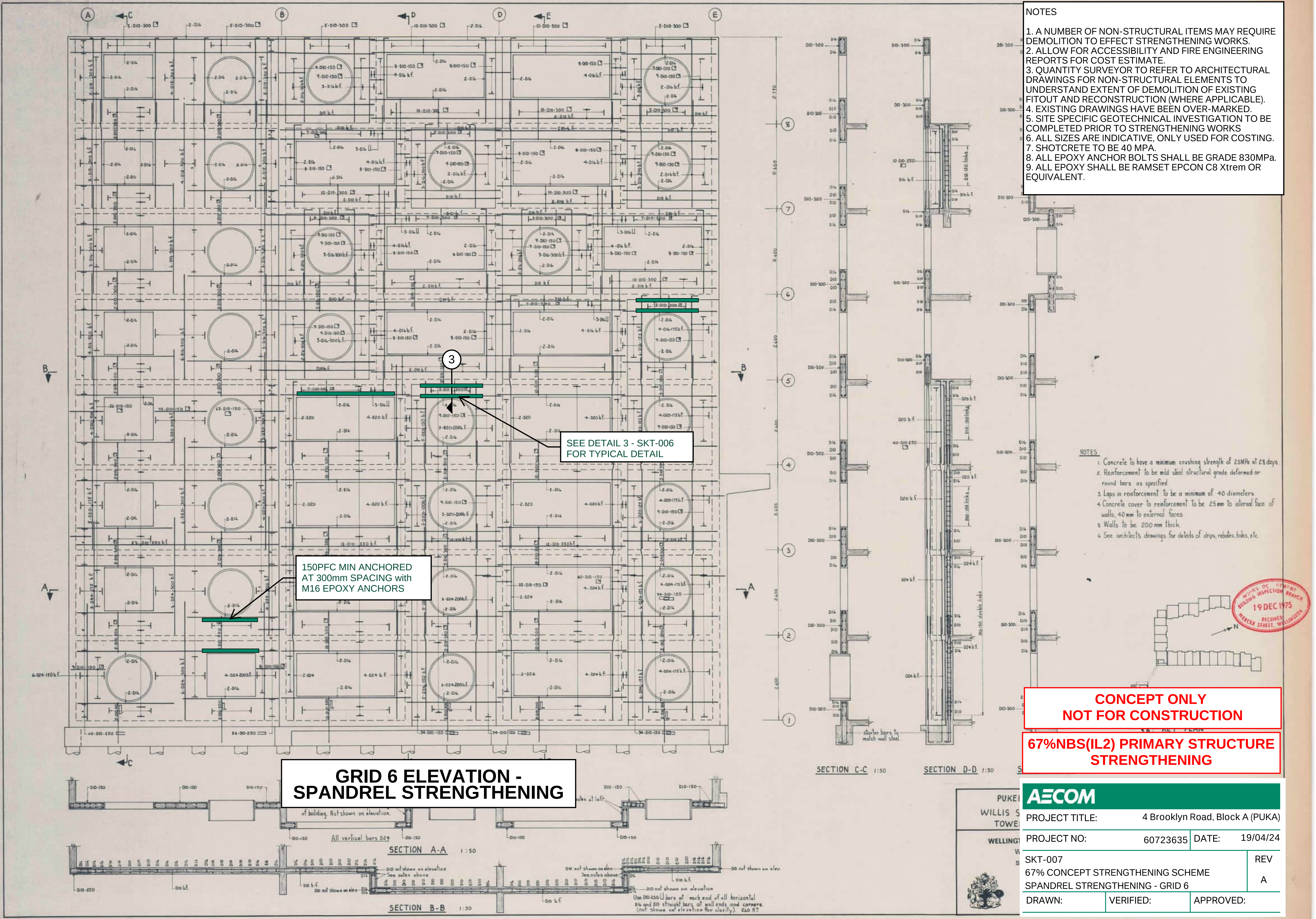
CONCEPT ONLY
NOT FOR CONSTRUCTION

67%NBS(IL2) PRIMARY STRUCTURE STRENGTHENING

AECOM

PROJECT TITLE:	4 Brooklyn Road, Block A (PUKA)		
PROJECT NO:	60723635	DATE:	19/04/24
SKT-006 67% CONCEPT STRENGTHENING SCHEME SPANDREL STRENGTHENING - GRID 5		REV	A
DRAWN:	VERIFIED:	APPROVED:	

GRID 6 ELEVATION - SPANDREL STRENGTHENING



SEE DETAIL 3 - SKT-006
FOR TYPICAL DETAIL

150PFC MIN ANCHORED
AT 300mm SPACING with
M16 EPOXY ANCHORS

NOTES

1. A NUMBER OF NON-STRUCTURAL ITEMS MAY REQUIRE DEMOLITION TO EFFECT STRENGTHENING WORKS.
2. ALLOW FOR ACCESSIBILITY AND FIRE ENGINEERING REPORTS FOR COST ESTIMATE.
3. QUANTITY SURVEYOR TO REFER TO ARCHITECTURAL DRAWINGS FOR NON-STRUCTURAL ELEMENTS TO UNDERSTAND EXTENT OF DEMOLITION OF EXISTING FITOUT AND RECONSTRUCTION (WHERE APPLICABLE).
4. EXISTING DRAWINGS HAVE BEEN OVER-MARKED.
5. SITE SPECIFIC GEOTECHNICAL INVESTIGATION TO BE COMPLETED PRIOR TO STRENGTHENING WORKS
6. ALL SIZES ARE INDICATIVE, ONLY USED FOR COSTING.
7. SHOTCRETE TO BE 40 MPA.
8. ALL EPOXY ANCHOR BOLTS SHALL BE GRADE 830MPa.
9. ALL EPOXY SHALL BE RAMSET EPCON C8 Xtrem OR EQUIVALENT.

NOTES

1. Concrete to have a minimum crushing strength of 25MPa at 28 days.
2. Reinforcement to be mild steel structural grade deformed or round bars as specified.
3. Laps in reinforcement to be a minimum of 40 diameters.
4. Concrete cover to reinforcement to be 25 mm to internal face of walls, 40 mm to external faces.
5. Walls to be 200 mm thick.
6. See architects drawings for details of drips, rebates, holes, etc.

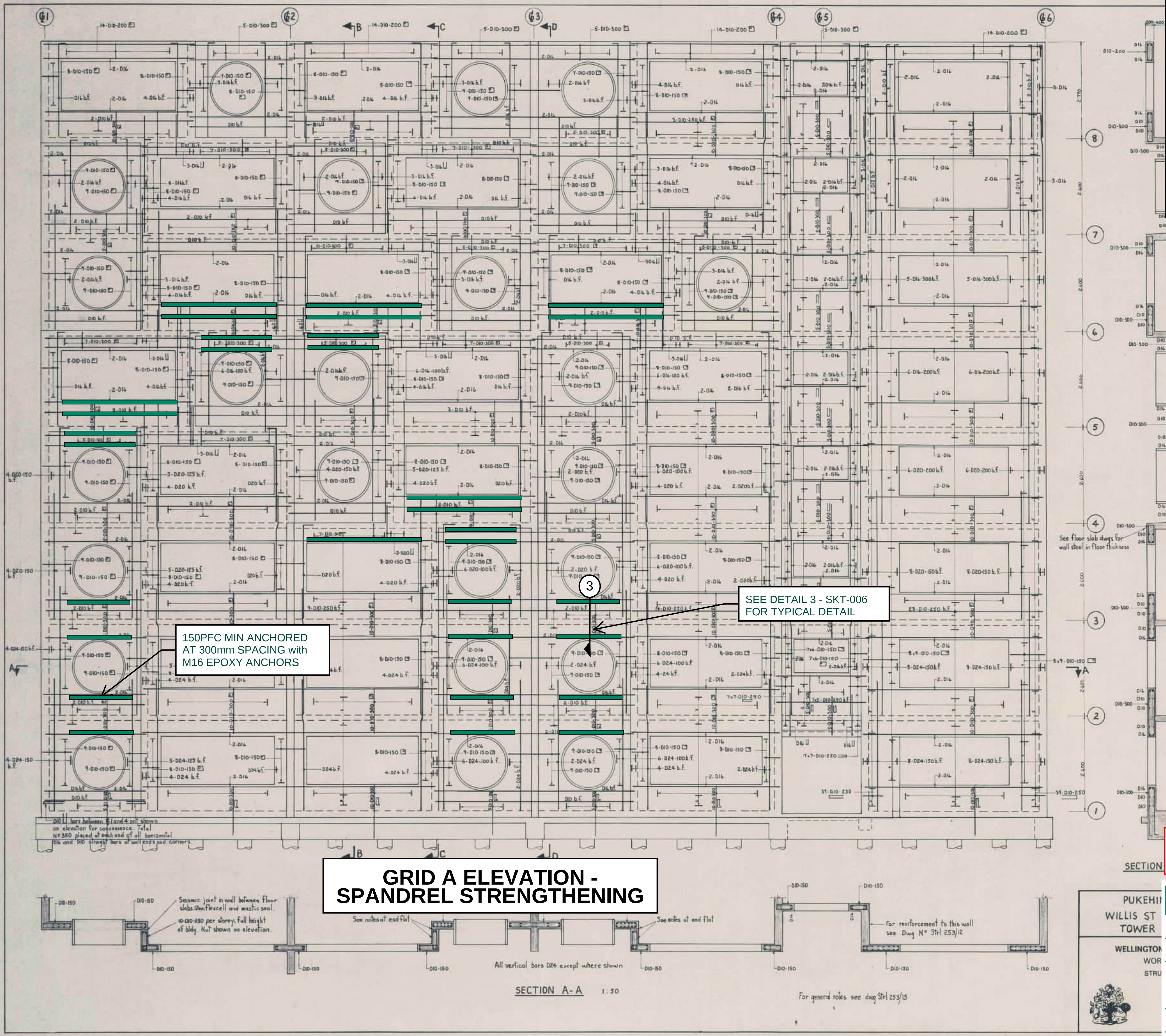
WORKS DEPARTMENT BUILDING INSPECTION BRANCH
19 DEC 1975
RECEIVED
MERCER STREET, WELLINGTON

CONCEPT ONLY
NOT FOR CONSTRUCTION

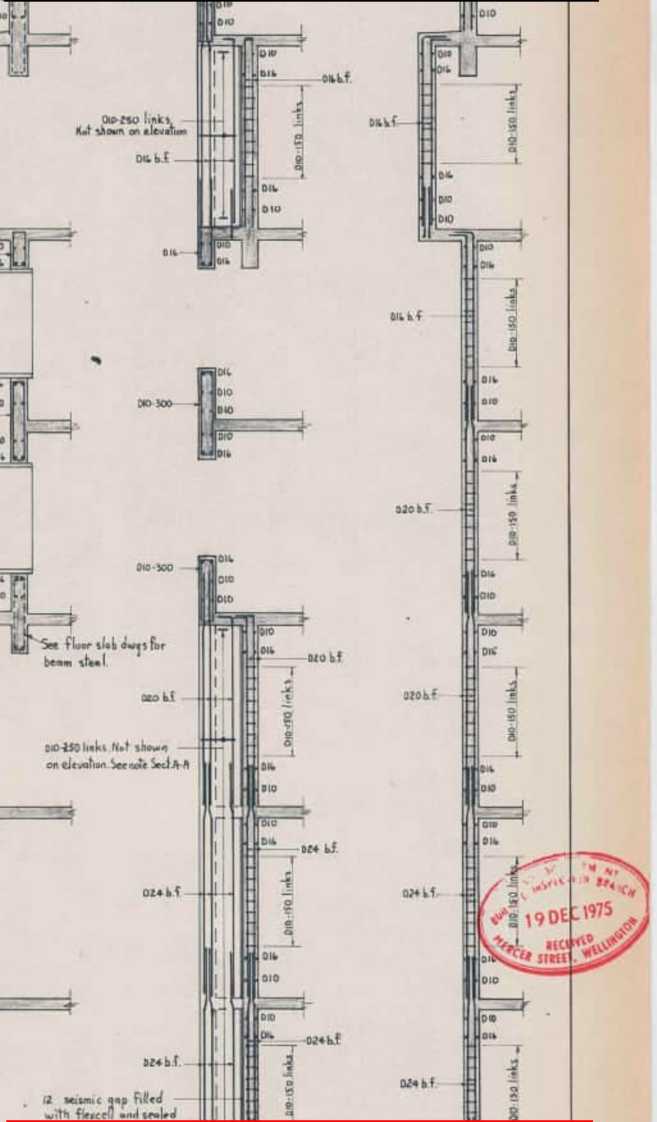
67%NBS(IL2) PRIMARY STRUCTURE STRENGTHENING

AECOM

PROJECT TITLE:	4 Brooklyn Road, Block A (PUKA)		
PROJECT NO:	60723635	DATE:	19/04/24
SKT-007 67% CONCEPT STRENGTHENING SCHEME SPANDREL STRENGTHENING - GRID 6		REV	A
DRAWN:	VERIFIED:	APPROVED:	



GRID A ELEVATION - SPANDREL STRENGTHENING



NOTES

1. A NUMBER OF NON-STRUCTURAL ITEMS MAY REQUIRE DEMOLITION TO EFFECT STRENGTHENING WORKS.
2. ALLOW FOR ACCESSIBILITY AND FIRE ENGINEERING REPORTS FOR COST ESTIMATE.
3. QUANTITY SURVEYOR TO REFER TO ARCHITECTURAL DRAWINGS FOR NON-STRUCTURAL ELEMENTS TO UNDERSTAND EXTENT OF DEMOLITION OF EXISTING FITOUT AND RECONSTRUCTION (WHERE APPLICABLE).
4. EXISTING DRAWINGS HAVE BEEN OVER-MARKED.
5. SITE SPECIFIC GEOTECHNICAL INVESTIGATION TO BE COMPLETED PRIOR TO STRENGTHENING WORKS
6. ALL SIZES ARE INDICATIVE, ONLY USED FOR COSTING.
7. SHOTCRETE TO BE 40 MPA.
8. ALL EPOXY ANCHOR BOLTS SHALL BE GRADE 830MPa.
9. ALL EPOXY SHALL BE RAMSET EPCON C8 Xtrem OR EQUIVALENT.

CONCEPT ONLY
NOT FOR CONSTRUCTION

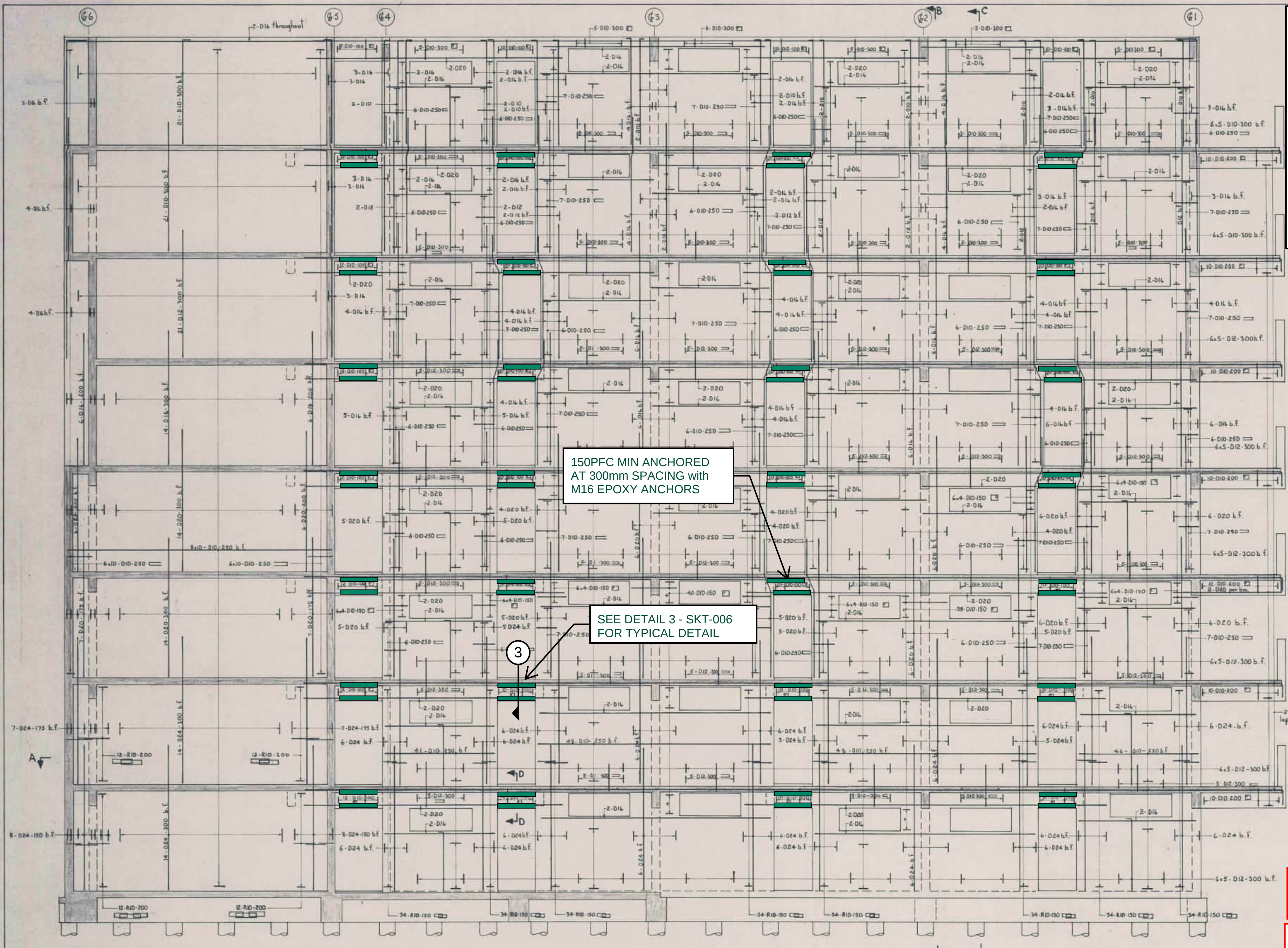
67%NBS(IL2) PRIMARY STRUCTURE STRENGTHENING

AECOM

PROJECT TITLE:	4 Brooklyn Road, Block A (PUKA)		
PROJECT NO:	60723635	DATE:	19/04/24
SKT-008 67% CONCEPT STRENGTHENING SCHEME SPANDREL STRENGTHENING - GRID A			REV A
DRAWN:	VERIFIED:	APPROVED:	

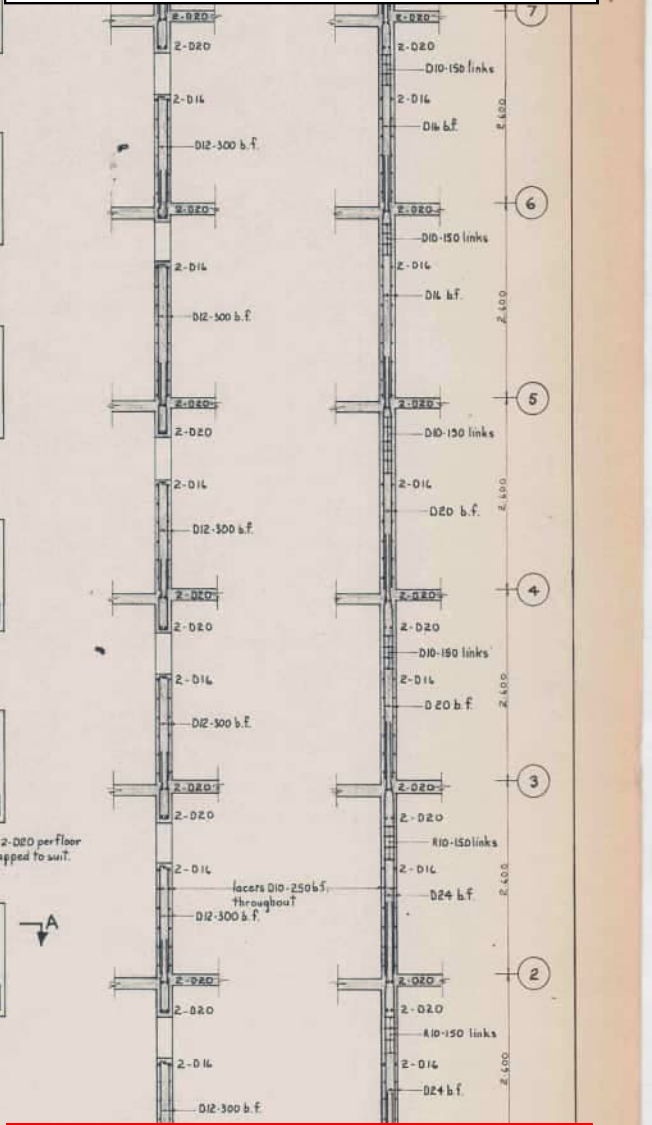
NOTES

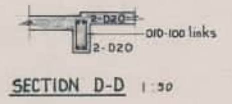
1. A NUMBER OF NON-STRUCTURAL ITEMS MAY REQUIRE DEMOLITION TO EFFECT STRENGTHENING WORKS.
2. ALLOW FOR ACCESSIBILITY AND FIRE ENGINEERING REPORTS FOR COST ESTIMATE.
3. QUANTITY SURVEYOR TO REFER TO ARCHITECTURAL DRAWINGS FOR NON-STRUCTURAL ELEMENTS TO UNDERSTAND EXTENT OF DEMOLITION OF EXISTING FITOUT AND RECONSTRUCTION (WHERE APPLICABLE).
4. EXISTING DRAWINGS HAVE BEEN OVER-MARKED.
5. SITE SPECIFIC GEOTECHNICAL INVESTIGATION TO BE COMPLETED PRIOR TO STRENGTHENING WORKS
6. ALL SIZES ARE INDICATIVE, ONLY USED FOR COSTING.
7. SHOTCRETE TO BE 40 MPA.
8. ALL EPOXY ANCHOR BOLTS SHALL BE GRADE 830MPa.
9. ALL EPOXY SHALL BE RAMSET EPCON C8 Xtrem OR EQUIVALENT.



150PFC MIN ANCHORED AT 300mm SPACING with M16 EPOXY ANCHORS

SEE DETAIL 3 - SKT-006 FOR TYPICAL DETAIL

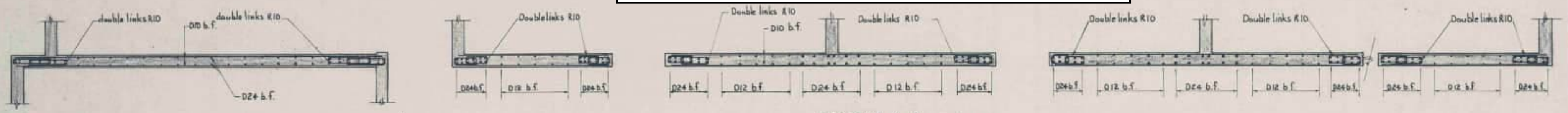




SECTION D-D 1:50

For general notes see Dwg Strl 253/12

GRID B ELEVATION - SPANDREL STRENGTHENING



SECTION A-A Scale 1:50

PUKEHIN
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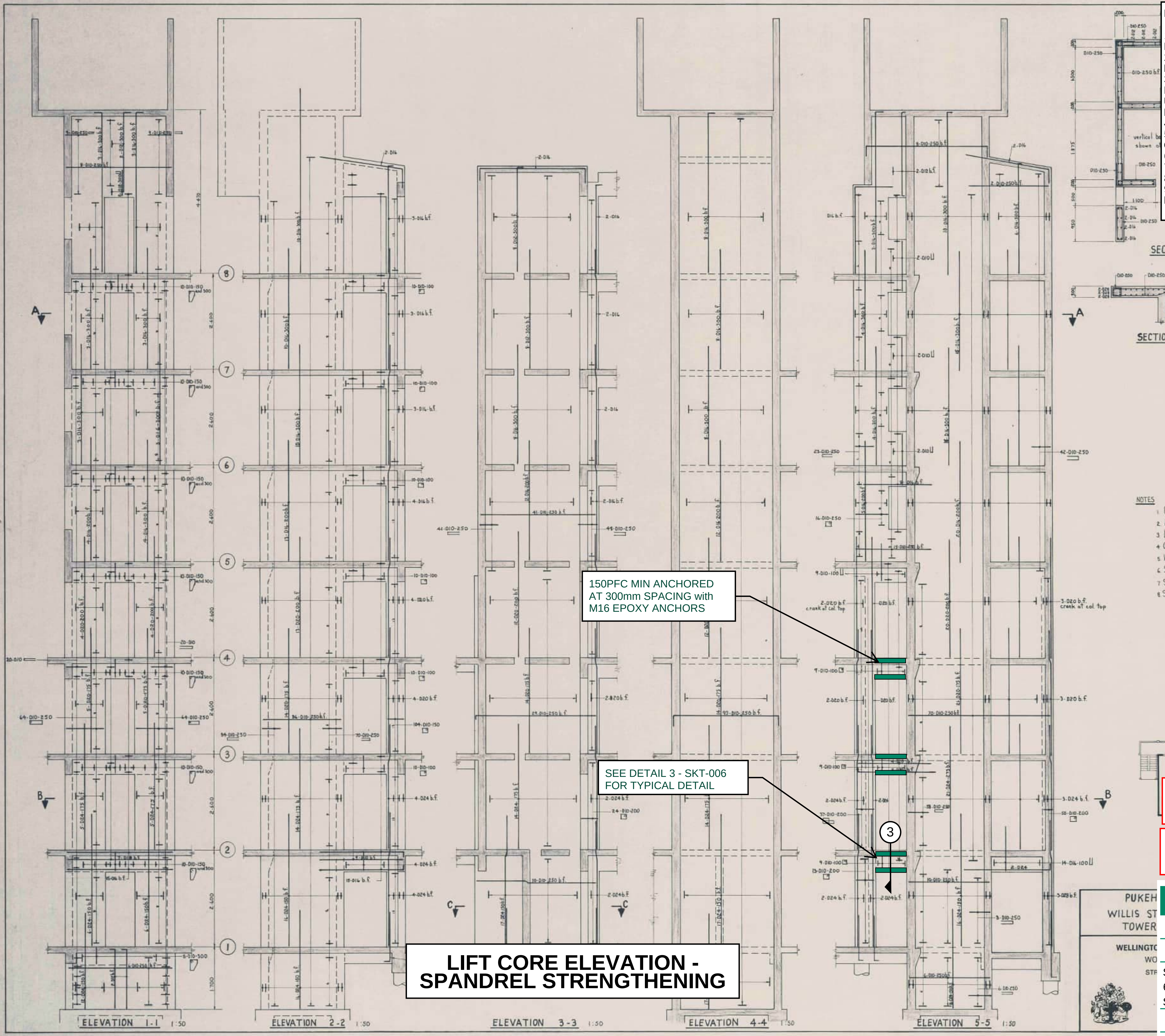
CONCEPT ONLY
NOT FOR CONSTRUCTION

67%NBS(IL2) PRIMARY STRUCTURE STRENGTHENING

AECOM

PROJECT TITLE:	4 Brooklyn Road, Block A (PUKA)
PROJECT NO: 60723635	DATE: 19/04/24
SKT-009 67% CONCEPT STRENGTHENING SCHEME SPANDREL STRENGTHENING - GRID B	REV A

DRAWN: VERIFIED: APPROVED:



NOTES

1. A NUMBER OF NON-STRUCTURAL ITEMS MAY REQUIRE DEMOLITION TO EFFECT STRENGTHENING WORKS.
2. ALLOW FOR ACCESSIBILITY AND FIRE ENGINEERING REPORTS FOR COST ESTIMATE.
3. QUANTITY SURVEYOR TO REFER TO ARCHITECTURAL DRAWINGS FOR NON-STRUCTURAL ELEMENTS TO UNDERSTAND EXTENT OF DEMOLITION OF EXISTING FITOUT AND RECONSTRUCTION (WHERE APPLICABLE).
4. EXISTING DRAWINGS HAVE BEEN OVER-MARKED.
5. SITE SPECIFIC GEOTECHNICAL INVESTIGATION TO BE COMPLETED PRIOR TO STRENGTHENING WORKS
6. ALL SIZES ARE INDICATIVE, ONLY USED FOR COSTING.
7. SHOTCRETE TO BE 40 MPA.
8. ALL EPOXY ANCHOR BOLTS SHALL BE GRADE 830MPa.
9. ALL EPOXY SHALL BE RAMSET EPCON C8 Xtrem OR EQUIVALENT.

NOTES

1. Concrete to have a minimum crushing strength of 25MPa at 28 days.
2. Reinforcement to be mild steel structural grade deformed or round bars as specified.
3. Laps in reinforcement to be a minimum of 40 diameters
4. Concrete cover to reinforcement to be 25mm to internal and 40mm to external faces of walls
5. Walls to be 200mm thick except where shown.
6. Starter bars to match wall steel.
7. See architect's drawings for details of rebates etc
8. See lift manufacturer's drawings for details of holes and supports for lift equipment.

CONCEPT ONLY
NOT FOR CONSTRUCTION

67%NBS(IL2) PRIMARY STRUCTURE STRENGTHENING

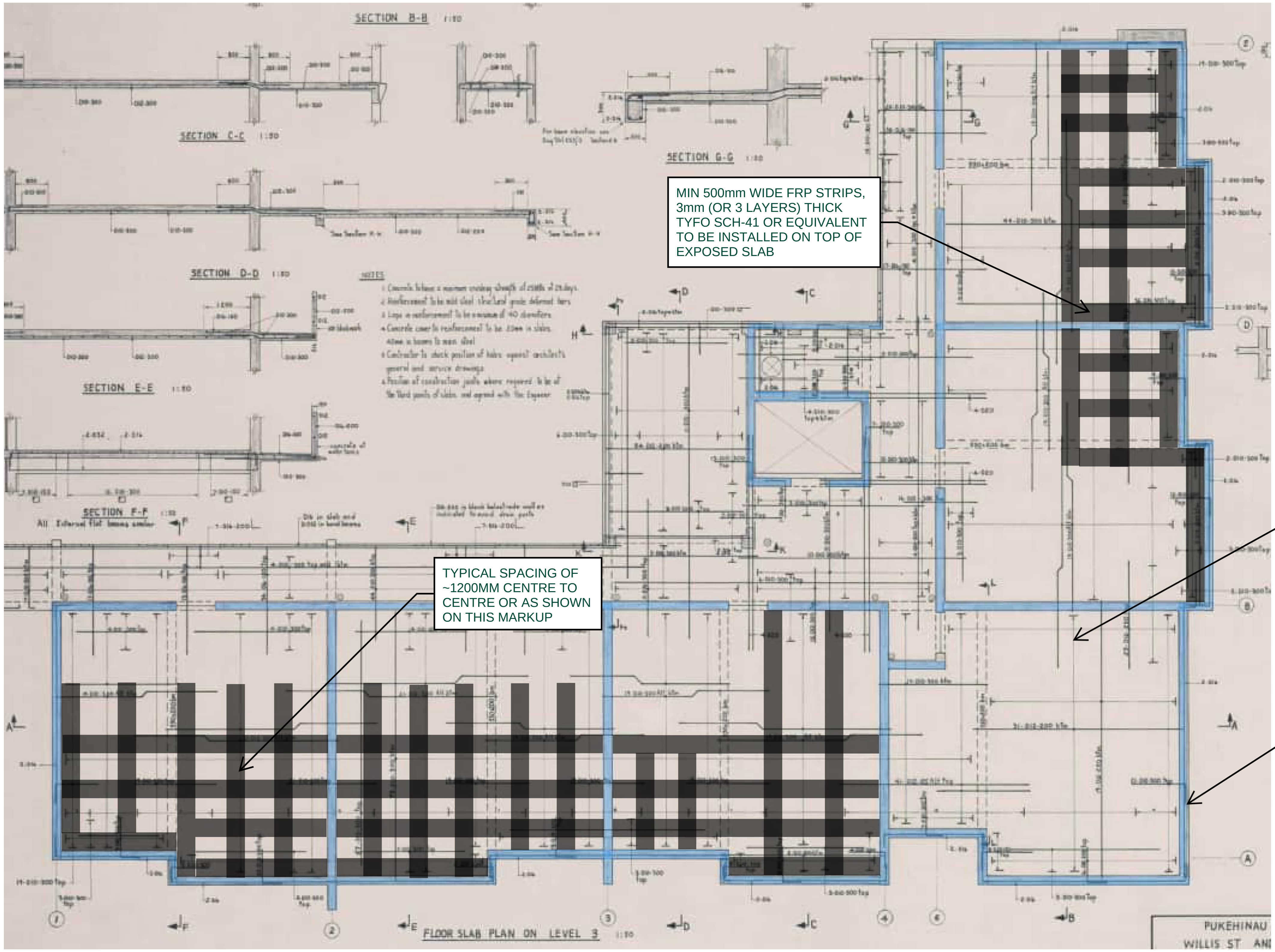
LIFT CORE ELEVATION - SPANDREL STRENGTHENING

AECOM

PROJECT TITLE:	4 Brooklyn Road, Block A (PUKA)
PROJECT NO: 60723635	DATE: 19/04/24
SKT-0010 67% CONCEPT STRENGTHENING SCHEME SPANDREL STRENGTHENING - LIFT CORE	REV A
DRAWN:	VERIFIED: / APPROVED:

NOTES

1. A NUMBER OF NON-STRUCTURAL ITEMS MAY REQUIRE DEMOLITION TO EFFECT STRENGTHENING WORKS.
2. ALLOW FOR ACCESSIBILITY AND FIRE ENGINEERING REPORTS FOR COST ESTIMATE.
3. QUANTITY SURVEYOR TO REFER TO ARCHITECTURAL DRAWINGS FOR NON-STRUCTURAL ELEMENTS TO UNDERSTAND EXTENT OF DEMOLITION OF EXISTING FITOUT AND RECONSTRUCTION (WHERE APPLICABLE).
4. EXISTING DRAWINGS HAVE BEEN OVER-MARKED.
5. SITE SPECIFIC GEOTECHNICAL INVESTIGATION TO BE COMPLETED PRIOR TO STRENGTHENING WORKS
6. ALL SIZES ARE INDICATIVE, ONLY USED FOR COSTING.
7. FRP TO BE TYFO SCH-41 COMPOSITE WITH TYFO S EPOXY OR EQUIVALENT. (MAPEI, ETC).
8. FRP WILL NEED TO BE INSTALLED BY TRAINED AND CERTIFIED APPLICATORS.



MIN 500mm WIDE FRP STRIPS, 3mm (OR 3 LAYERS) THICK TYFO SCH-41 OR EQUIVALENT TO BE INSTALLED ON TOP OF EXPOSED SLAB

TYPICAL SPACING OF ~1200MM CENTRE TO CENTRE OR AS SHOWN ON THIS MARKUP

NOTE THIS IS THE THIRD FLOOR PLAN WITH SIMILAR ARRANGEMENTS USED FOR ALL FLOORS

STRUCTURAL SHEAR WALLS ARE HIGHLIGHTED BLUE FOR CLARITY

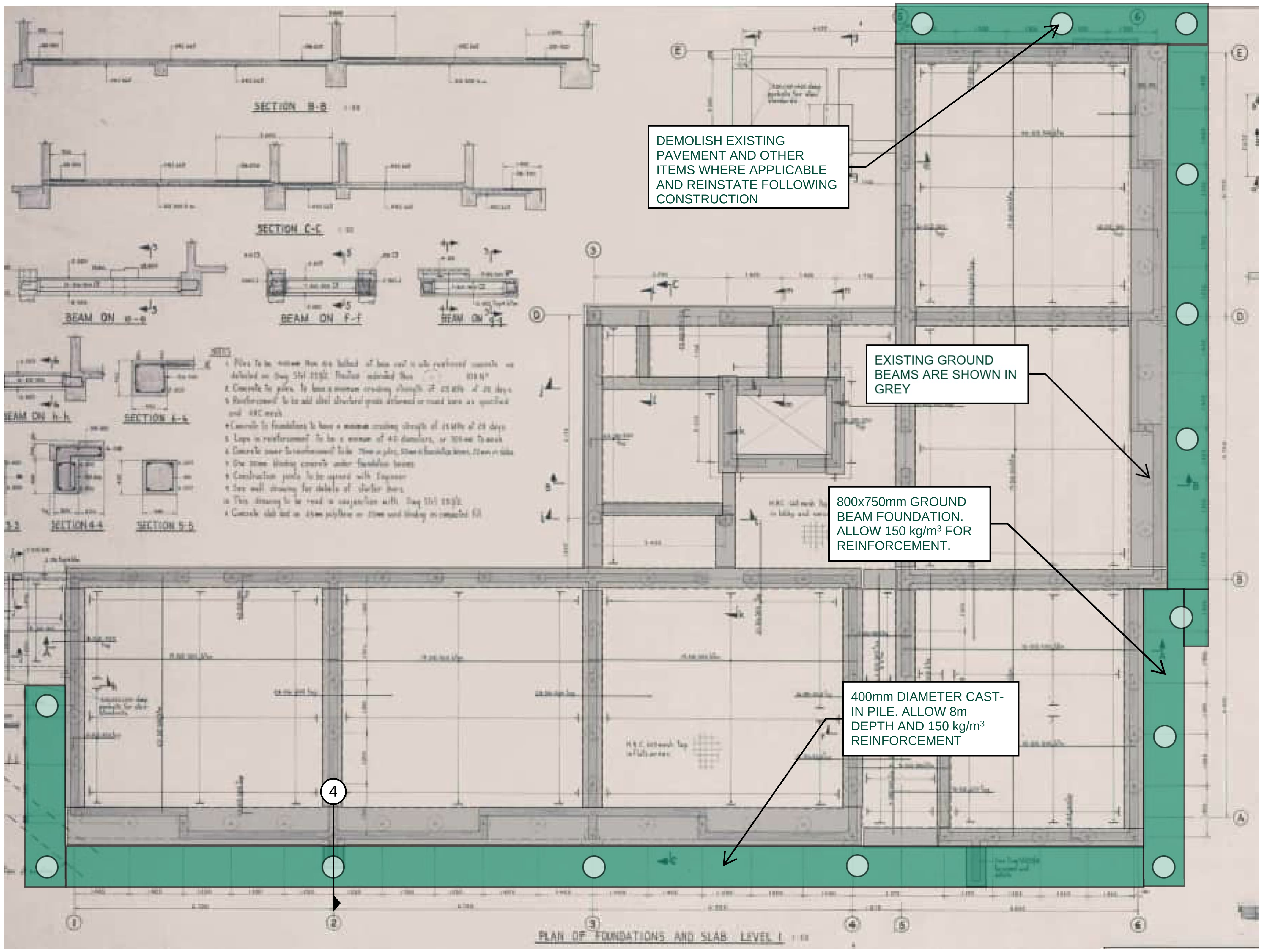
PLAN VIEW - DIAPHRAGM STRENGTHENING

**CONCEPT ONLY
NOT FOR CONSTRUCTION**

67%NBS(IL2) PRIMARY STRUCTURE STRENGTHENING

AECOM

PROJECT TITLE:	4 Brooklyn Road, Block A (PUKA)		
PROJECT NO:	60723635	DATE:	19/04/24
SKT-0011 67% CONCEPT STRENGTHENING SCHEME DIAPHRAGM STRENGTHENING		REV	A
DRAWN:	VERIFIED:	APPROVED:	



DEMOLISH EXISTING PAVEMENT AND OTHER ITEMS WHERE APPLICABLE AND REINSTATE FOLLOWING CONSTRUCTION

EXISTING GROUND BEAMS ARE SHOWN IN GREY

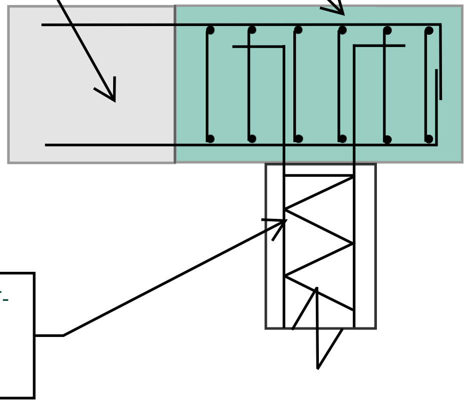
800x750mm GROUND BEAM FOUNDATION. ALLOW 150 kg/m³ FOR REINFORCEMENT.

400mm DIAMETER CAST-IN PILE. ALLOW 8m DEPTH AND 150 kg/m³ REINFORCEMENT

FOUNDATION PLAN VIEW - FOUNDATION STRENGTHENING

NOTES

1. A NUMBER OF NON-STRUCTURAL ITEMS MAY REQUIRE DEMOLITION TO EFFECT STRENGTHENING WORKS.
2. ALLOW FOR ACCESSIBILITY AND FIRE ENGINEERING REPORTS FOR COST ESTIMATE.
3. QUANTITY SURVEYOR TO REFER TO ARCHITECTURAL DRAWINGS FOR NON-STRUCTURAL ELEMENTS TO UNDERSTAND EXTENT OF DEMOLITION OF EXISTING FITOUT AND RECONSTRUCTION (WHERE APPLICABLE).
4. EXISTING DRAWINGS HAVE BEEN OVER-MARKED.
5. SITE SPECIFIC GEOTECHNICAL INVESTIGATION TO BE COMPLETED PRIOR TO STRENGTHENING WORKS
6. ALL SIZES ARE INDICATIVE, ONLY USED FOR COSTING.
7. GROUND BEAMS TO BE 40 MPA CONCRETE.
8. PILES TO BE 40 MPA CONCRETE.



800x750mm GROUND BEAM FOUNDATION. ALLOW 150 kg/m³ FOR REINFORCEMENT.

EXISTING GROUND BEAM, EPOXY DOWELS USED TO CONNECT TO NEW FOUNDATION.

400mm DIAMETER CAST-IN PILE. ALLOW 8m DEPTH AND 150 kg/m³ REINFORCEMENT

DETAIL 4 - SECTION OF FOUNDATION STRENGTHENING

CONCEPT ONLY
NOT FOR CONSTRUCTION

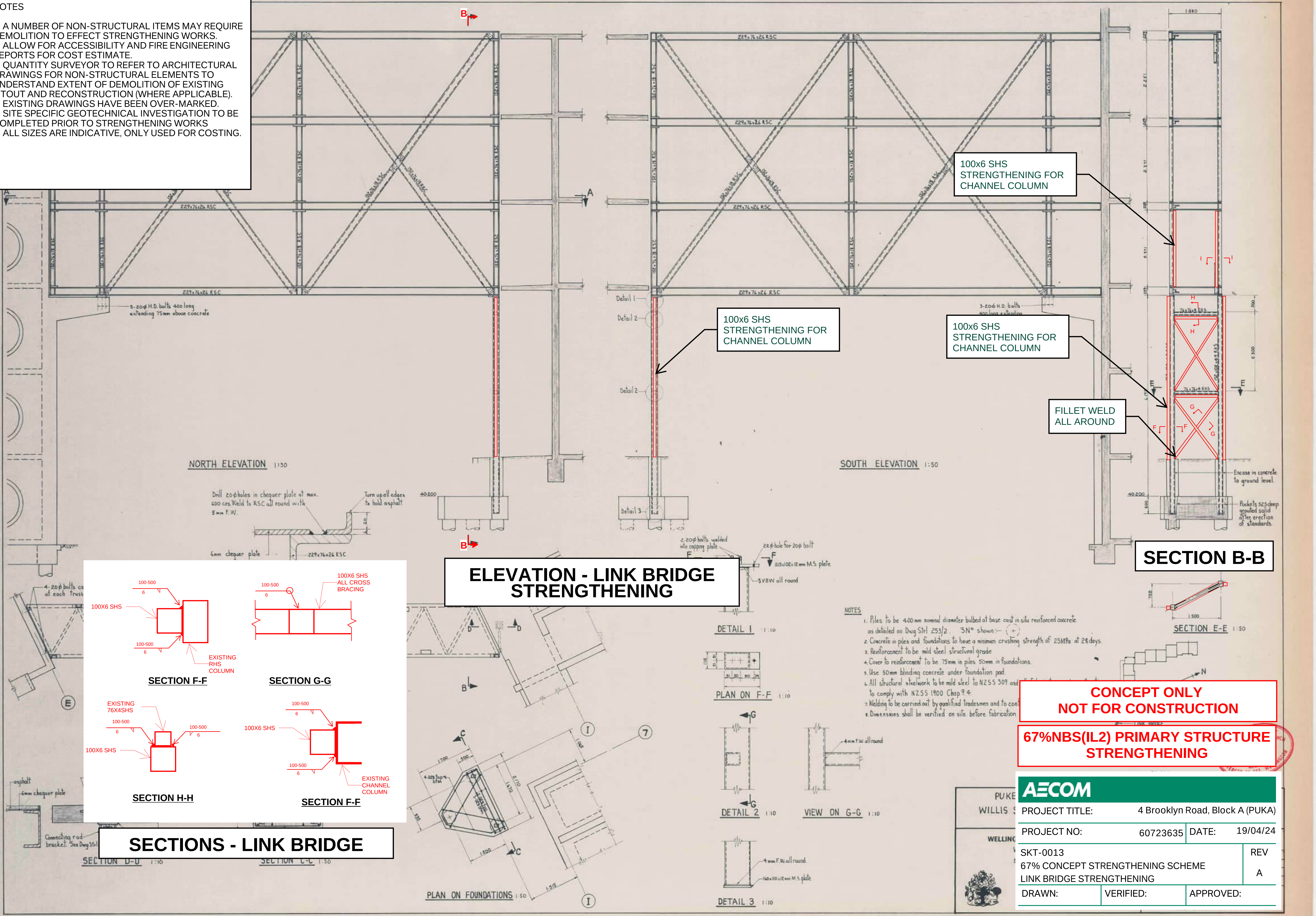
67%NBS(IL2) PRIMARY STRUCTURE STRENGTHENING

AECOM

PROJECT TITLE:	4 Brooklyn Road, Block A (PUKA)		
PROJECT NO:	60723635	DATE:	19/04/24
SKT-0012 67% CONCEPT STRENGTHENING SCHEME FOUNDATION STRENGTHENING		REV	A
DRAWN:	VERIFIED:	APPROVED:	

NOTES

1. A NUMBER OF NON-STRUCTURAL ITEMS MAY REQUIRE DEMOLITION TO EFFECT STRENGTHENING WORKS.
2. ALLOW FOR ACCESSIBILITY AND FIRE ENGINEERING REPORTS FOR COST ESTIMATE.
3. QUANTITY SURVEYOR TO REFER TO ARCHITECTURAL DRAWINGS FOR NON-STRUCTURAL ELEMENTS TO UNDERSTAND EXTENT OF DEMOLITION OF EXISTING FITOUT AND RECONSTRUCTION (WHERE APPLICABLE).
4. EXISTING DRAWINGS HAVE BEEN OVER-MARKED.
5. SITE SPECIFIC GEOTECHNICAL INVESTIGATION TO BE COMPLETED PRIOR TO STRENGTHENING WORKS
6. ALL SIZES ARE INDICATIVE, ONLY USED FOR COSTING.



ELEVATION - LINK BRIDGE STRENGTHENING

SECTIONS - LINK BRIDGE

NOTES

1. Piles to be 400mm nominal diameter bulbed at base cast in situ reinforced concrete as detailed on Dwg Strl 253/2. 3N° shown:- (+)
2. Concrete in piles and foundations to have a minimum crushing strength of 25MPa at 28 days.
3. Reinforcement to be mild steel structural grade.
4. Cover to reinforcement to be 75mm in piles 50mm in foundations.
5. Use 50mm blinding concrete under foundation pad.
6. All structural steelwork to be mild steel to NZSS 309 and to comply with NZSS 1900 Chap 9.4.
7. Welding to be carried out by qualified tradesmen and to con
8. Dimensions shall be verified on site before fabrication

CONCEPT ONLY
NOT FOR CONSTRUCTION

67%NBS(IL2) PRIMARY STRUCTURE STRENGTHENING

AECOM

PROJECT TITLE:	4 Brooklyn Road, Block A (PUKA)		
PROJECT NO:	60723635	DATE:	19/04/24
SKT-0013 67% CONCEPT STRENGTHENING SCHEME LINK BRIDGE STRENGTHENING		REV	A
DRAWN:	VERIFIED:	APPROVED:	

Appendix G

Existing Structural Drawings

PUKEHINAU FLATS
STRUCTURAL DRAWING INDEX

BLOCK.A.

1.	FOUNDATIONS & SLAB LEVEL.1.
2.	FOUNDATION BEAM DETAILS.
3.	FLOOR SLAB LEVEL 2.
4.	FLOOR SLAB LEVEL 3.
5.	FLOOR SLAB LEVEL 4.
6.	FLOOR SLAB LEVEL 5.
7.	FLOOR SLAB LEVEL 6.
8.	FLOOR SLAB LEVEL 7.
9.	FLOOR SLABS LEVELS 8,9 & 10.
10.	WALLS 1 & 2.
11.	WALLS 3 & 4
12.	WALL 5.
13.	WALL 6.
14.	WALL A.
15.	WALLS B & C.
16.	WALLS D & E.
17.	LIFT WALLS.
18.	MISCELLANEOUS WALLS.

LINK BRIDGE.

19.	GENERAL ARRANGEMENT.
20.	TRUSS DETAIL.
21.	DETAIL BTM. TRUSS & BRACING.

BLOCK.B.

22.	FOUNDATIONS & GRND. FLOOR SLAB.
23.	FOUNDATION DETAILS.
24.	FLOOR SLABS LEVELS 4 & 5.
25.	FLOOR SLABS LEVELS 3 & 6. FLOOR SLAB SECTIONS.
26.	WALL 7.
27.	WALL 8.
28.	WALLS P, O, N, M & L.
29.	DRYING AREA WALLS BEAMS & COLUMNS.

BLOCKS. C & D.

30.	FOUNDATIONS & GRND. FLOOR SLAB, BLOCKS C & D.
31.	FOUNDATION DETAILS.
32.	FLOOR SLAB LEVEL 4.
33.	CONC. BEAMS, BALUSTRADE & DRYING AREA DETAILS.
34.	WALL I.
35.	WALL K.
36.	WALLS 9, 10, 11, 12 & 13.
37.	WALLS 14, 15, 16 & 17.
38.	WALLS BLOCK D.

BLOCK.E.

39.	FOUNDATIONS & GRND. FLOOR SLAB.
40.	FOUNDATION DETAILS WALLS Q & S.
41.	WALLS T, U, V, W, P & R.
42.	WALLS 21 to 27.

STAIR DRAWINGS.

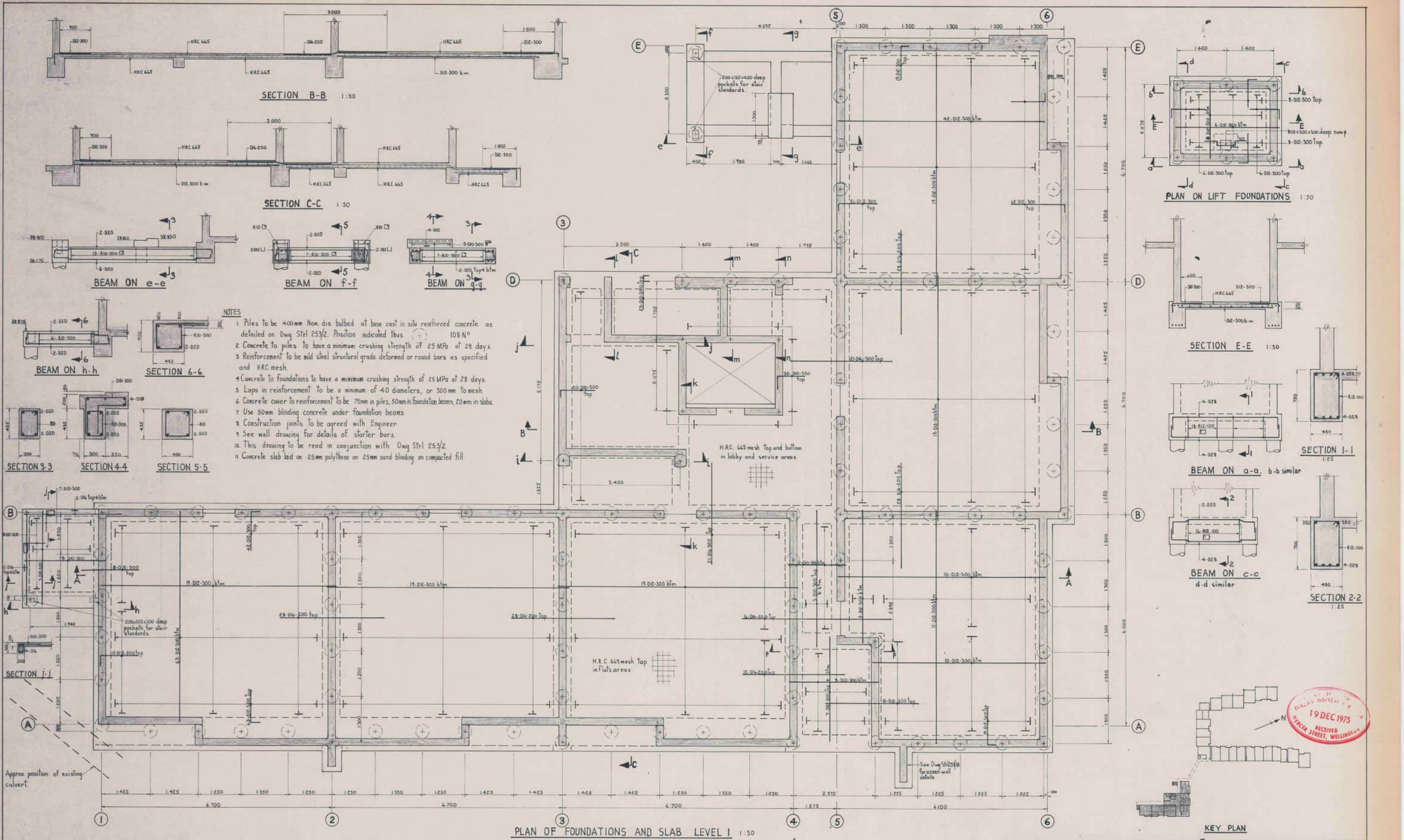
43.	STAIRWAY 2 & 3.
44.	STAIRWAY 1, 4 & 5.
45.	STAIR SUPPORT FRAMES.

SITE WALLS.

46.	WALLS A, B, C & D.
47.	WALLS E & F.
48.	WALLS G H & J. CRIB WALL. STAIRS 6 & 7.

WELLINGTON CITY CORPORATION
WORKS DEPARTMENT
STRUCTURAL BRANCH.
SET No.

110-5625
44
140-52



NOTES

1. Piles to be 400mm Nom. dia. bulbed at base cast in situ reinforced concrete as detailed on Dwg Strl 253/2. Position indicated thus (+) 108 N°
2. Concrete to piles to have a minimum crushing strength of 25 MPa at 28 days.
3. Reinforcement to be mild steel structural grade deformed or round bars as specified and HRC mesh.
4. Concrete to foundations to have a minimum crushing strength of 25 MPa at 28 days.
5. Laps in reinforcement to be a minimum of 40 diameters, or 300 mm to mesh.
6. Concrete cover to reinforcement to be 75mm in piles, 50mm in foundation beams, 20mm in slabs.
7. Use 50mm blinding concrete under foundation beams
8. Construction joints to be agreed with Engineer
9. See wall drawing for details of starter bars.
10. This drawing to be read in conjunction with Dwg Strl 253/2.
11. Concrete slab laid on 25mm polythene on 25mm sand blinding on compacted fill.

PUKEHINAU FLATS
WILLIS ST AND ARO ST
TOWER BLOCK A

WELLINGTON CITY CORPORATION
WORKS DEPARTMENT
STRUCTURAL BRANCH

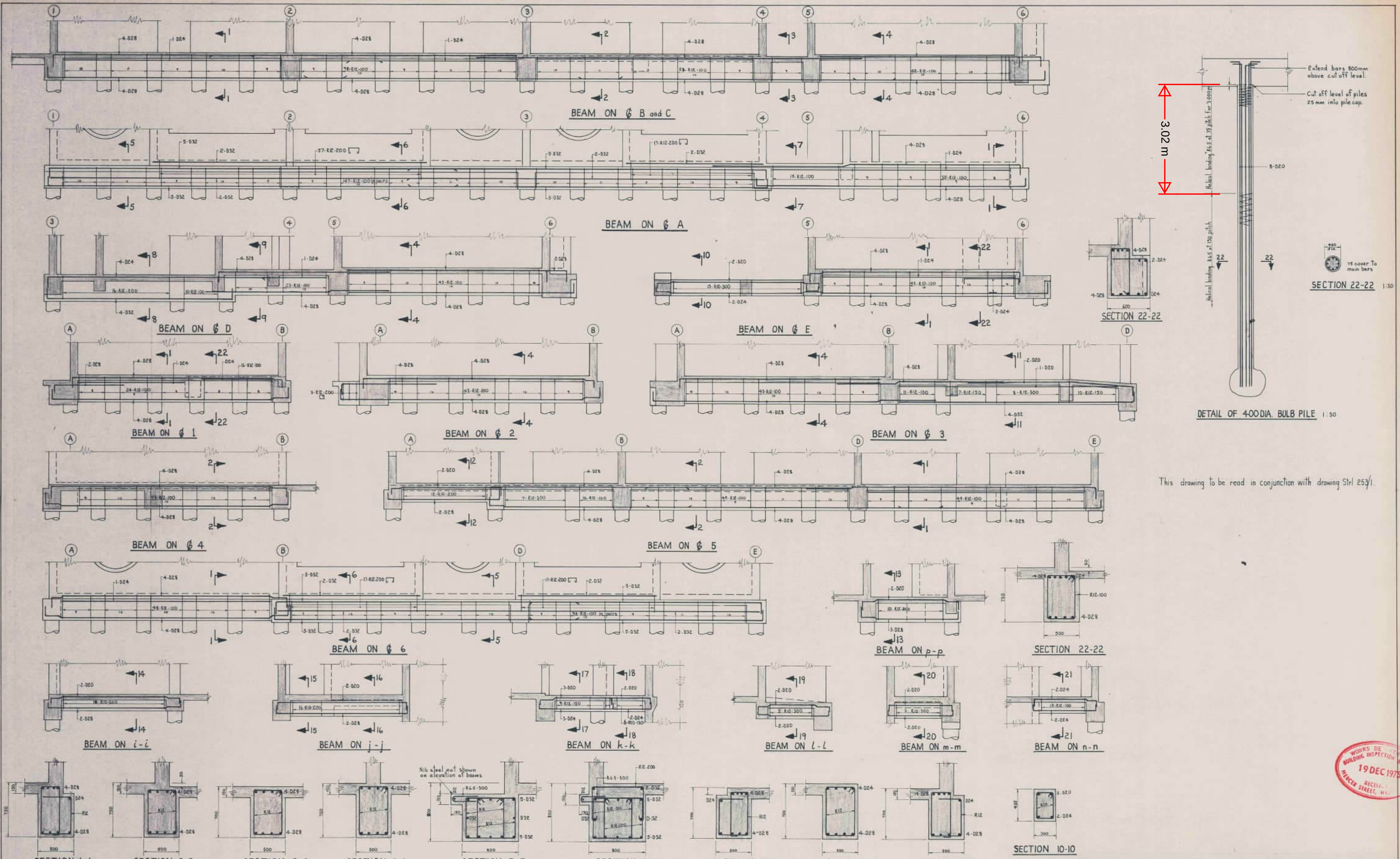
A. D. MARTIN CITY ENGINEER

CONTRACT NUMBER 2469
Scale 1:50
FOUNDATIONS AND SLAB LEVEL 1
SHEET No. 1
IN SET OF: 48

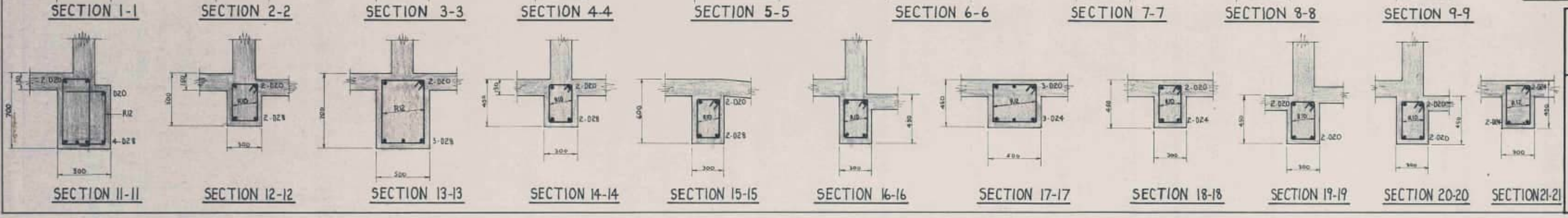
TRACING NO. STRL 253/1

DESIGNED	TPN	Aug 75
DRAWN	TPN	Aug 75
TRACED	RP	
CHECKED		

APPROVED
CHIEF STRUCTURAL ENGINEER



This drawing to be read in conjunction with drawing Strl 253/1.



PUKEHINAU FLATS
WILLIS ST AND ARO ST
TOWER BLOCK A

WELLINGTON CITY CORPORATION
WORKS DEPARTMENT
STRUCTURAL BRANCH

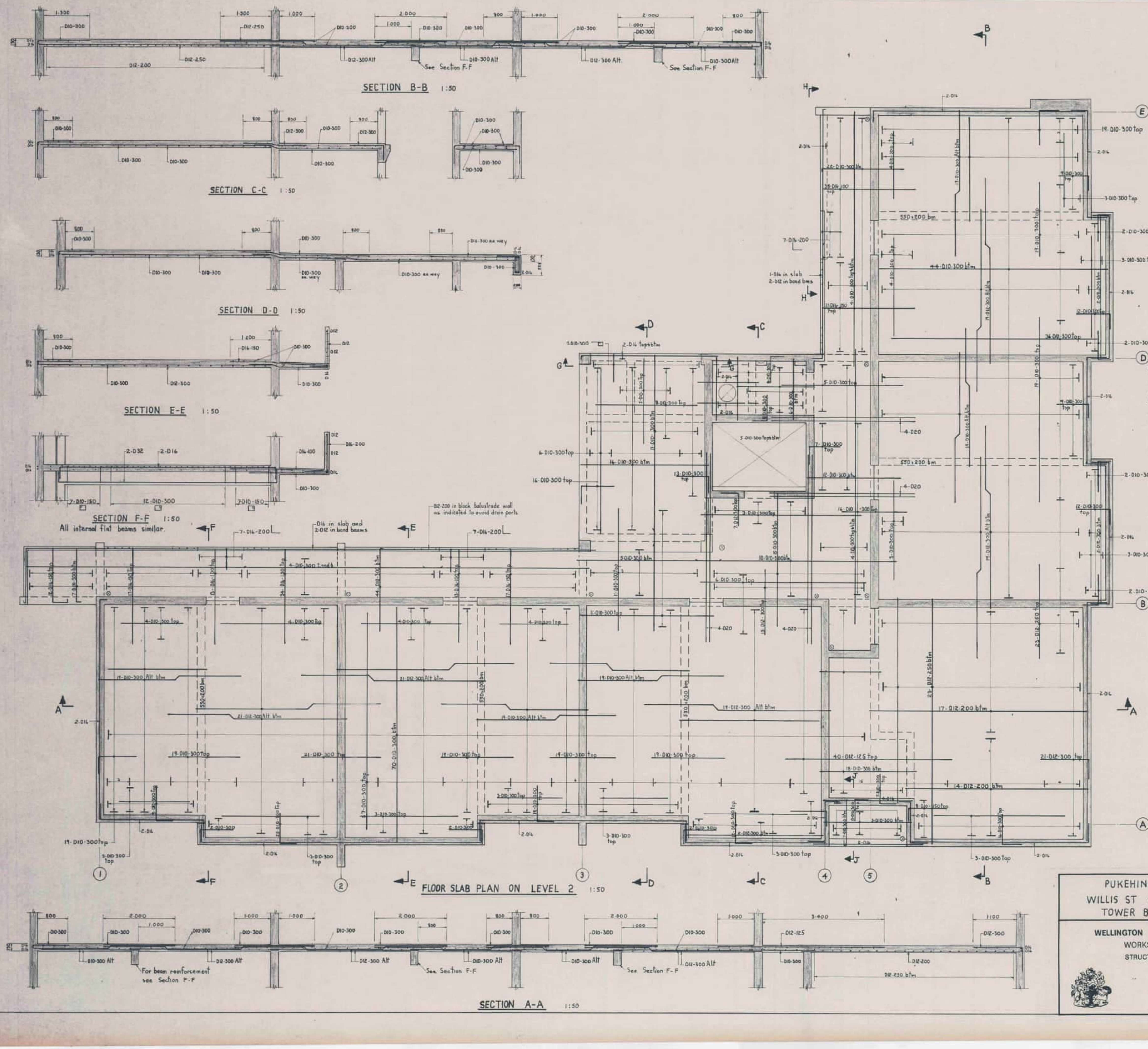
A. D. MARTIN, CITY ENGINEER

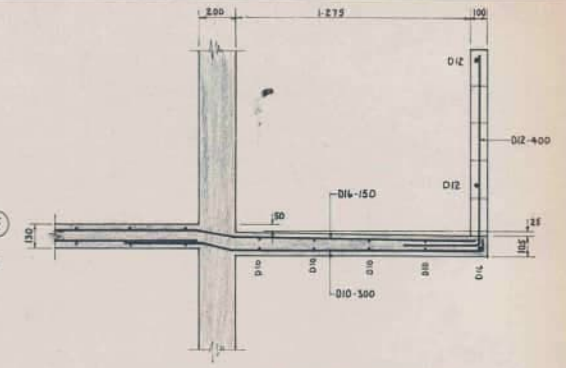
CONTRACT NUMBER 2469
Scale 1:50 1:25
FOUNDATION BEAM DETAILS
SHEET No. 2
IN SET OF 48

TRACING NO. STRL 253/2

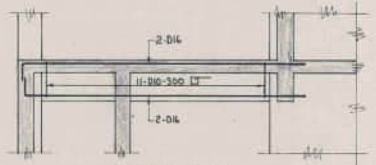
DESIGNED	TPN	Aug 75
DRAWN	TPN	Aug 75
TRACED		
CHECKED	RJP	

APPROVED
CHIEF STRUCTURAL ENGINEER

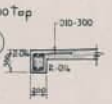




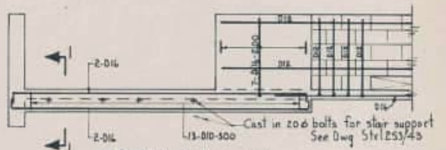
DETAIL AT BALCONY WALKWAY 1:20



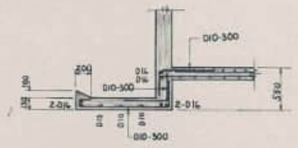
SECTION G-G 1:50



SECTION 1-1



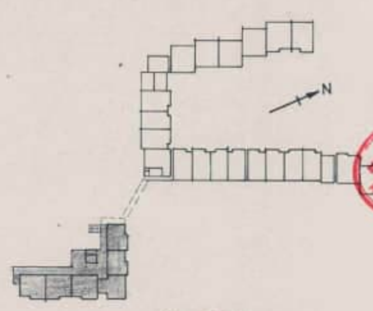
SECTION H-H 1:50



SECTION J-J 1:50

NOTES

1. Concrete to have a minimum crushing strength of 25MPa at 28 days.
2. Reinforcement to be mild steel structural grade deformed bars.
3. Laps in reinforcement to be a minimum of 40 diameters.
4. Concrete cover to reinforcement to be 20mm in slabs, 40mm in beams to main bars.
5. Contractor to check position of holes shown against architect's general and service drawings.
6. Position of construction joints where required to be at the third points of slabs and to be agreed with the Engineer.



KEY PLAN

PUKEHINAU FLATS
WILLIS ST AND ARO ST
TOWER BLOCK A

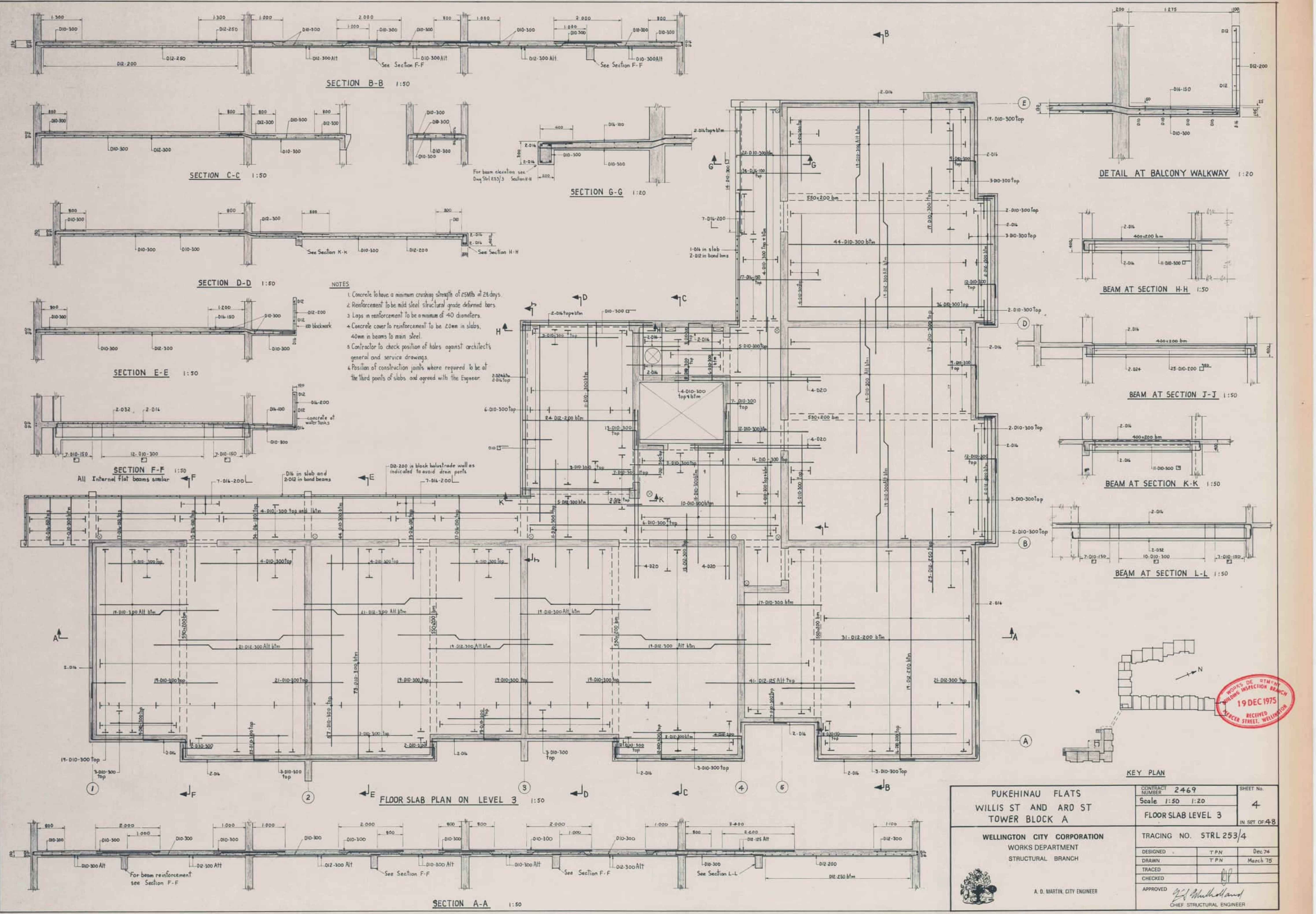
WELLINGTON CITY CORPORATION
WORKS DEPARTMENT
STRUCTURAL BRANCH

A. D. MARTIN CITY ENGINEER

CONTRACT NUMBER 2469
Scale 1:50 1:20
FLOOR SLAB LEVEL 2
SHEET No. 3 IN SET OF 48
TRACING NO. STRL 253/3

DESIGNED	TPN	Dec 74
DRAWN	TPN	Feb 75
TRACED		
CHECKED		

APPROVED Mulholland
CHIEF STRUCTURAL ENGINEER



NOTES

1. Concrete to have a minimum crushing strength of 25MPa at 28 days.
2. Reinforcement to be mild steel structural grade deformed bars
3. Laps in reinforcement to be a minimum of 40 diameters.
4. Concrete cover to reinforcement to be 20mm in slabs, 40mm in beams to main steel.
5. Contractor to check position of holes against architect's general and service drawings.
6. Position of construction joints where required to be at the third points of slabs and agreed with the Engineer.

PUKEHINAU FLATS
WILLIS ST AND ARD ST
TOWER BLOCK A

CONTRACT NUMBER 2469
Scale 1:50 1:20
FLOOR SLAB LEVEL 3
SHEET No. 4 IN SET OF 48

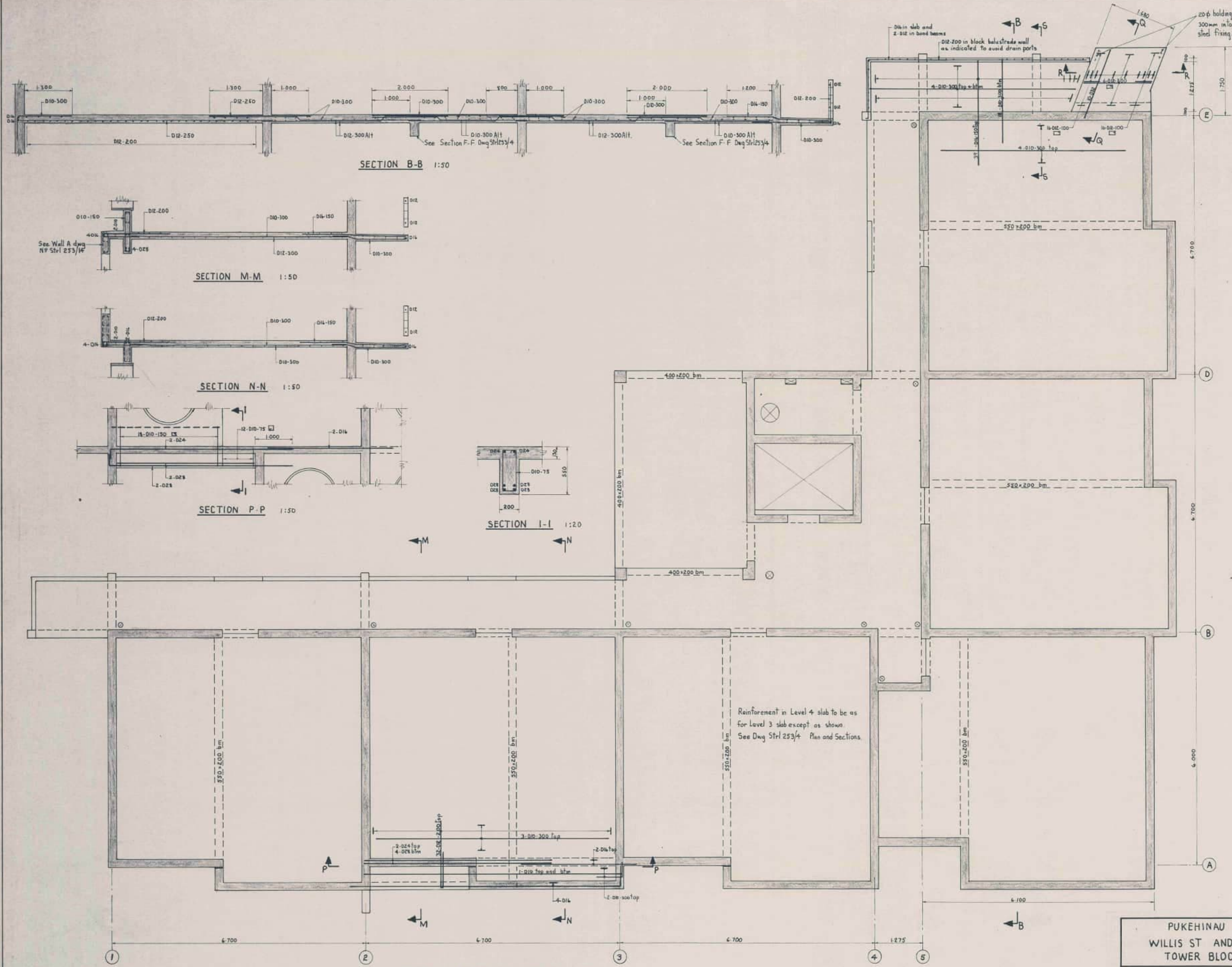
WELLINGTON CITY CORPORATION
WORKS DEPARTMENT
STRUCTURAL BRANCH

A. D. MARTIN, CITY ENGINEER

TRACING NO. STRL 253/4

DESIGNED	TPN	Dec 74
DRAWN	TPN	March 75
TRACED		
CHECKED	RJP	

APPROVED Mulholland
CHIEF STRUCTURAL ENGINEER



SECTION B-B 1:50

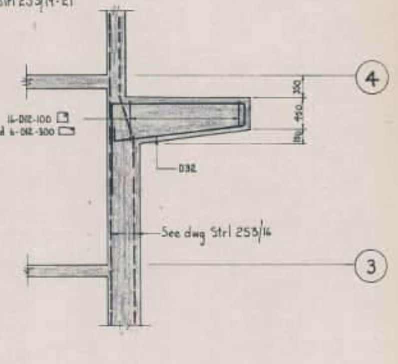
SECTION M-M 1:50

SECTION N-N 1:50

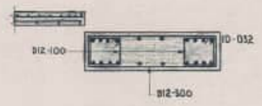
SECTION P-P 1:50

SECTION I-I 1:20

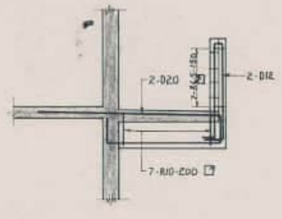
FLOOR SLAB PLAN ON LEVEL 4 1:50



SECTION Q-Q 1:50



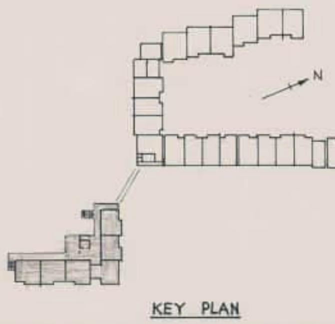
SECTION R-R 1:50



SECTION S-S 1:50

NOTES

1. Concrete to have a minimum crushing strength of 25 MPa at 28 days.
2. Reinforcement to be mild steel structural grade deformed bars.
3. Laps in reinforcement to be a minimum of 40 diameters.
4. Concrete cover to reinforcement to be 20mm in slabs, 40 mm in beams to main steel.
5. Contractor to check position of holes against architect's general and service drawings.
6. Position of construction joints where required to be at the third points of slabs and agreed with the Engineer.
7. This drawing to be read in conjunction with Dwg Strl 253/4.



KEY PLAN

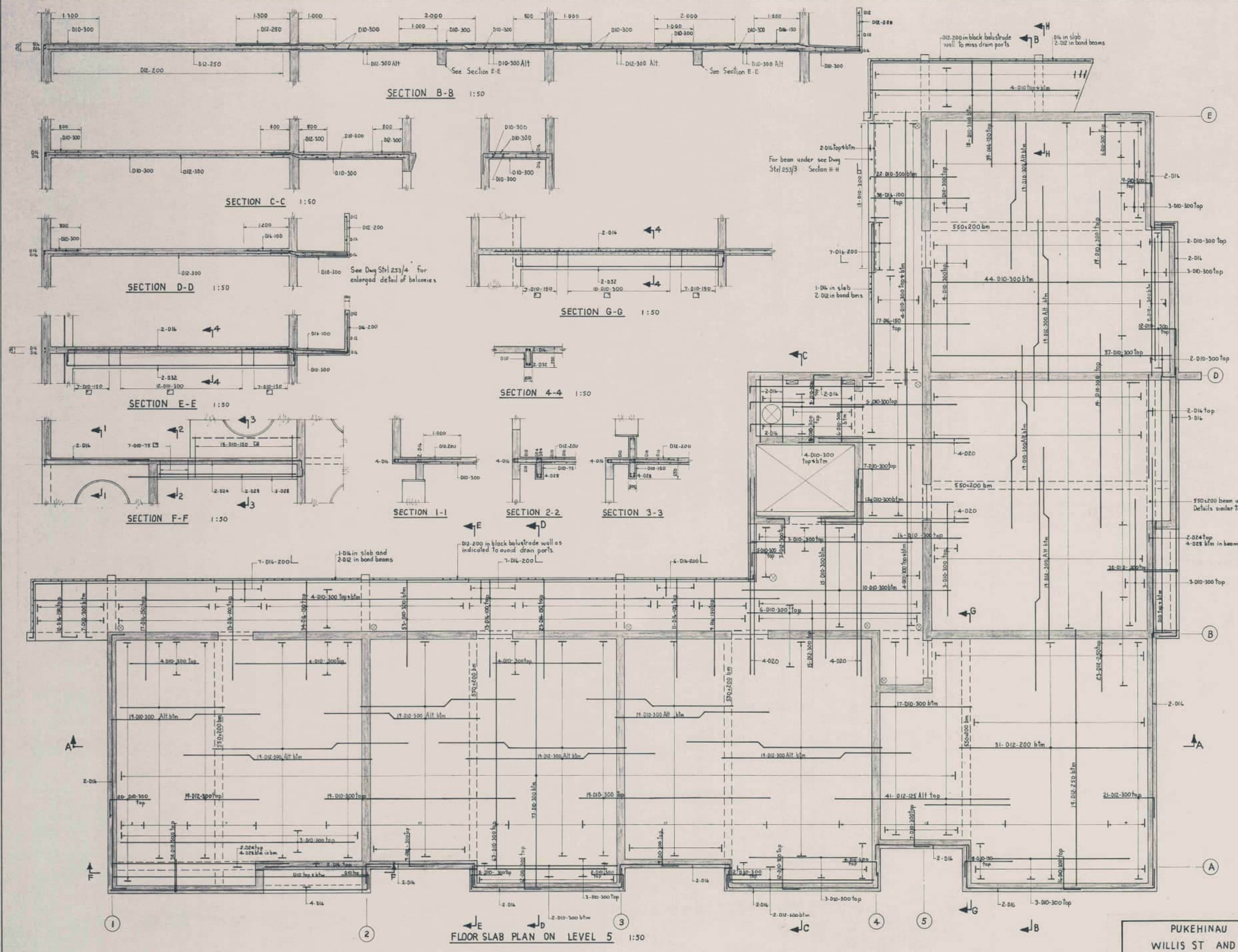
PUKEHINAU FLATS
WILLIS ST AND ARO ST
TOWER BLOCK A

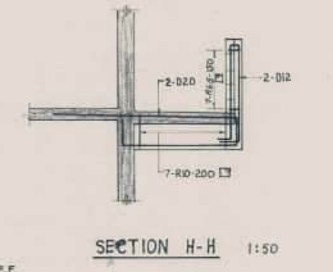
CONTRACT NUMBER 2469			SHEET No. 5 IN SET OF 48
Scale 1:50			
FLOOR SLAB LEVEL 4			
TRACING NO. STRL 253/5			
DESIGNED	T.P.N.	Dec 74	
DRAWN	T.P.N.	March 75	
TRACED			
CHECKED			
APPROVED			

WELLINGTON CITY CORPORATION
WORKS DEPARTMENT
STRUCTURAL BRANCH

A. D. MARTIN CITY ENGINEER

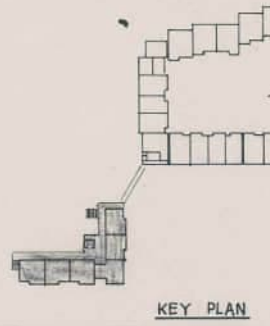
CHIEF STRUCTURAL ENGINEER

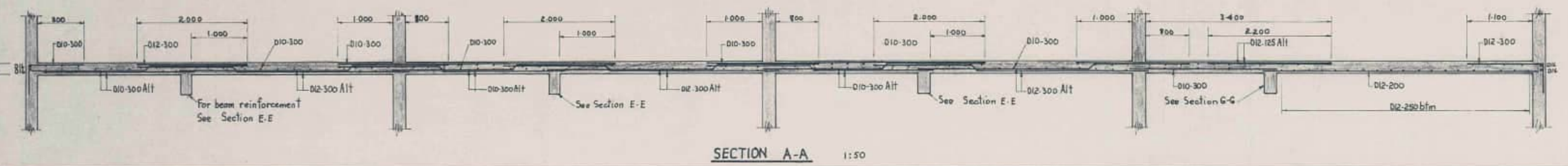




NOTES

1. Concrete to have a minimum crushing strength of 25 MPa at 28 days.
2. Reinforcement to be mild steel structural grade deformed bars.
3. Laps in reinforcement to be a minimum of 40 diameters.
4. Concrete cover to reinforcement to be 20mm in slabs, 40mm in beams to main steel.
5. Contractor to check position of holes against architects general and service drawings.
6. Position of construction joints where required to be at the third points of slabs and agreed with the Engineer.
7. For enlarged detail of balcony and block balustrade see drawing Strl 253/4.





PUKEHINAU FLATS
WILLIS ST AND ARO ST
TOWER BLOCK A

CONTRACT NUMBER 2469
Scale 1:50
FLOORSLAB LEVEL 5
SHEET No. 6
IN SET OF 48

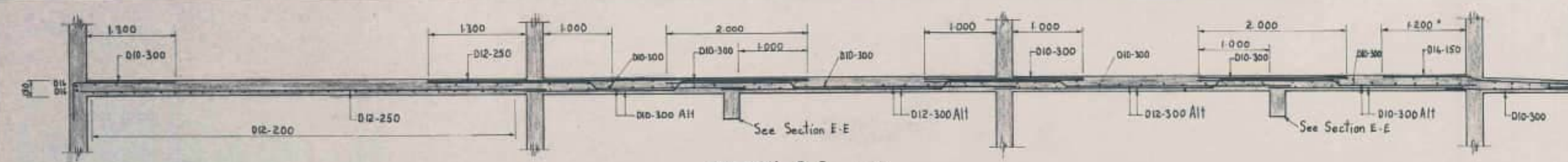
WELLINGTON CITY CORPORATION
WORKS DEPARTMENT
STRUCTURAL BRANCH

A. D. MARTIN CITY ENGINEER

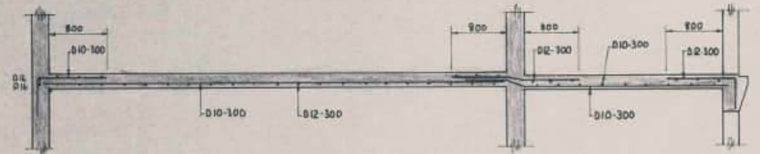
TRACING NO. STRL 253/6

DESIGNED	T.P.N	Dec 74
DRAWN	T.P.N.	March 75
TRACED		
CHECKED		
APPROVED		

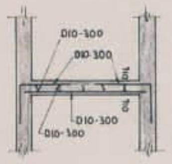
CHIEF STRUCTURAL ENGINEER

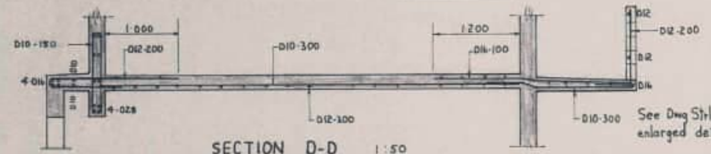


SECTION B-B 1:50

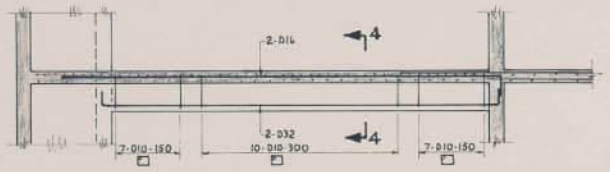


SECTION C-C 1:50

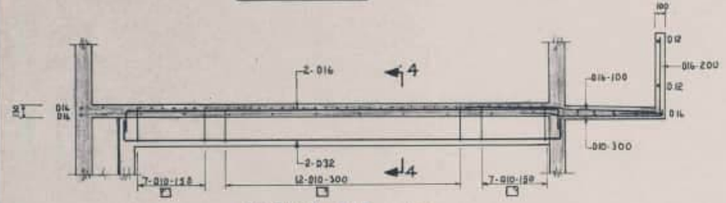




SECTION D-D 1:50

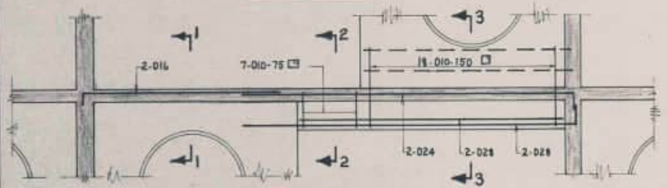


SECTION G-G 1:50

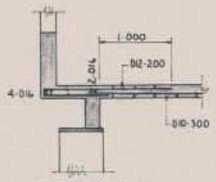


SECTION E-E 1:50

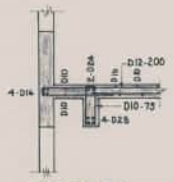
SECTION 4-4 1:50



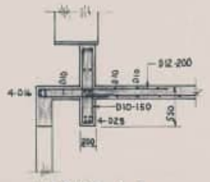
SECTION F-F 1:50



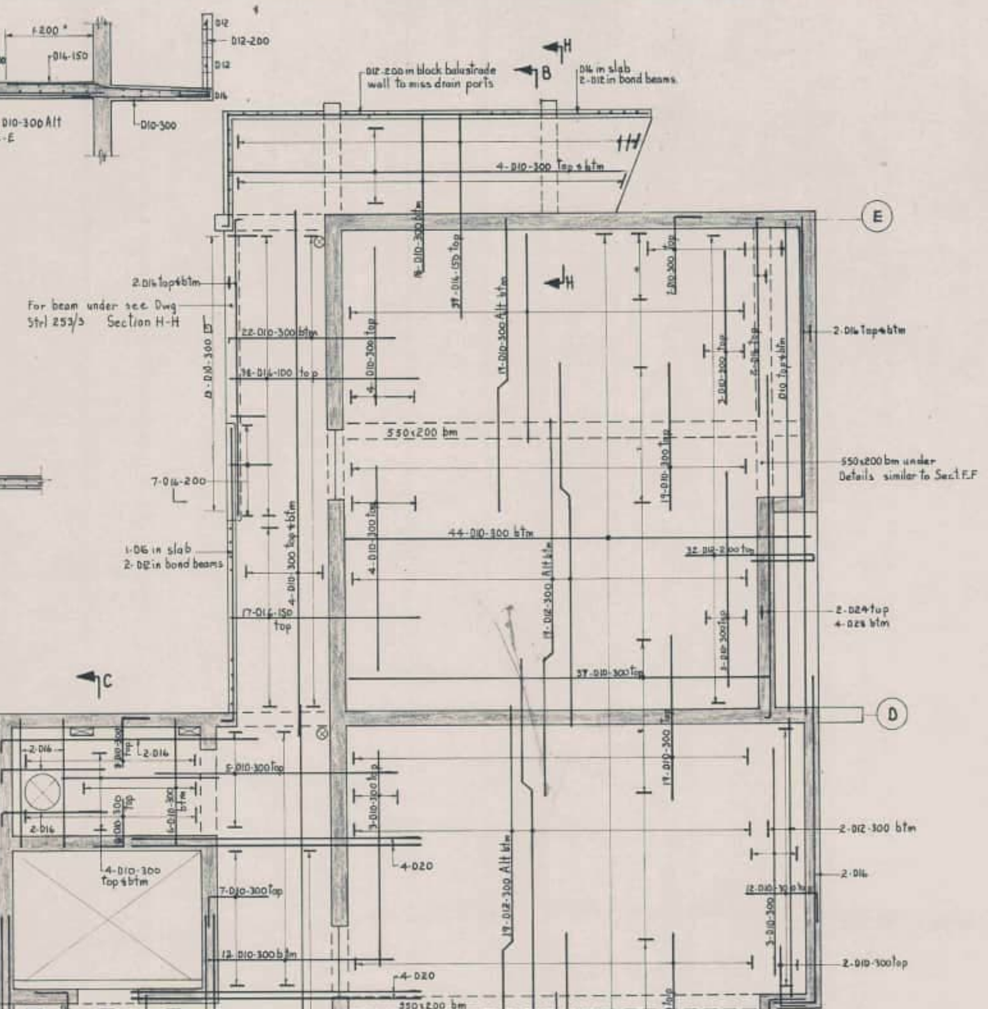
SECTION 1-1

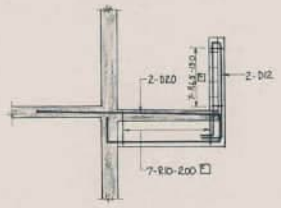


SECTION 2-2



SECTION 3-3

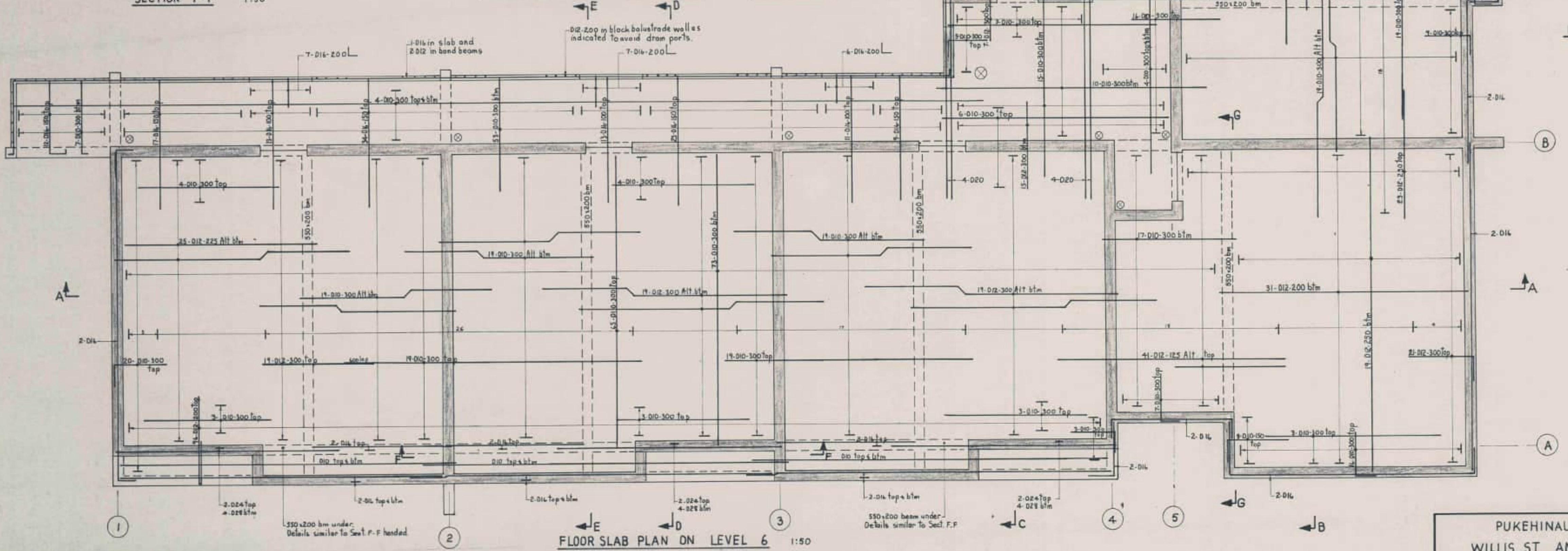




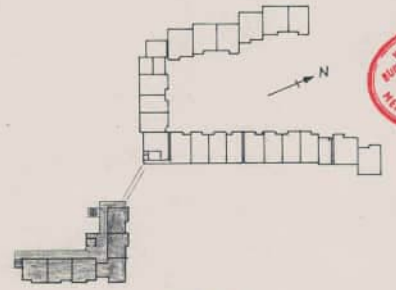
SECTION H-H 1:50

NOTES

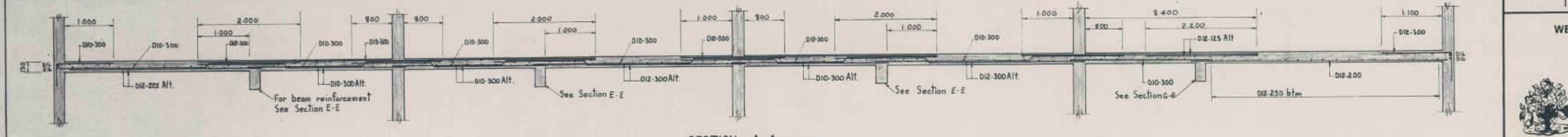
1. Concrete to have a minimum crushing strength of 25MPa at 28 days.
2. Reinforcement to be mild steel structural grade deformed bars.
3. Laps in reinforcement to be a minimum of 40 diameters.
4. Concrete cover to reinforcement to be 20mm in slabs, 40mm in beams to main steel.
5. Contractor to check position of holes against architect's general and service drawings.
6. Position of construction joints where required to be at the third points of slabs and agreed with the Engineer.
7. For enlarged detail of balcony and block balustrade see drawing Strl 253/4.



FLOOR SLAB PLAN ON LEVEL 6 1:50



KEY PLAN



SECTION A-A 1:50

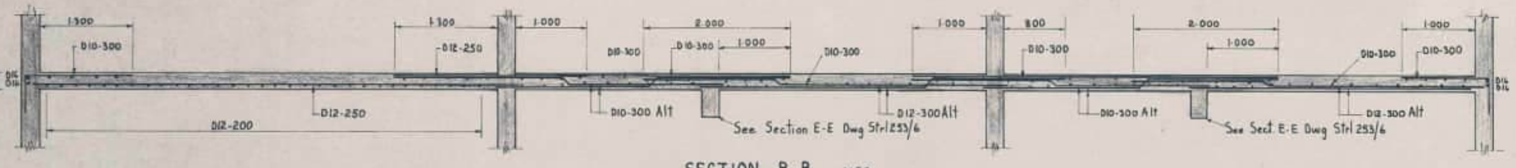
PUKEHINAU FLATS
WILLIS ST AND ARO ST
TOWER BLOCK A

WELLINGTON CITY CORPORATION
WORKS DEPARTMENT
STRUCTURAL BRANCH

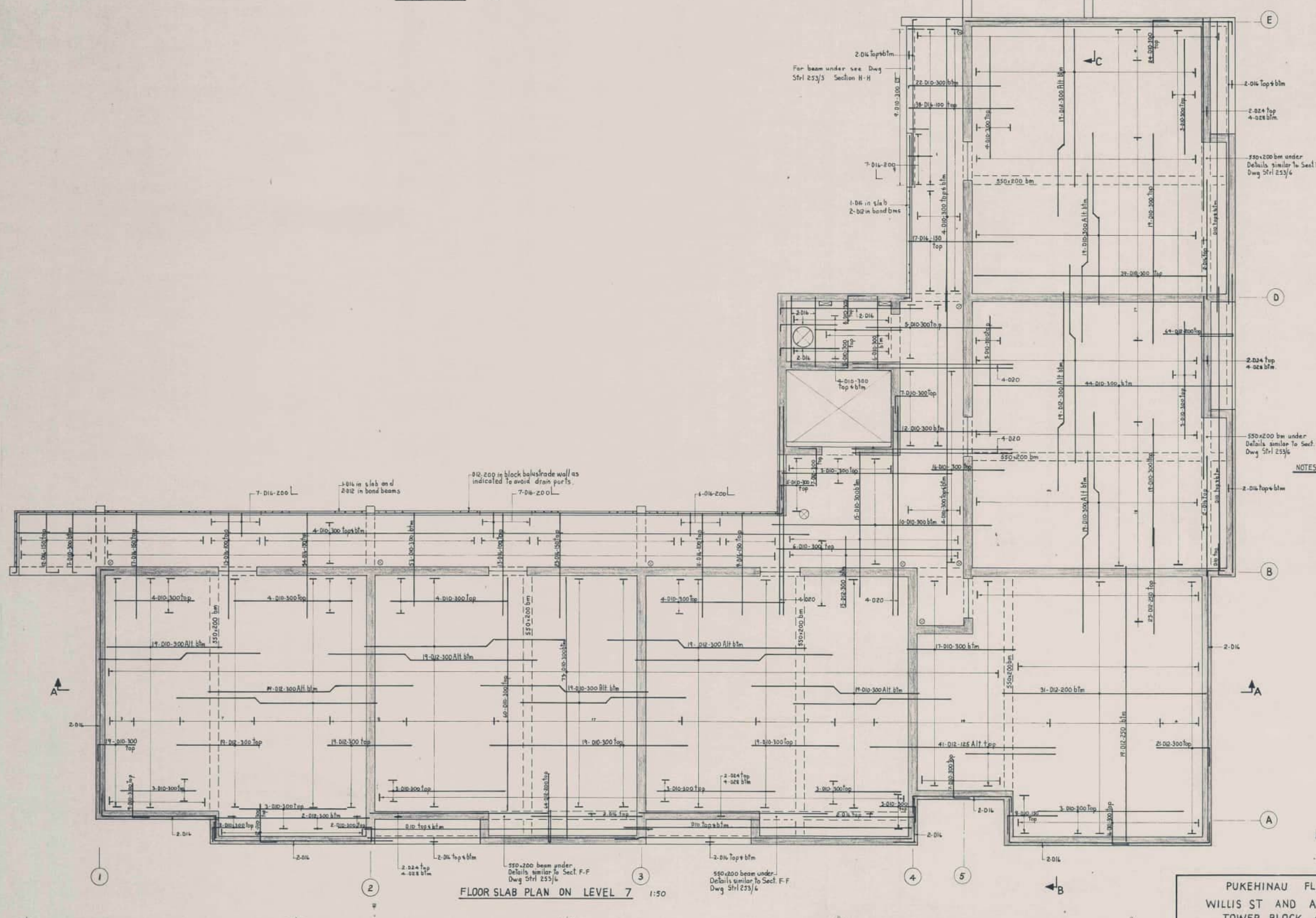
A. D. MARTIN, CITY ENGINEER

CONTRACT NUMBER 2469		SHEET No. 7 IN SET OF 48
Scale 1:50		
FLOOR SLAB LEVEL 6		
TRACING NO. STRL 253/7		
DESIGNED	TPN	Dec 74
DRAWN	TPN	March 75
TRACED	RJP	
CHECKED		
APPROVED		

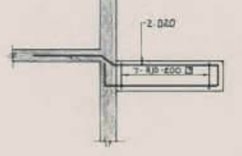
CHIEF STRUCTURAL ENGINEER



SECTION B-B 1:50



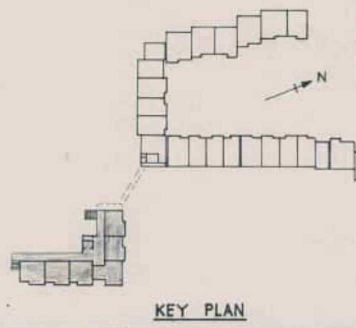
FLOOR SLAB PLAN ON LEVEL 7 1:50



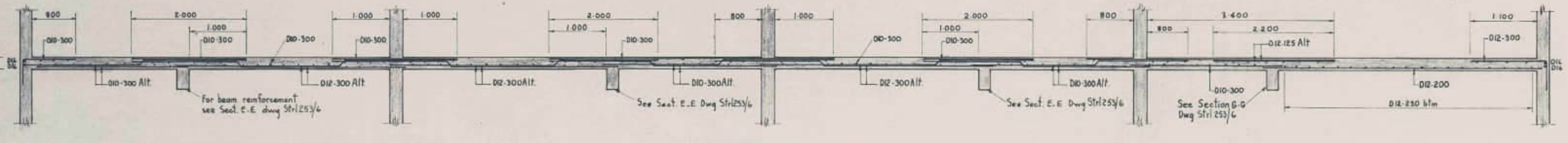
SECTION C-C 1:50

NOTES

1. Concrete to have a minimum crushing strength of 25MPa at 28 days
2. Reinforcement to be mild steel structural grade deformed bars
3. Laps in reinforcement to be a minimum of 40 diameters.
4. Concrete cover to reinforcement to be 20mm in slabs, 40mm to main bars in beams.
5. Contractor to check position of holes against architect's general and service dwgs
6. Position of construction joints where required to be at the third points of slabs and agreed with the Engineer.
7. For enlarged detail of balcony and block balustrade see drawing Strl 253/4
8. For beam elevations see drawing Strl 253/6.



KEY PLAN



SECTION A-A 1:50

PUKEHINAU FLATS
WILLIS ST AND ARO ST
TOWER BLOCK A

CONTRACT NUMBER 2469
Scale 1:50
FLOOR SLAB LEVEL 7
SHEET No. 8
IN SET OF 48

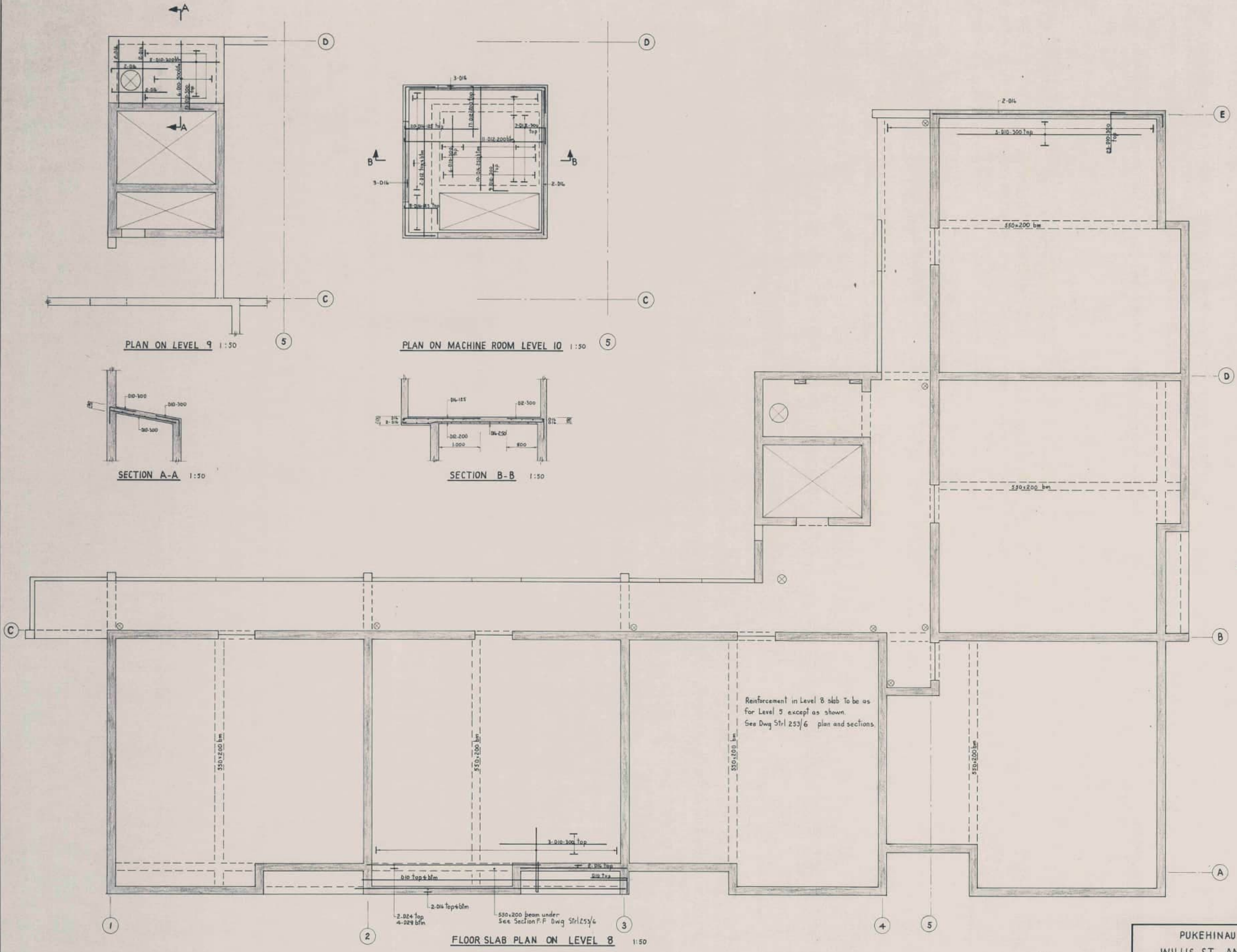
WELLINGTON CITY CORPORATION
WORKS DEPARTMENT
STRUCTURAL BRANCH

A. D. MARTIN CITY ENGINEER

TRACING NO. STRL 253/8

DESIGNED	TPN	Dec 74
DRAWN	TPN	March 75
TRACED	RJ	
CHECKED		

APPROVED
CHIEF STRUCTURAL ENGINEER



PLAN ON LEVEL 9 1:50

PLAN ON MACHINE ROOM LEVEL 10 1:50

SECTION A-A 1:50

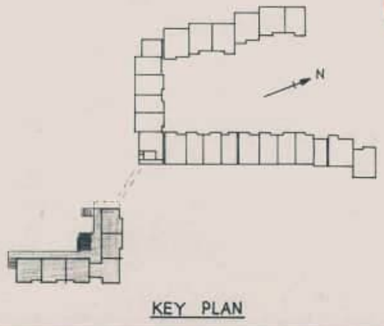
SECTION B-B 1:50

Reinforcement in Level 8 slab To be as for Level 5 except as shown. See Dwg Strl 253/6 plan and sections.

FLOOR SLAB PLAN ON LEVEL 8 1:50

NOTES

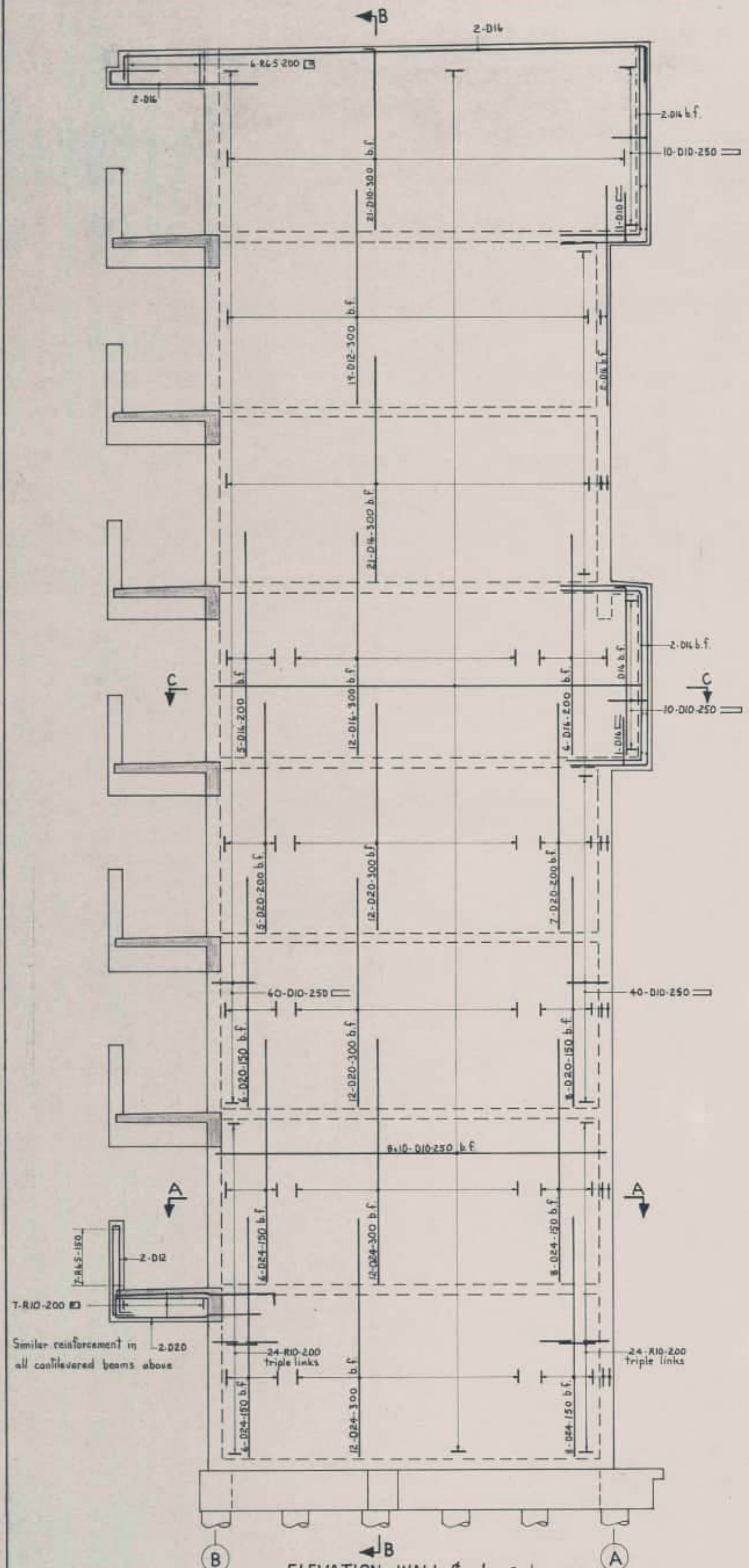
1. Concrete to have a minimum crushing strength of 25MPa at 28 days.
2. Reinforcement to be mild steel structural grade deformed bars.
3. Laps in reinforcement to be a minimum of 40 diameters.
4. Concrete cover to reinforcement to be 20mm in slabs, 40mm to main bars in beams.
5. Contractor to check position of holes against architect's general and service drawings.
6. Position of construction joints where required to be at the third points of slabs and agreed with the Engineer.
7. This drawing to be read in conjunction with drawing Strl 253/6.
8. See lift manufacturer's drawings for holes and fixtures in machine room slab.



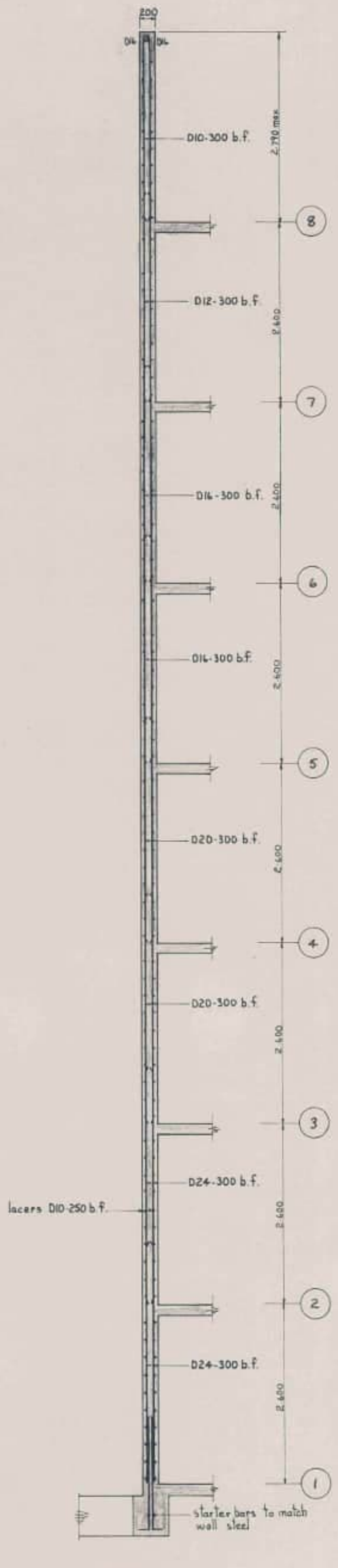
KEY PLAN

PUKEHINAU FLATS WILLIS ST AND ARO ST TOWER BLOCK A	CONTRACT NUMBER 2469 Scale 1:50 FLOOR SLAB LEVELS 8, 9 and 10	SHEET No. 9 IN SET OF: 48
WELLINGTON CITY CORPORATION WORKS DEPARTMENT STRUCTURAL BRANCH A. D. MARTIN, CITY ENGINEER	TRACING NO. STRL 253/9	

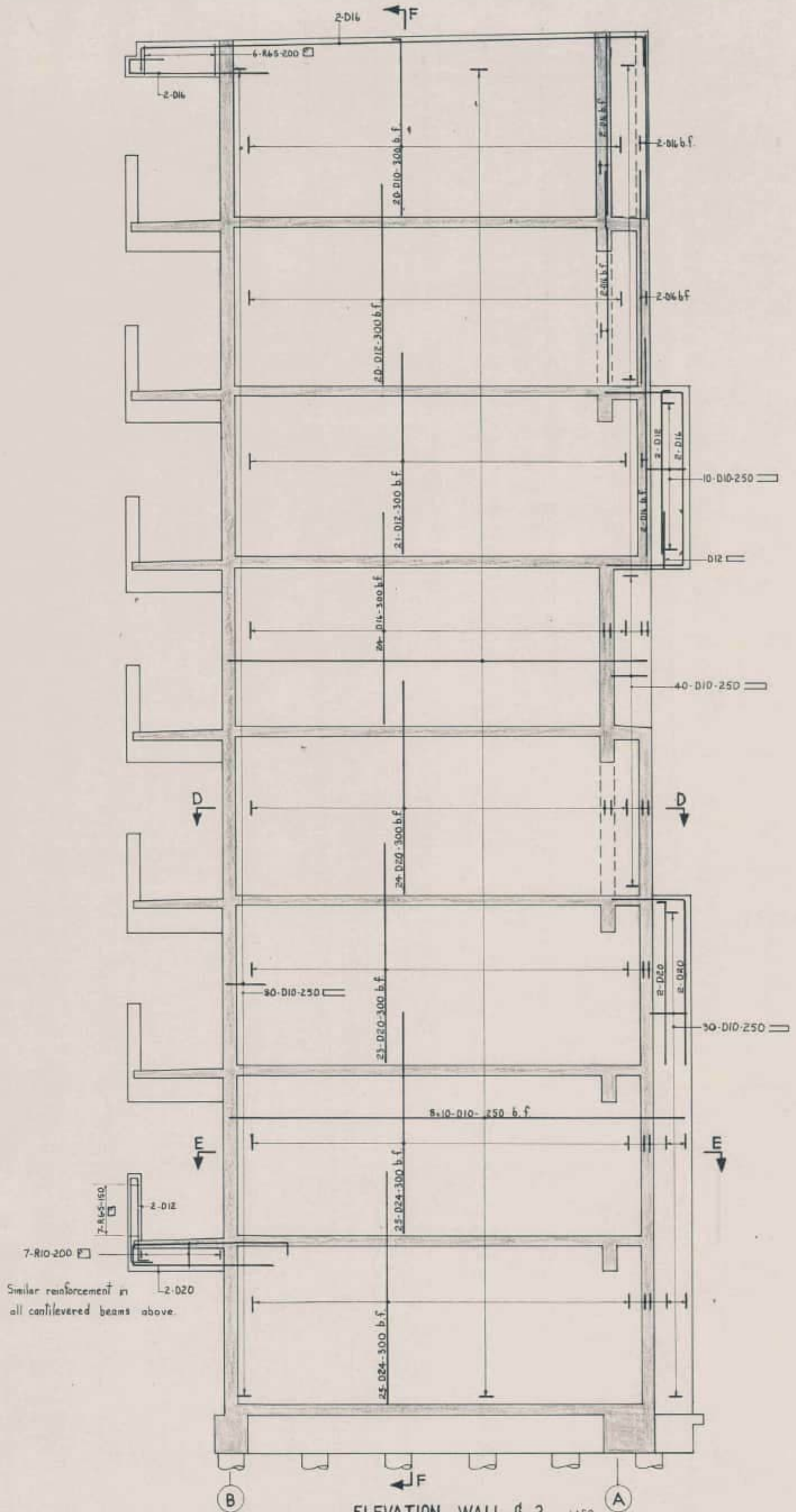
DESIGNED	TPN	Dec 74
DRAWN	TPN	March 75
TRACED		
CHECKED	RP	
APPROVED	G. J. Mulholland CHIEF STRUCTURAL ENGINEER	



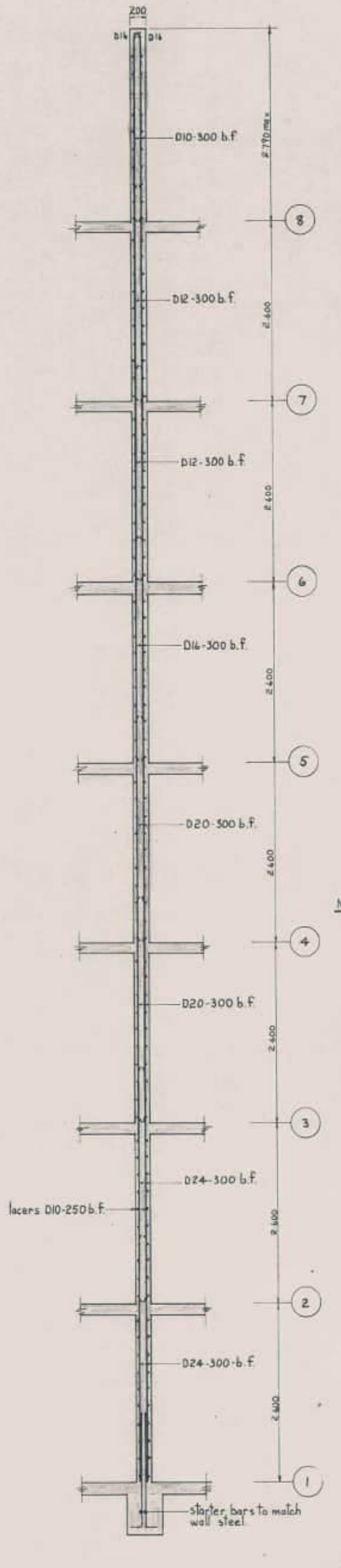
ELEVATION WALL ℄ 1 Scale 1:50



SECTION B-B 1:50



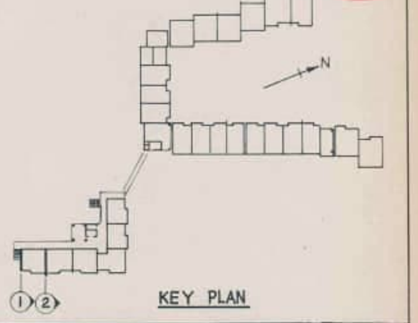
ELEVATION WALL ℄ 2 1:50



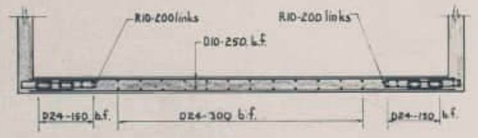
SECTION F-F 1:50

NOTES

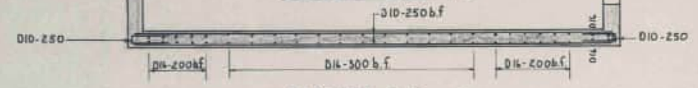
1. Concrete to have a minimum crushing strength of 25MPa at 28days.
2. Reinforcement to be mild steel structural grade deformed or round bars as specified.
3. Laps in reinforcement to be a minimum of 40 diameters.
4. Concrete cover to reinforcement to be 25mm to internal face of walls, 40mm to external faces.
5. Walls to be 200mm thick.
6. See architect's drawings for details of drips, rebates, holes etc.



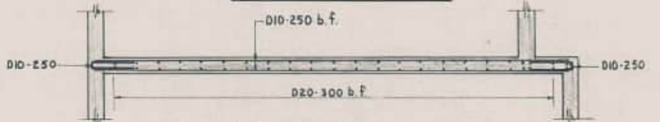
KEY PLAN



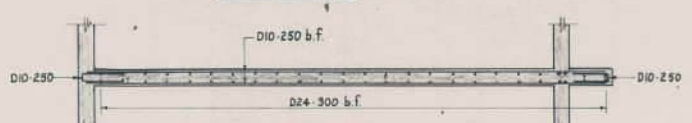
SECTION A-A 1:50



SECTION C-C 1:50



SECTION D-D 1:50



SECTION E-E 1:50

PUKEHINAU FLATS
WILLIS ST. AND ARO ST
TOWER BLOCK A

CONTRACT NUMBER	2469
Scale 1:50	
WALLS ON ℄ 1 and 2	
SHEET No.	10 IN SET OF 48

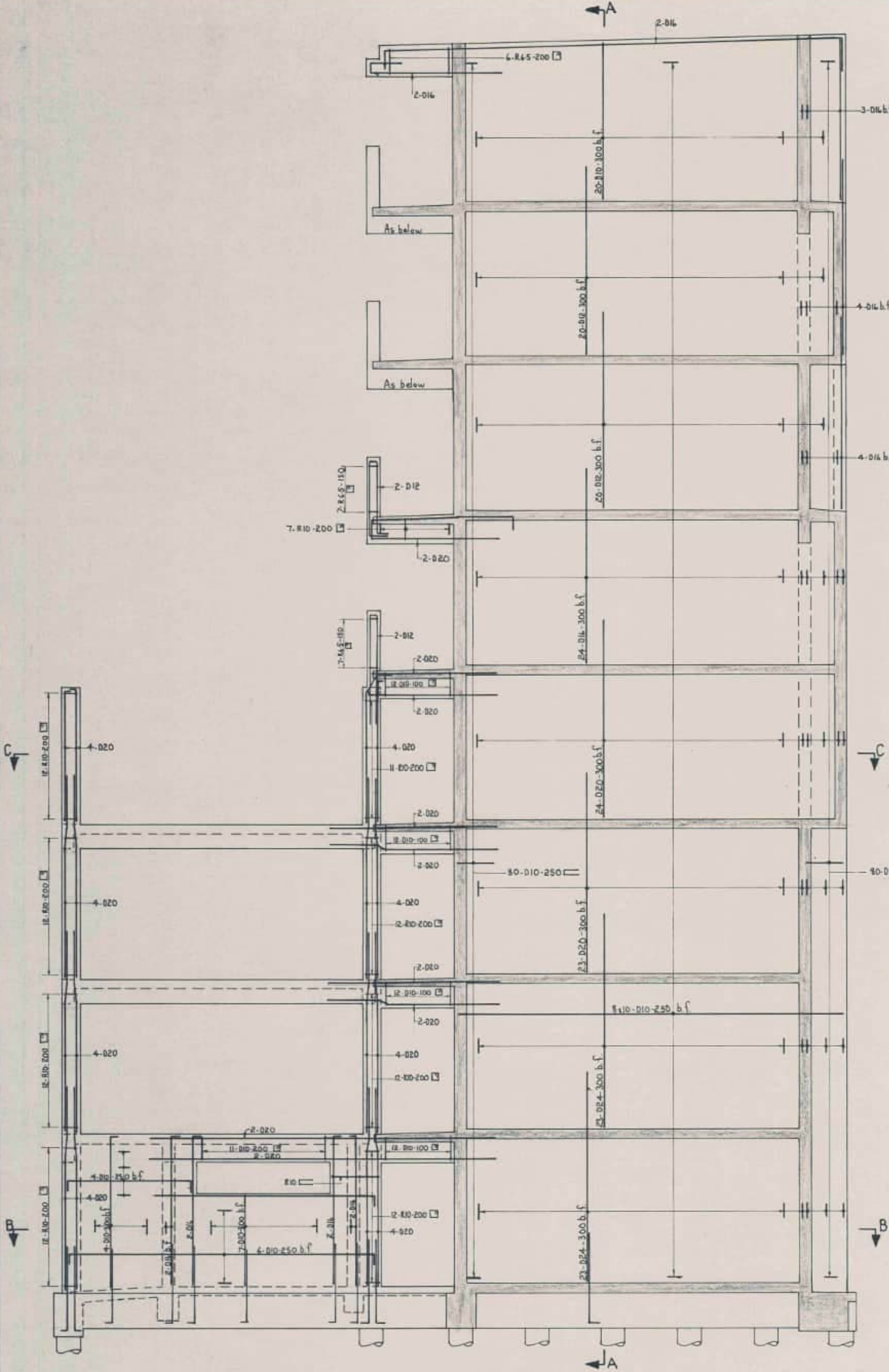
WELLINGTON CITY CORPORATION
WORKS DEPARTMENT
STRUCTURAL BRANCH

A. D. MARTIN CITY ENGINEER

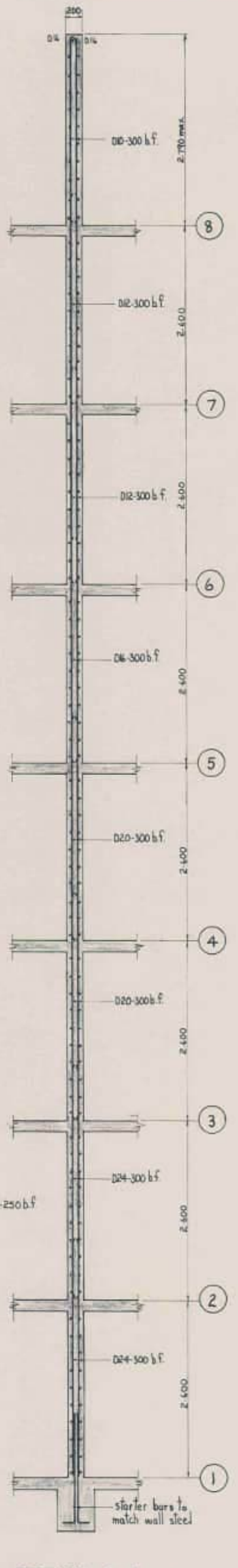
TRACING NO. STRL 253/10

DESIGNED	T. P. N.	Dec 74
DRAWN	T. P. N.	Feb 75
TRACED		
CHECKED		

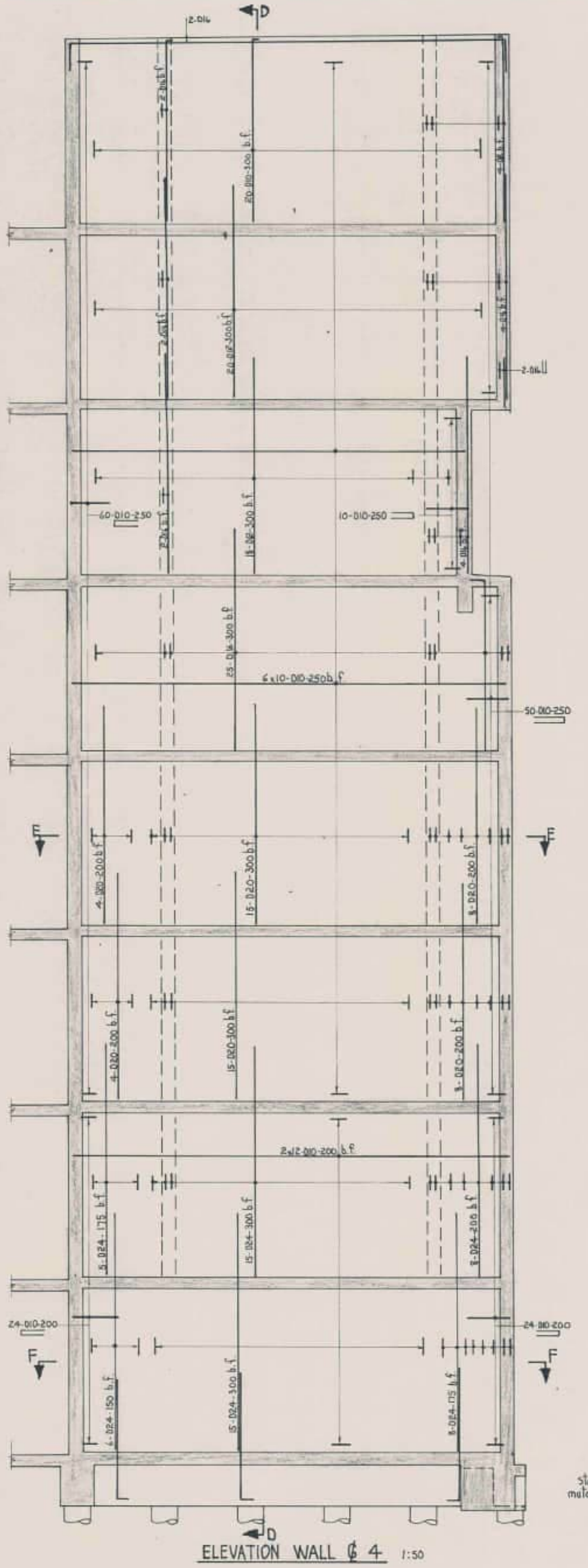
APPROVED
CHIEF STRUCTURAL ENGINEER



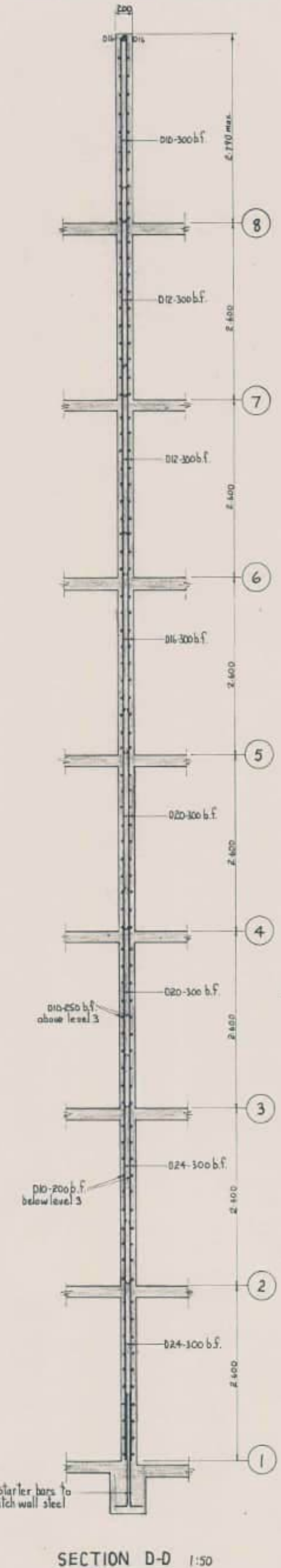
ELEVATION WALL ℄ 3 1:50



SECTION A-A 1:50



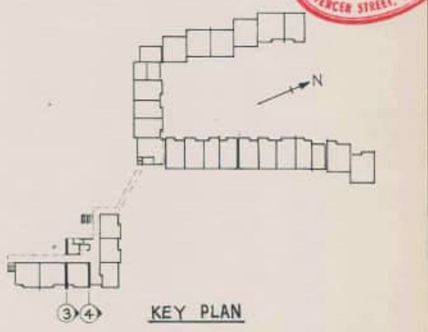
ELEVATION WALL ℄ 4 1:50



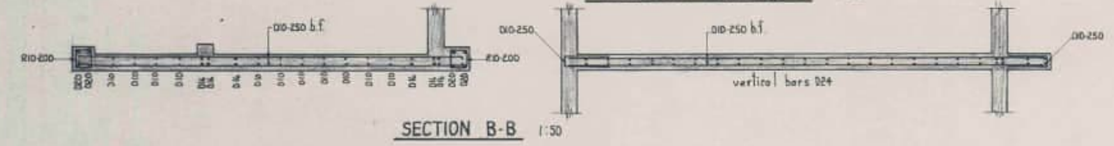
SECTION D-D 1:50

NOTES

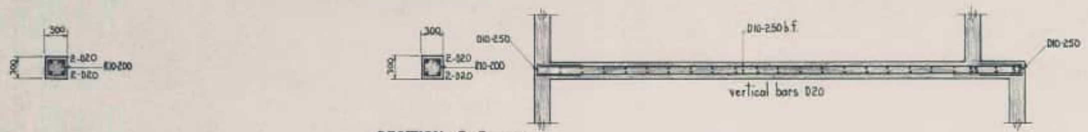
1. Concrete to have a minimum crushing strength of 25MPa at 28 days
2. Reinforcement to be mild steel structural grade deformed or round bars as specified
3. Laps in reinforcement to be a minimum of 40 diameters.
4. Cover to reinforcement to be 25mm to internal face 40mm to external face of walls and 50mm to columns
5. Walls to be 200mm thick
6. See architects drawing for details of drips, rebates, holes etc.



KEY PLAN

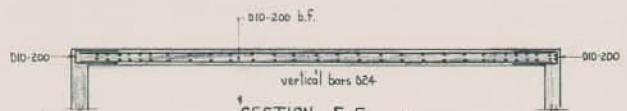


SECTION B-B 1:50



SECTION C-C 1:50

SECTION E-E 1:50



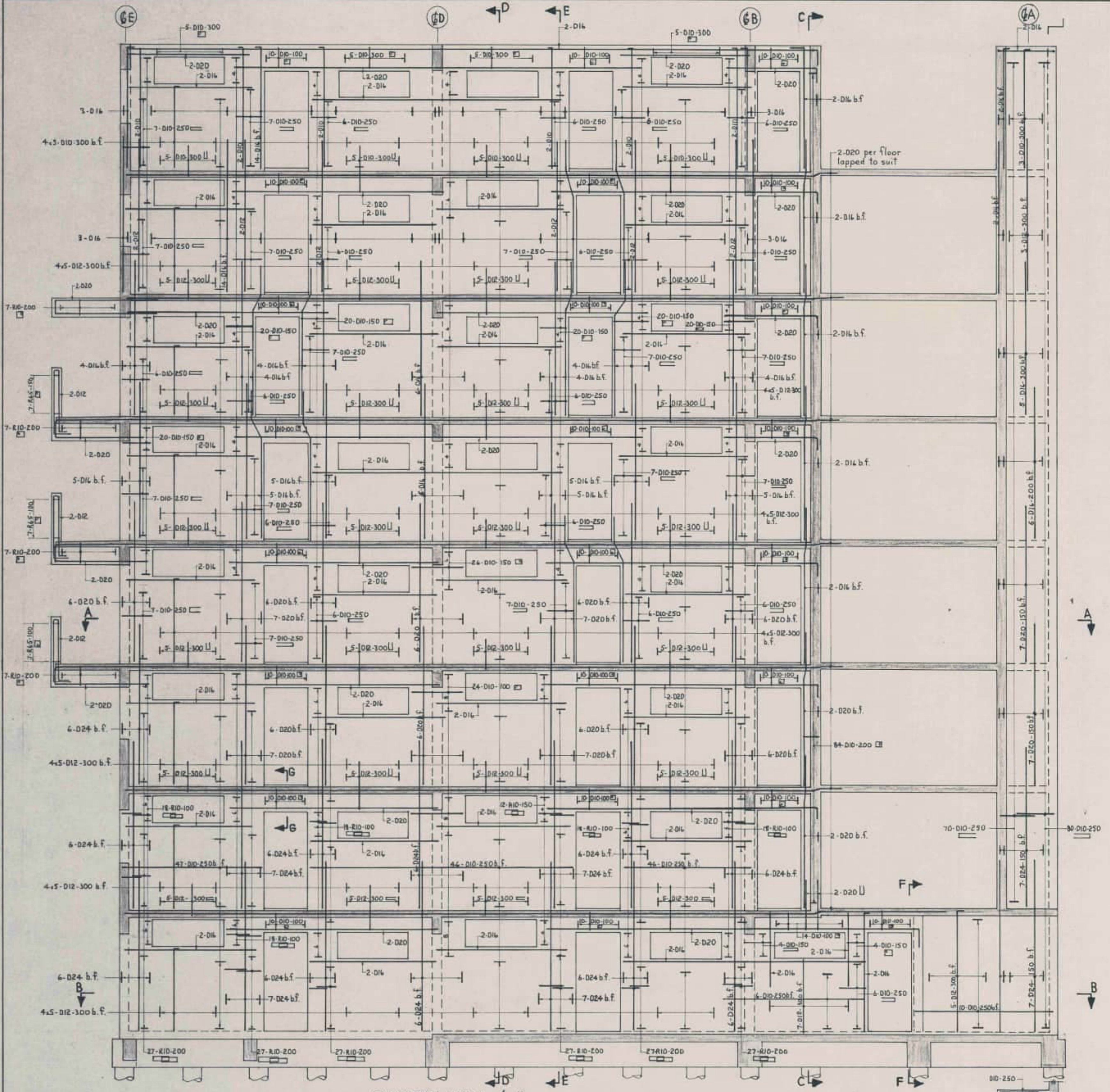
SECTION F-F 1:50

PUKEHINAU FLATS
WILLIS ST AND ARD ST
TOWER BLOCK A

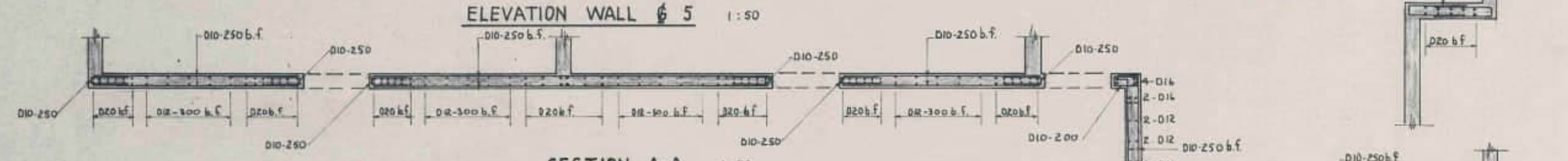
WELLINGTON CITY CORPORATION
WORKS DEPARTMENT
STRUCTURAL BRANCH

A. D. MARTIN CITY ENGINEER

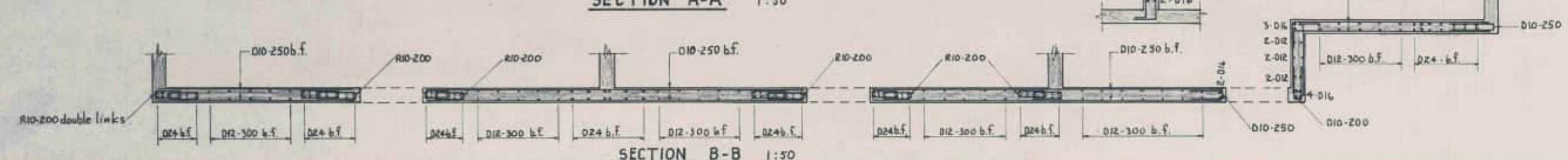
CONTRACT NUMBER 2469		SHEET No. 11
SCALE 1:50		
WALLS 3 and 4		IN SET OF 48
TRACING NO. STRL 253/11		
DESIGNED	TPN	Aug 75
DRAWN	TPN	Sept 75
TRACED		
CHECKED	RP.	
APPROVED G. S. Mulholland		
CHIEF STRUCTURAL ENGINEER		



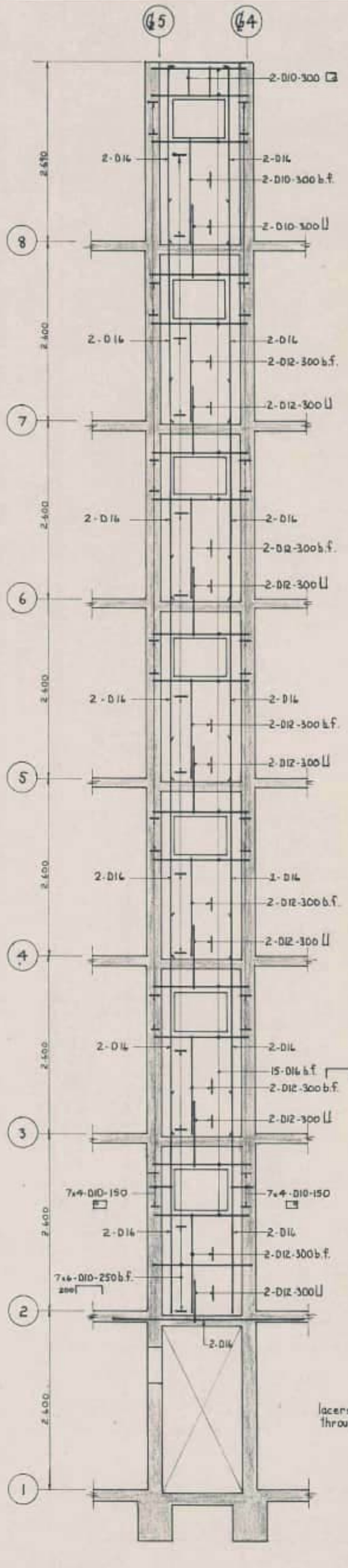
ELEVATION WALL Ⓖ 5 1:50



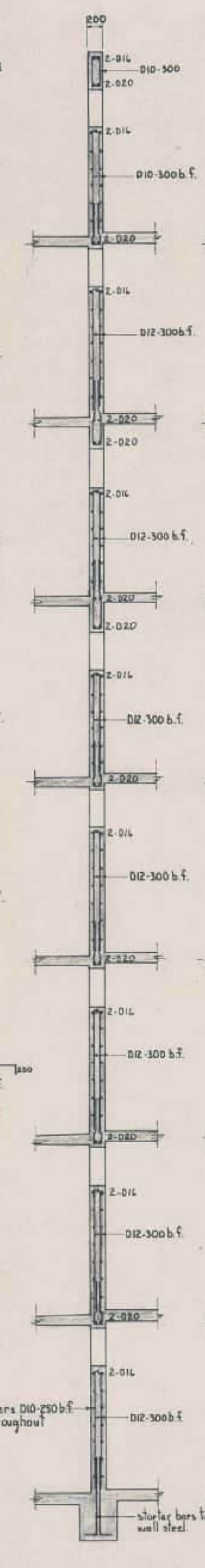
SECTION A-A 1:50



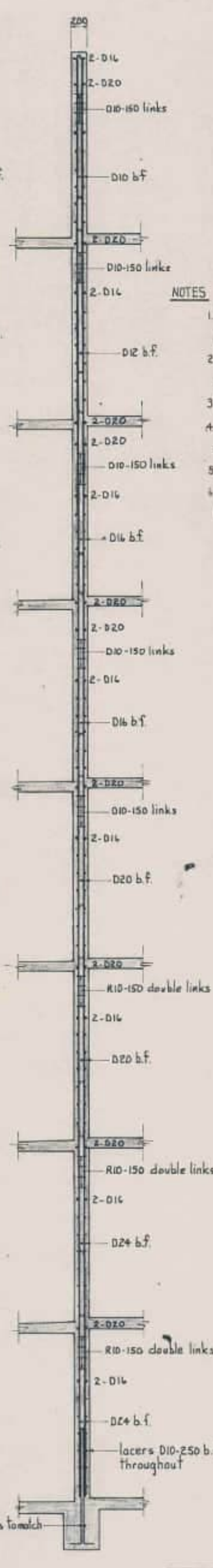
SECTION B-B 1:50



SECTION C-C 1:50



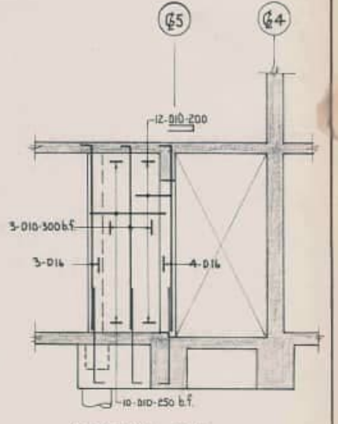
SECTION D-D 1:50



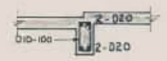
SECTION E-E

NOTES

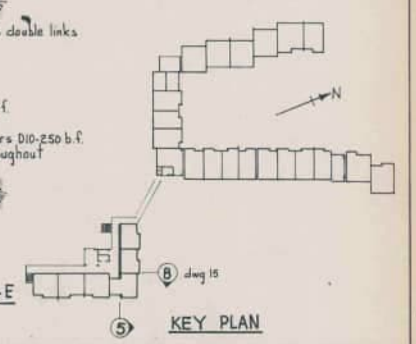
1. Concrete to have a minimum crushing strength of 25 MPa at 28 days.
2. Reinforcement to be mild steel structural grade deformed or round bars as specified
3. Laps in reinforcement to be a minimum of 40 diameters.
4. Concrete cover to reinforcement to be 25mm to internal and 40mm to external faces of walls.
5. Walls to be 200mm thick.
6. See architects drawings for details of drips, rebates, holes etc.



SECTION F-F 1:50



SECTION G-G 1:50



KEY PLAN

PUKEHINAU FLATS
WILLIS ST AND ARO ST
TOWER BLOCK A

CONTRACT NUMBER 2469
Scale 1:50
WALL ON Ⓖ 5
SHEET No. 12
IN SET OF: 48

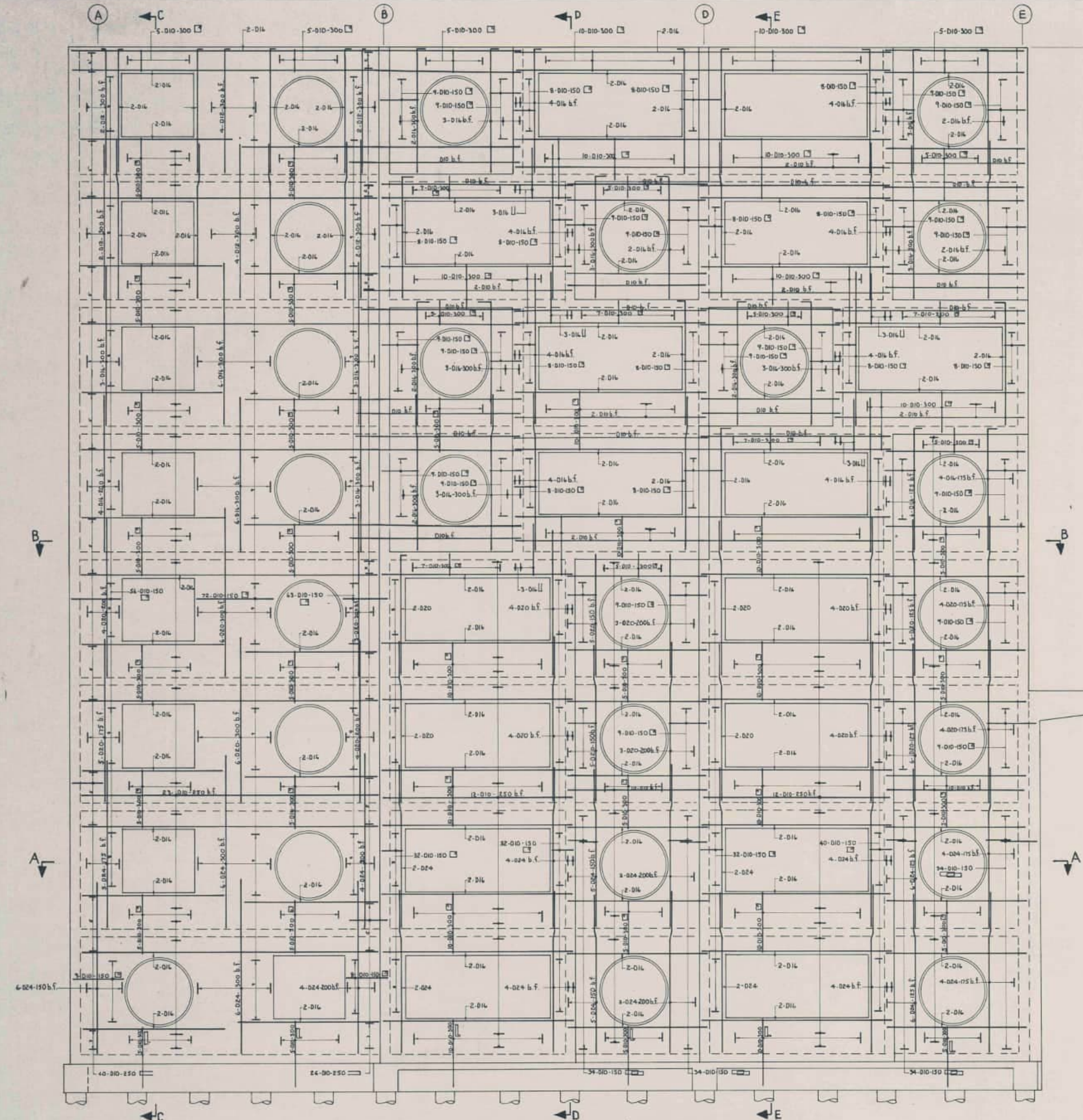
WELLINGTON CITY CORPORATION
WORKS DEPARTMENT
STRUCTURAL BRANCH

A. D. MARTIN, CITY ENGINEER

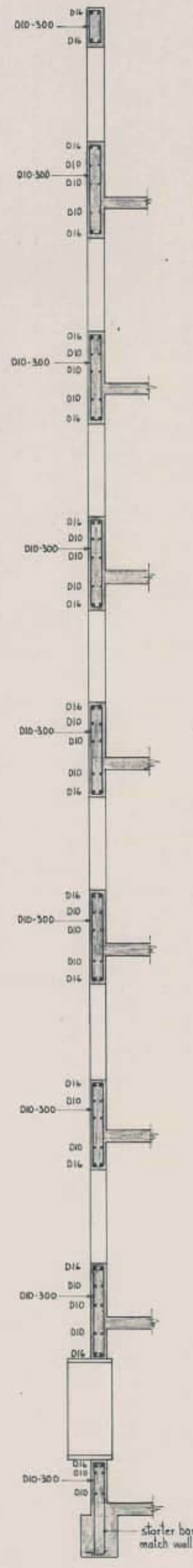
TRACING NO. STRL 253/12

DESIGNED	TPN	Dec 74
DRAWN	TPN	Feb 75
TRACED		
CHECKED	RJP	

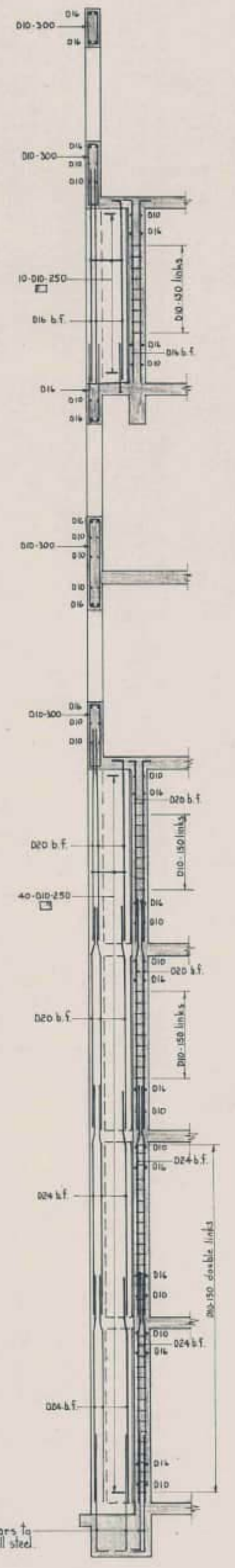
APPROVED
CHIEF STRUCTURAL ENGINEER



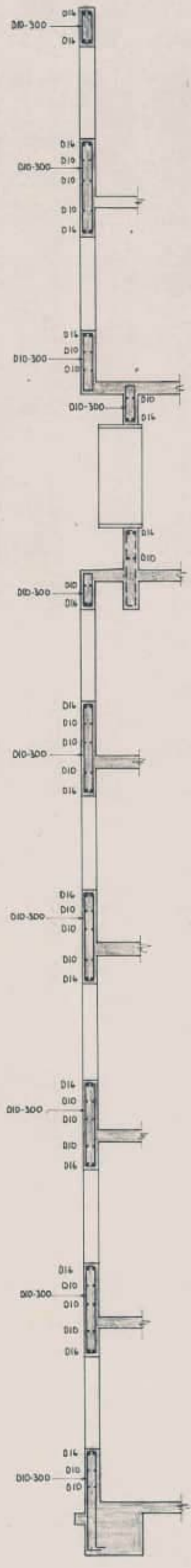
ELEVATION WALL ℄ 6 1:50



SECTION C-C 1:50



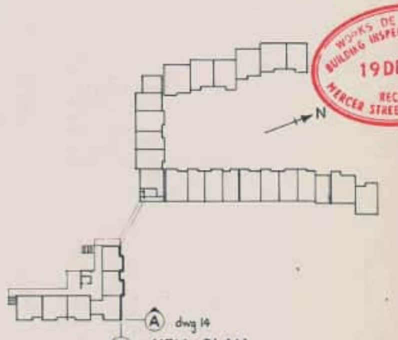
SECTION D-D 1:50



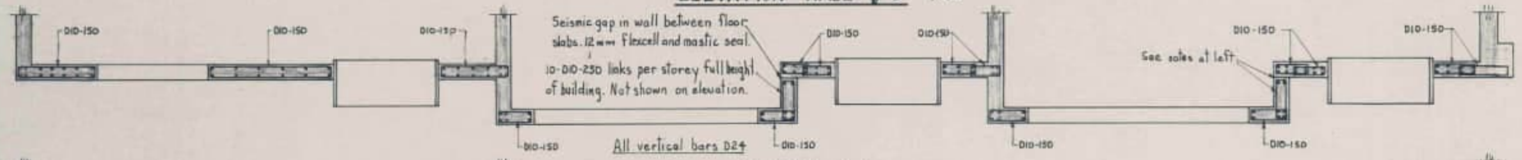
SECTION E-E 1:50

NOTES

1. Concrete to have a minimum crushing strength of 25MPa at 28 days
2. Reinforcement to be mild steel structural grade deformed or round bars as specified.
3. Laps in reinforcement to be a minimum of 40 diameters.
4. Concrete cover to reinforcement to be 25mm to internal face of walls, 40mm to external faces
5. Walls to be 200mm thick.
6. See architects drawings for details of drips, rebates, holes, etc.



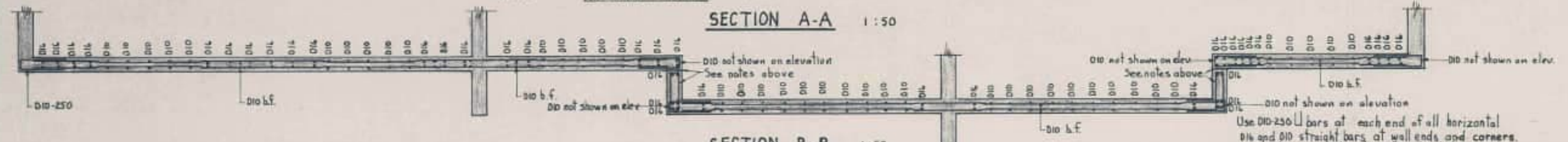
A dwg 14
6 **KEY PLAN**



Seismic gap in wall between floor slabs. 12mm Flexcell and mastic seal.
10-D10-250 links per storey full height of building. Not shown on elevation.

See notes at left.

SECTION A-A 1:50



Use D10-250 ⊔ bars at each end of all horizontal D16 and D10 straight bars at wall ends and corners. (not shown on elevation for clarity) RGD N°

SECTION B-B 1:50

PUKEHINAU FLATS
WILLIS ST AND ARO ST
TOWER BLOCK A

WELLINGTON CITY CORPORATION
WORKS DEPARTMENT
STRUCTURAL BRANCH

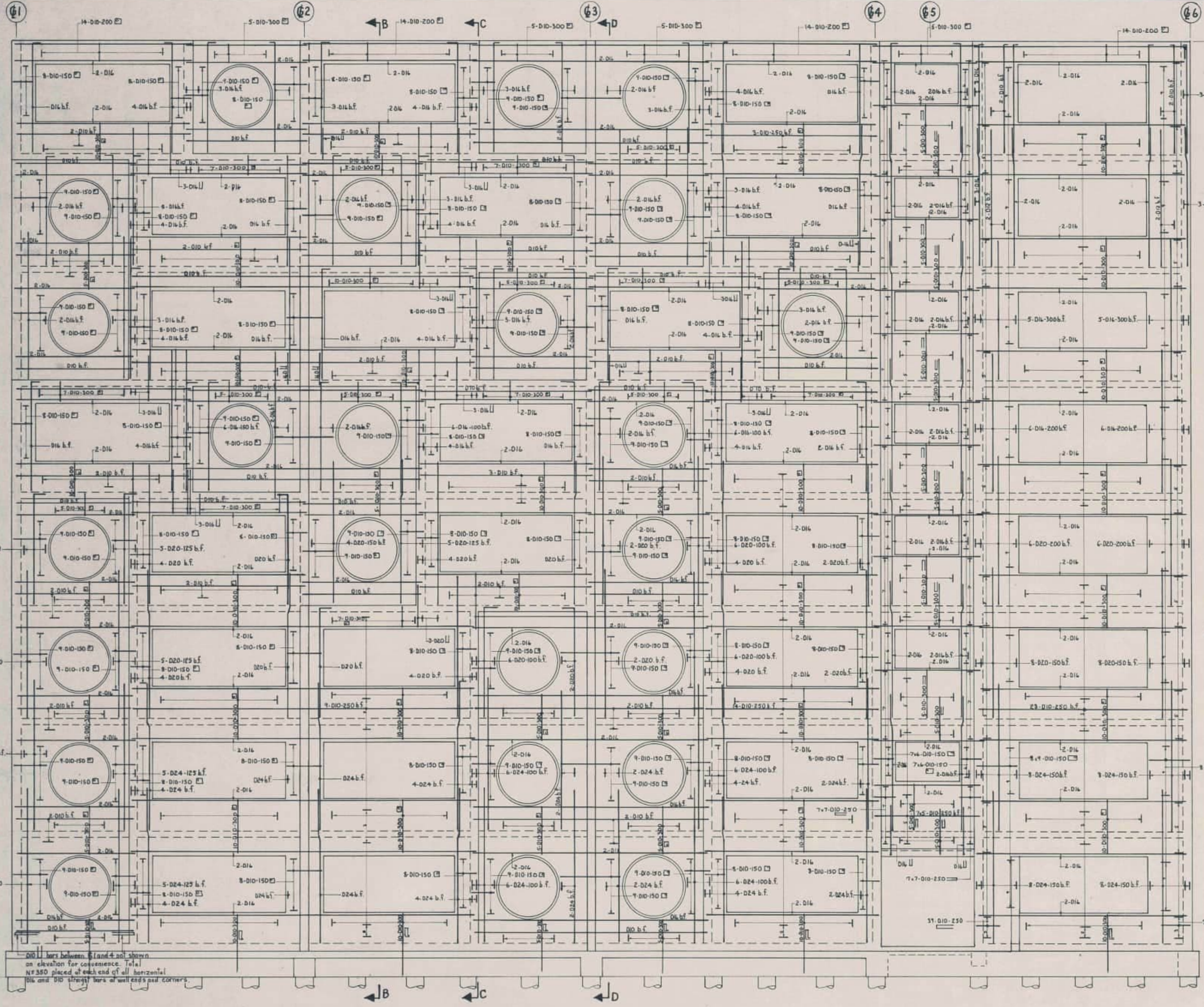
A. D. MARTIN CITY ENGINEER

CONTRACT NUMBER 2469
Scale 1:50
WALL ON ℄ 6
SHEET No. 13 IN SET OF 48

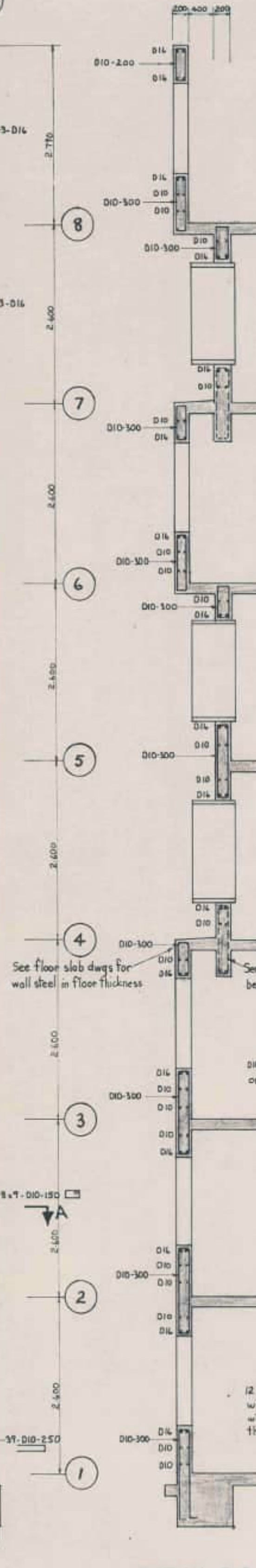
TRACING NO. STRL 253/13

DESIGNED	T.P.N.	Dec 74
DRAWN	T.P.N.	April 75
TRACED		
CHECKED		

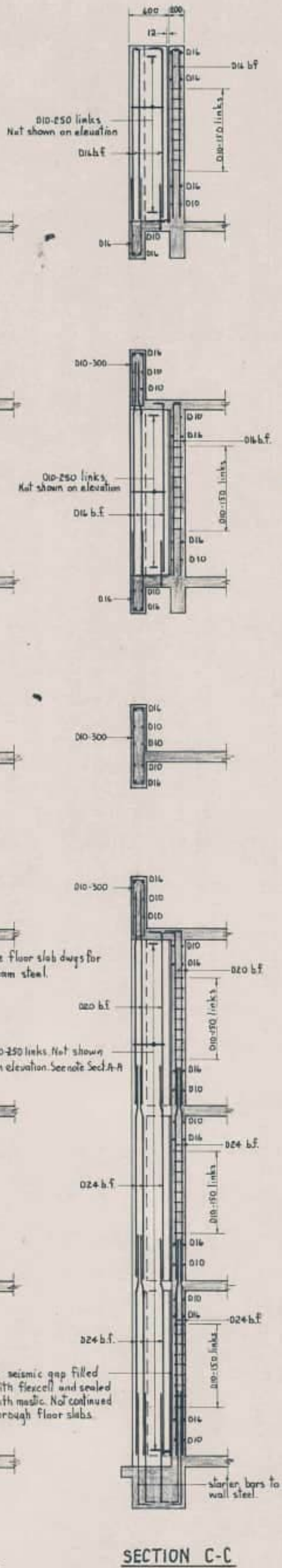
APPROVED G. L. Mulholland
CHIEF STRUCTURAL ENGINEER



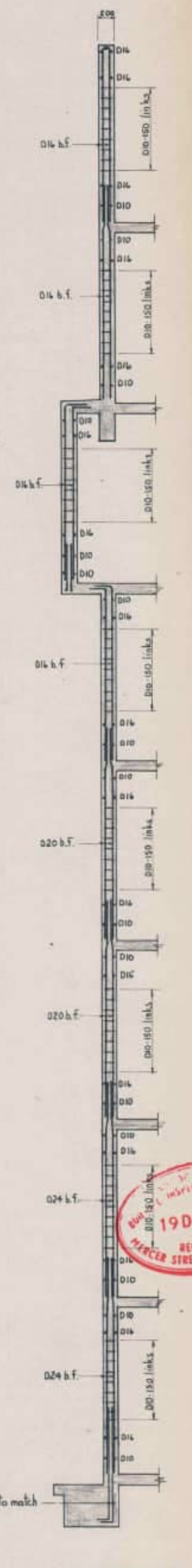
ELEVATION WALL ℄ A 1:50



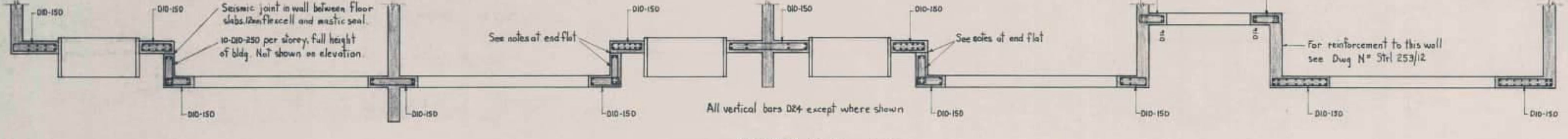
SECTION B-B



SECTION C-C



SECTION D-D



SECTION A-A 1:50

For general notes see dwg Strl 253/13

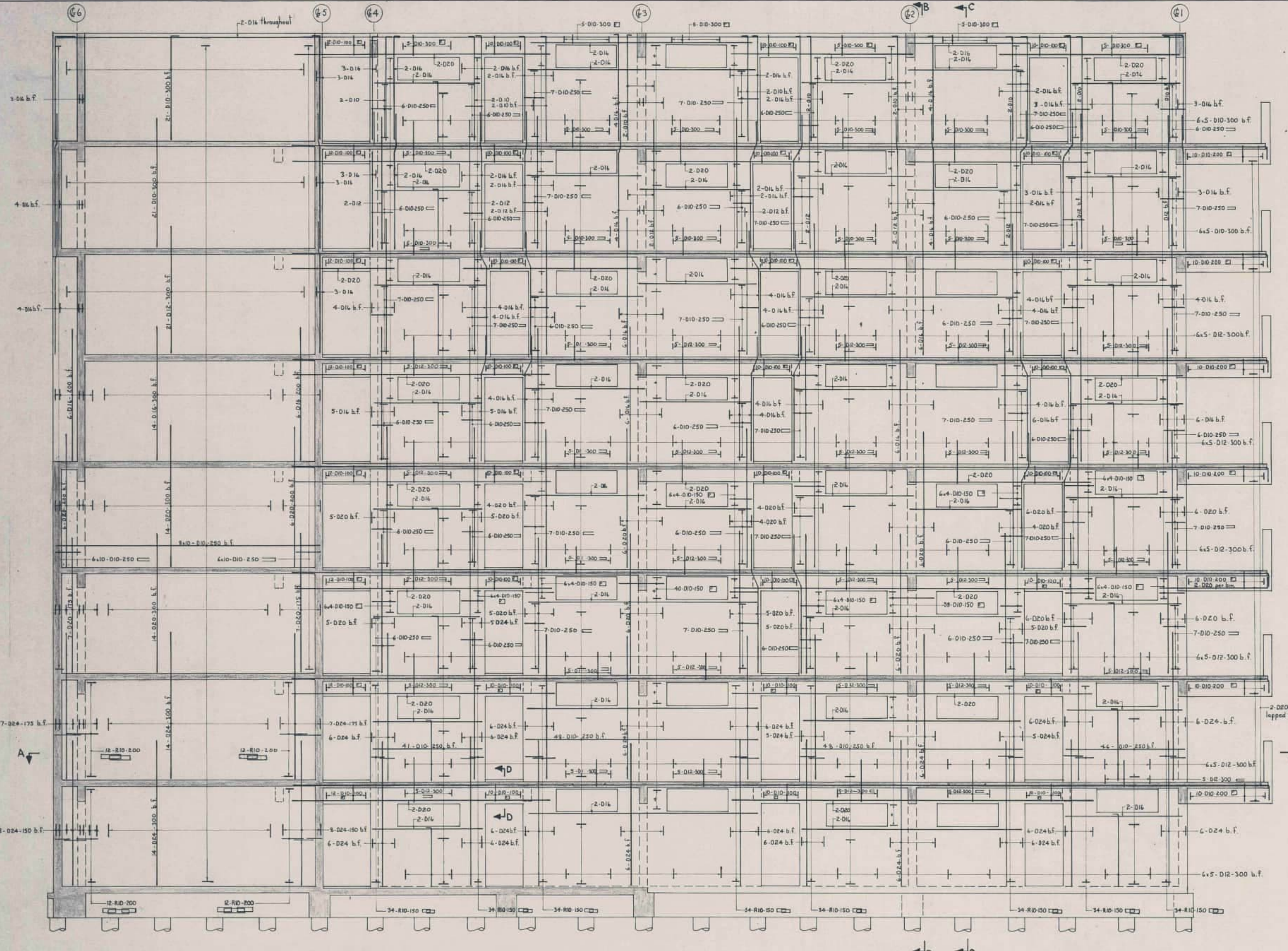
PUKEHINAU FLATS
WILLIS ST AND ARO ST
TOWER BLOCK A.

WELLINGTON CITY CORPORATION
WORKS DEPARTMENT
STRUCTURAL BRANCH

A. D. MARTIN, CITY ENGINEER

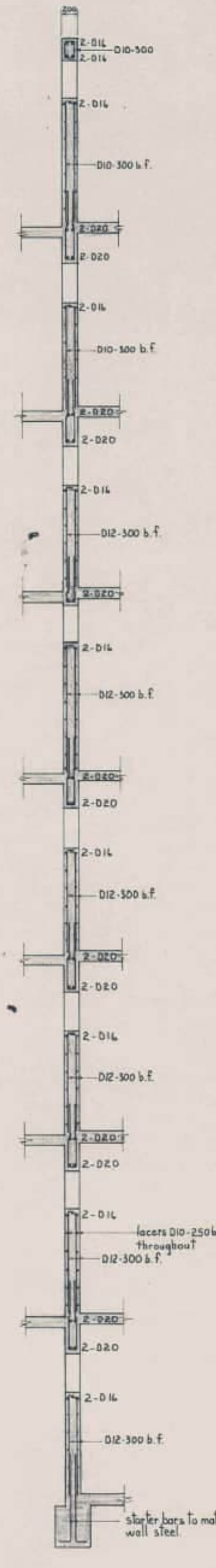
CONTRACT NUMBER 2469		SHEET No. 14 IN SET OF 48
Scale 1:50		
WALL ON ℄ A		
TRACING NO. STRL 253/14		
DESIGNED	TPN	Dec 74
DRAWN	TPN	March 75
TRACED		
CHECKED		

APPROVED
CHIEF STRUCTURAL ENGINEER

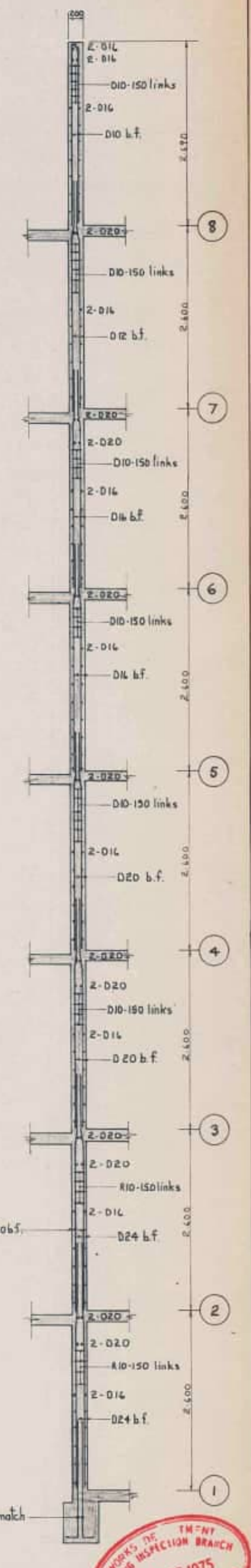


ELEVATION WALL ℄ B AND C Scale 1:50

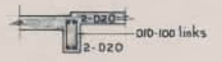
For general notes see Dwg Strl 253/12.



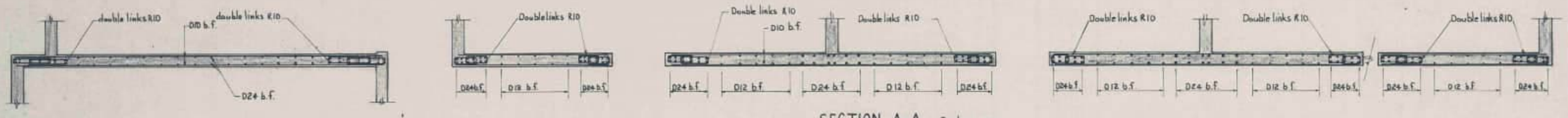
SECTION C-C 1:50



SECTION B-B 1:50



SECTION D-D 1:50



SECTION A-A Scale 1:50

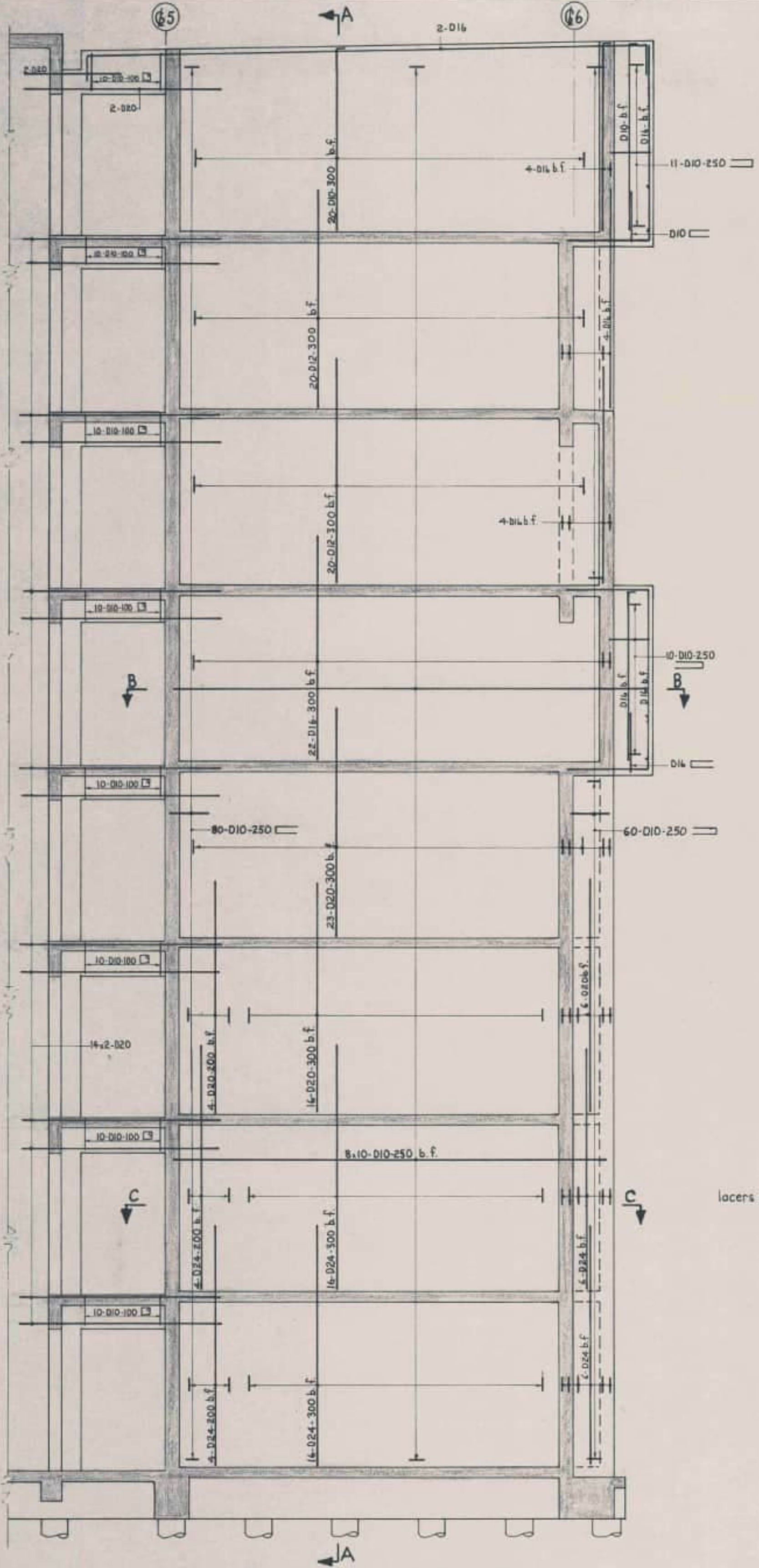
PUKEHINAU FLATS
WILLIS ST. AND ARD ST
TOWER BLOCK A

WELLINGTON CITY CORPORATION
WORKS DEPARTMENT
STRUCTURAL BRANCH

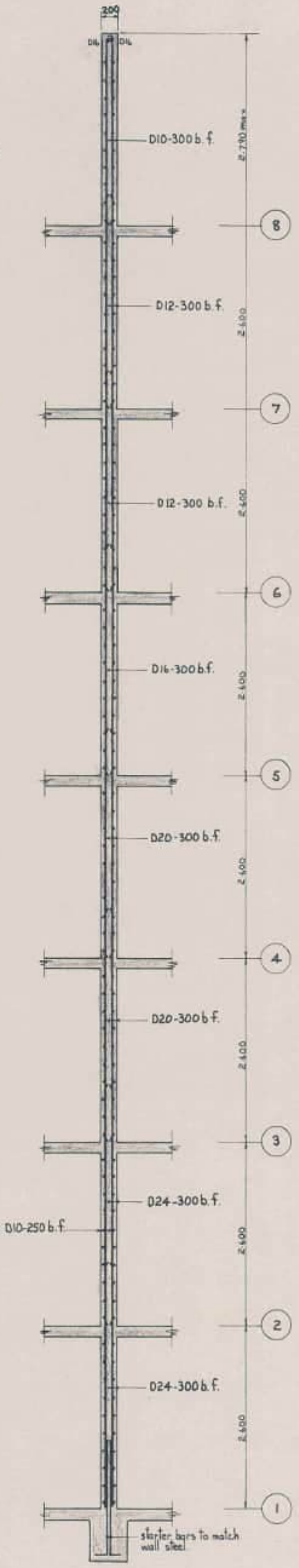
A. D. MARTIN, CITY ENGINEER

CONTRACT NUMBER 2469		SHEET No. 15 IN SET OF 48
Scale 1:50		
WALL ON ℄ B and C		
TRACING NO. STRL 253/15		
DESIGNED	T.P.N	Dec 74
DRAWN	T.P.N.	Feb 75
TRACED		
CHECKED		

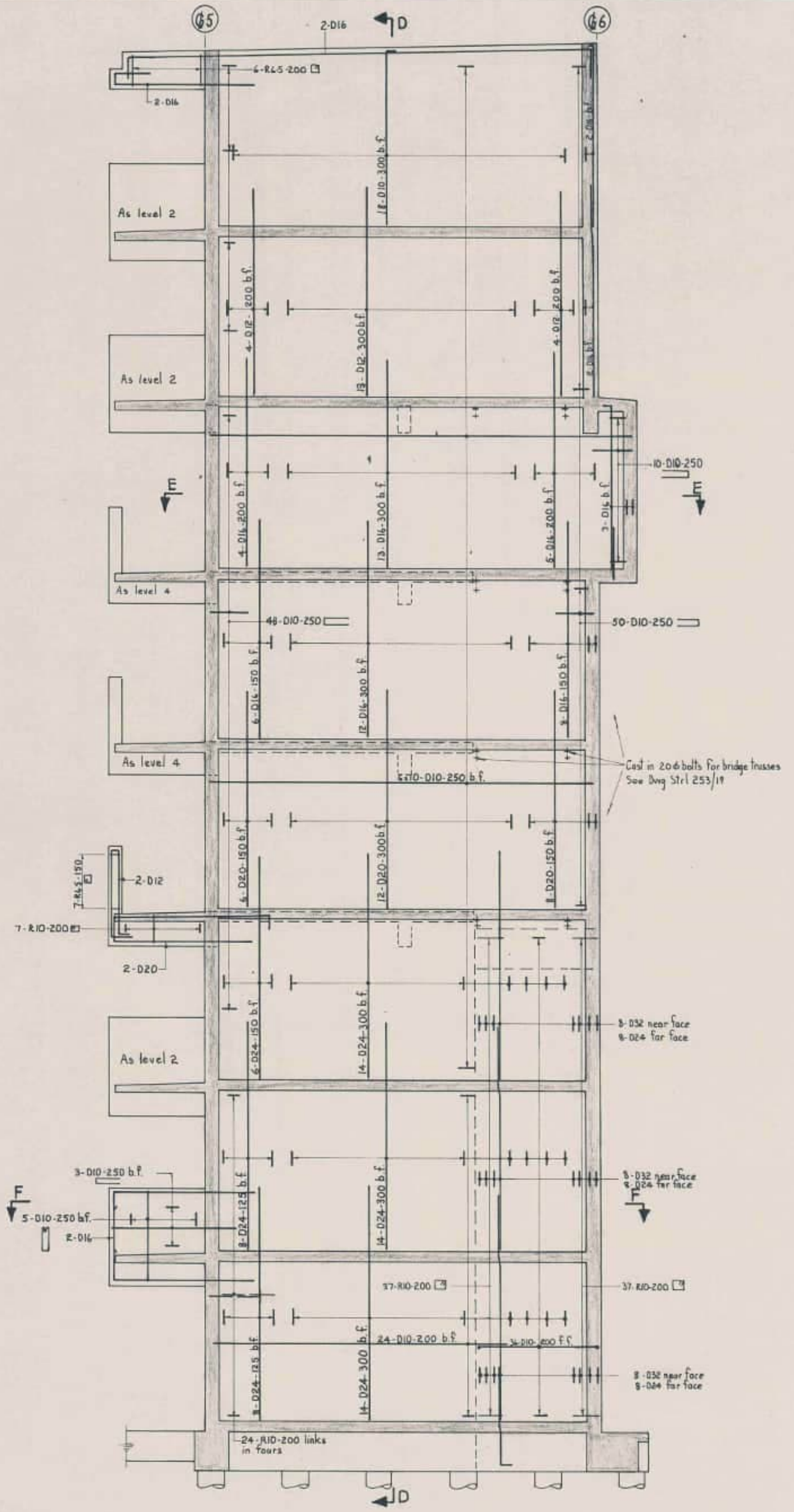
APPROVED
CHIEF STRUCTURAL ENGINEER



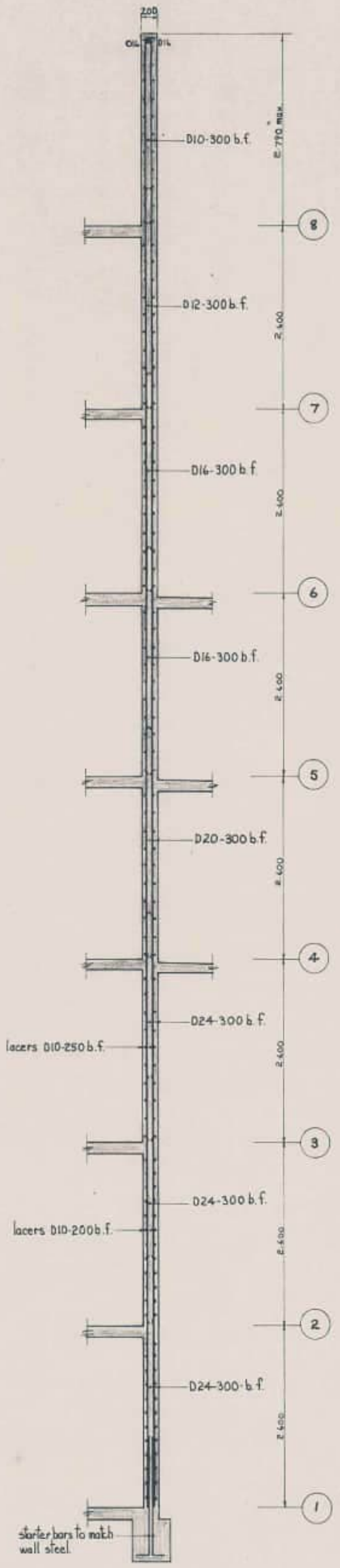
ELEVATION WALL ℄ D 1:50



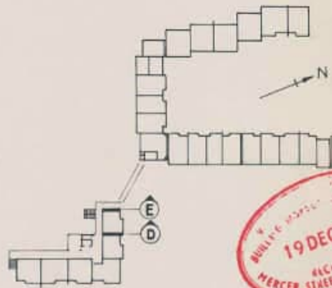
SECTION A-A 1:50



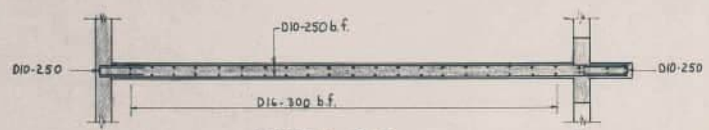
ELEVATION WALL ℄ E 1:50



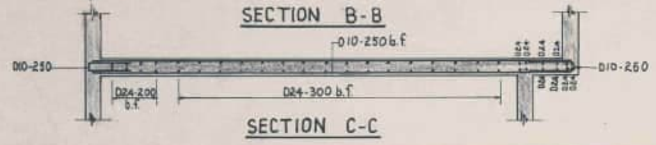
SECTION D-D 1:50



KEY PLAN



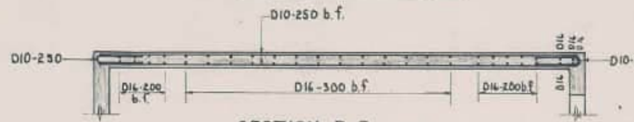
SECTION B-B



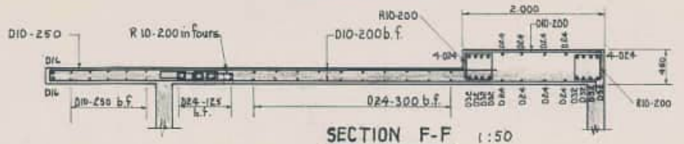
SECTION C-C

NOTES

1. Concrete to have a minimum crushing strength of 25MPa at 28 days.
2. Reinforcement to be mild steel structural grade deformed or round bars as specified.
3. Laps in reinforcement to be a minimum of 40 diameters.
4. Concrete cover to reinforcement to be 25mm to internal and 40mm to external faces of walls.
5. Walls to be 200mm thick.
6. See architect's drawings for details of drips, rebates, holes etc.

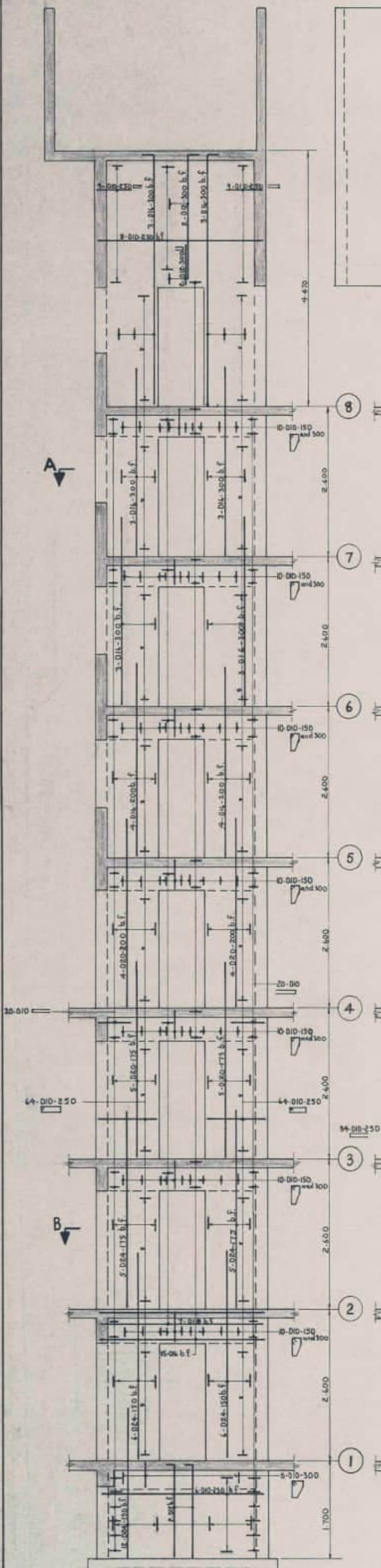


SECTION E-E 1:50

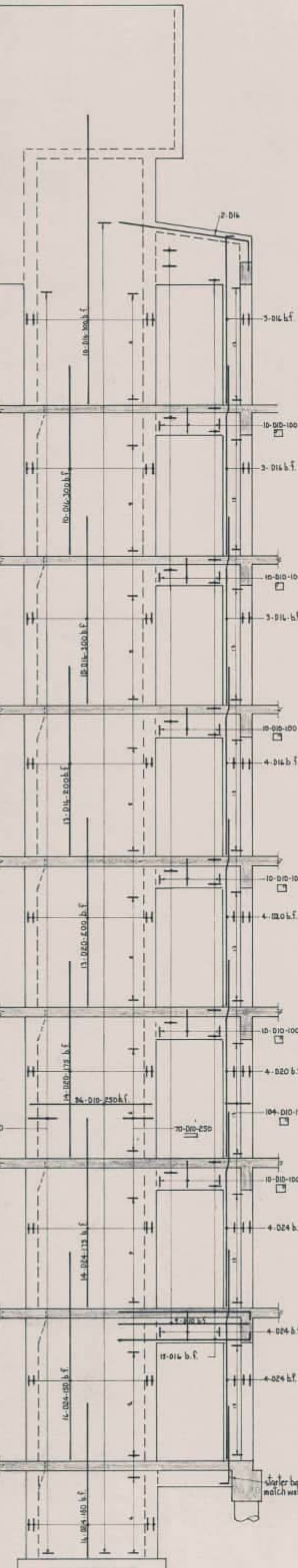


SECTION F-F 1:50

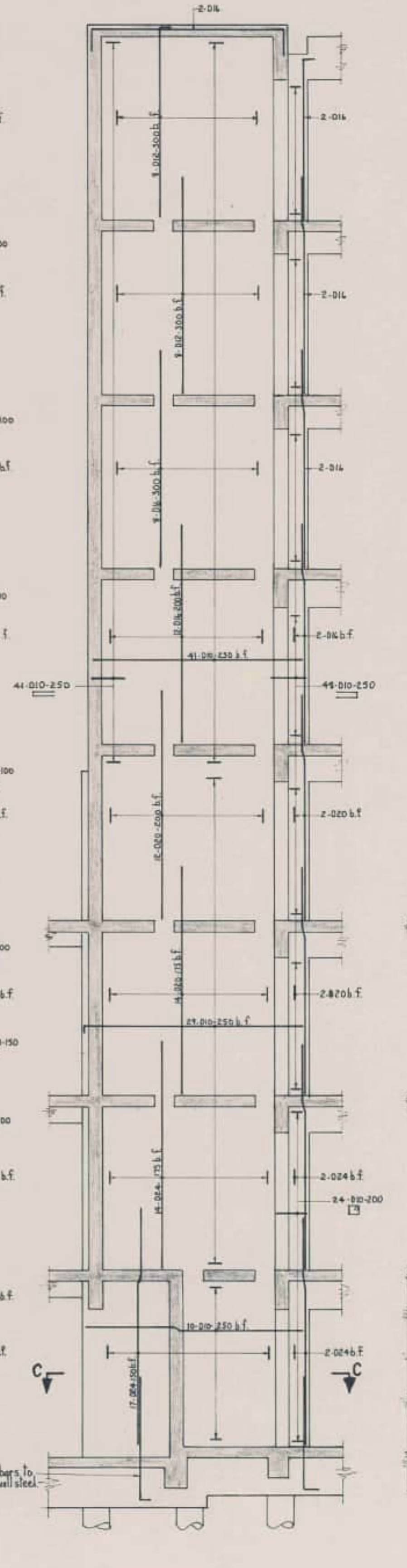
PUKEHINAU FLATS WILLIS ST. AND ARD ST TOWER BLOCK A	CONTRACT NUMBER 2469 Scale 1:50 WALLS ON ℄ D and E	SHEET No. 16 IN SET OF 48
WELLINGTON CITY CORPORATION WORKS DEPARTMENT STRUCTURAL BRANCH A. D. MARTIN, CITY ENGINEER	TRACING NO. STRL 253/16	
	DESIGNED T. P. N.	Dec 74
	DRAWN T. P. N.	Feb 75
	TRACED	
	CHECKED	
	APPROVED CHIEF STRUCTURAL ENGINEER	



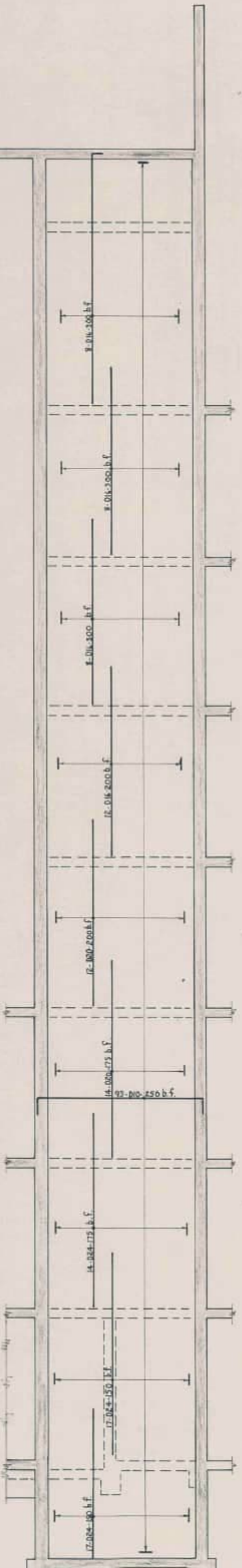
ELEVATION 1-1 1:50



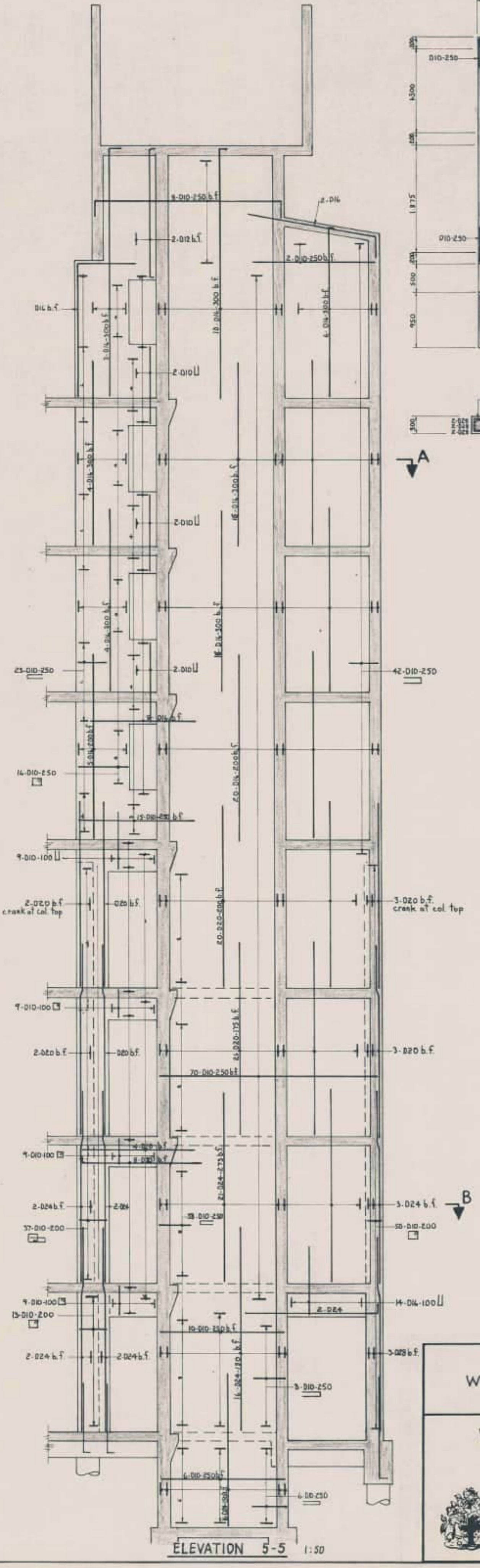
ELEVATION 2-2 1:50



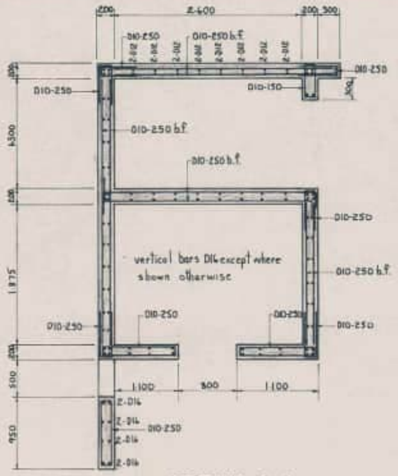
ELEVATION 3-3 1:50



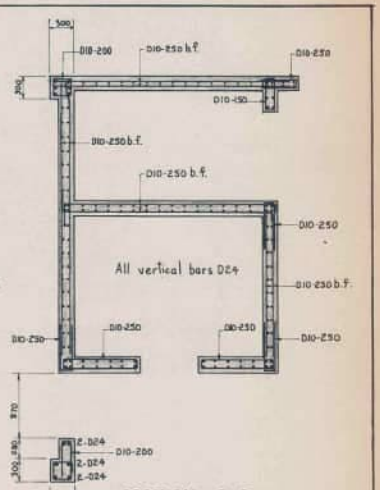
ELEVATION 4-4 1:50



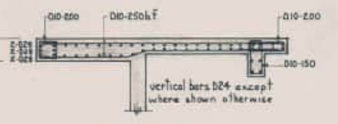
ELEVATION 5-5 1:50



SECTION A-A 1:50



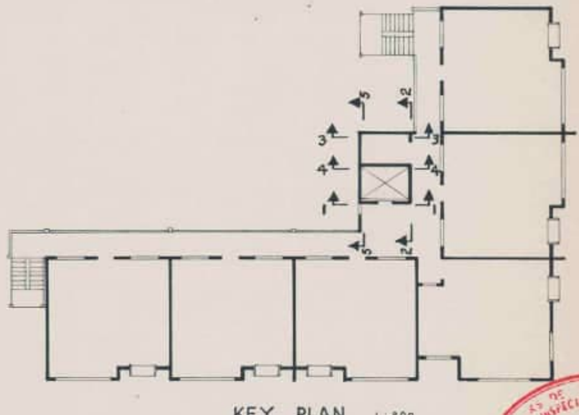
SECTION B-B 1:50



SECTION C-C 1:50

NOTES

1. Concrete to have a minimum crushing strength of 25MPa at 28 days.
2. Reinforcement to be mild steel structural grade deformed or round bars as specified.
3. Laps in reinforcement to be a minimum of 40 diameters
4. Concrete cover to reinforcement to be 25mm to internal and 40mm to external faces of walls.
5. Walls to be 200mm thick except where shown.
6. Starter bars to match wall steel.
7. See architect's drawings for details of rebates etc.
8. See lift manufacturer's drawings for details of holes and supports for lift equipment.



KEY PLAN 1:200

W. AND S. DEPARTMENT BUILDING INSPECTION BRANCH
19 DEC 1975
RECEIVED
MERCER STREET, WELLINGTON

PUKEHINAU FLATS
WILLIS ST AND ARO ST
TOWER BLOCK A

WELLINGTON CITY CORPORATION
WORKS DEPARTMENT
STRUCTURAL BRANCH

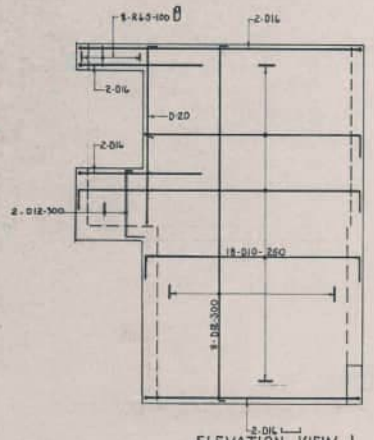
A. D. MARTIN, CITY ENGINEER

CONTRACT NUMBER 2469
Scale :- 1:50 1:200
LIFT WALLS
SHEET No. 17
IN SET OF: 48

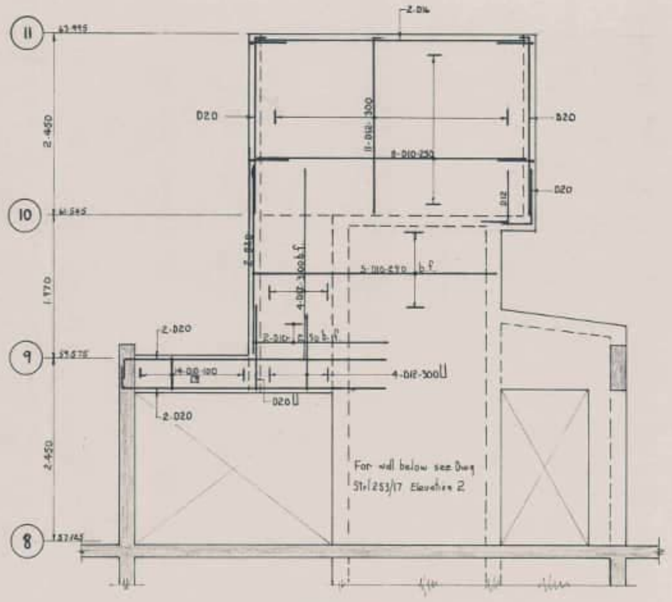
TRACING NO. STRL 253/17

DESIGNED	T.P.N.	Dec 74
DRAWN	T.P.N.	April 75
TRACED		
CHECKED	DP	

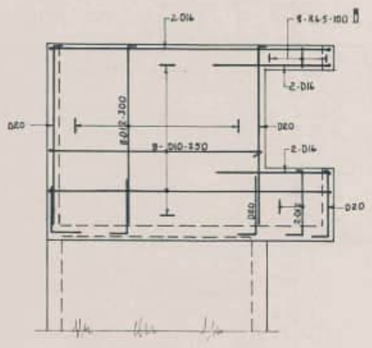
APPROVED
CHIEF STRUCTURAL ENGINEER



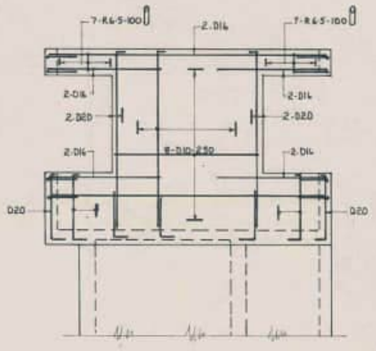
ELEVATION VIEW 1



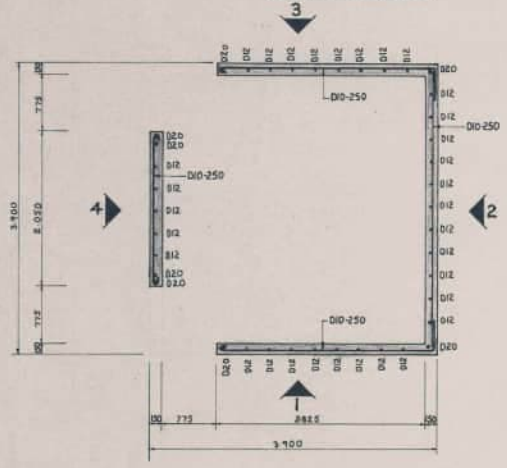
ELEVATION VIEW 2



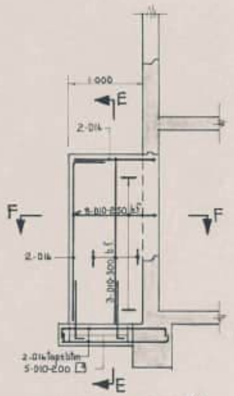
ELEVATION VIEW 3



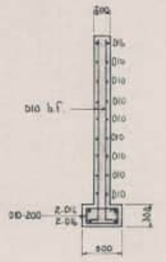
ELEVATION VIEW 4



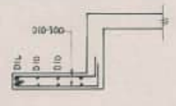
PLAN SECTION MACHINE ROOM WALLS



SCREEN WALL OFF ℄ A

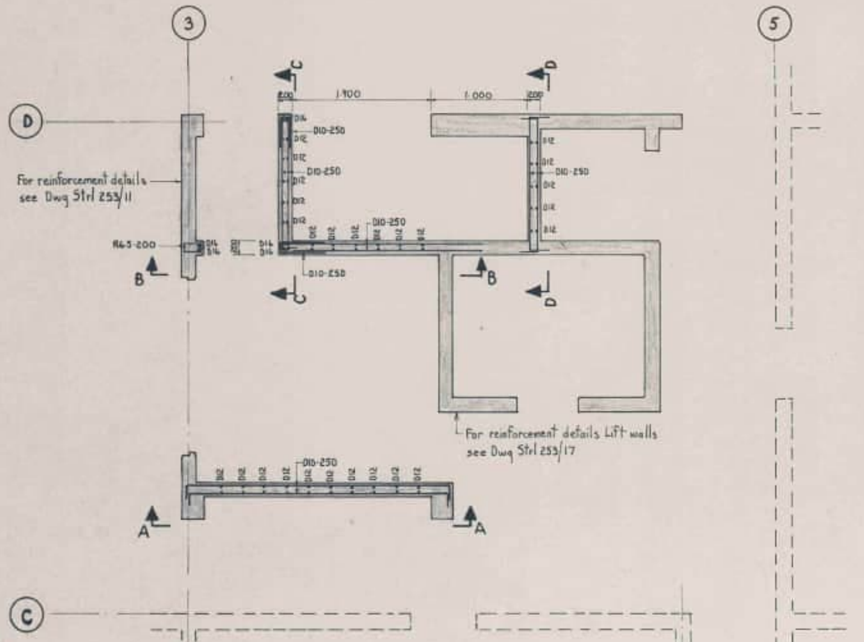


SECTION E-E



PLAN SECTION F-F

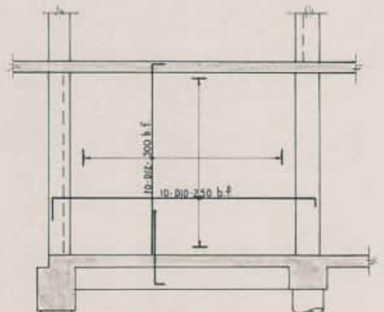
NOTES
1. Concrete to have a minimum crushing strength of 25MPa at 28 days.
2. Reinforcement to be mild steel structural grade deformed or round bars as specified.
3. Laps in reinforcement to be a minimum of 40 diameters.
4. Concrete cover to reinforcement to be 25mm to internal 40mm to external faces of walls.
5. See architect's drawings for details of rebates holes etc.
6. See lift manufacturer's drawings for details of holes, fixings, lifting beams etc.



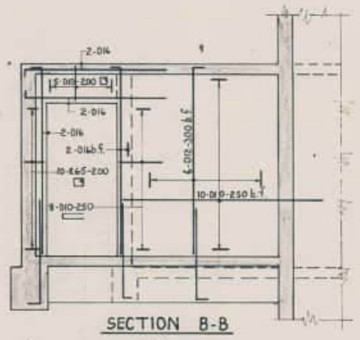
For reinforcement details see Dwg Strl 253/11

For reinforcement details Lift walls see Dwg Strl 253/17

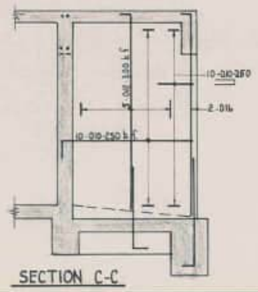
WALLS ADJACENT TO LIFT LOBBY LEVEL 1-2 PLAN SECTION



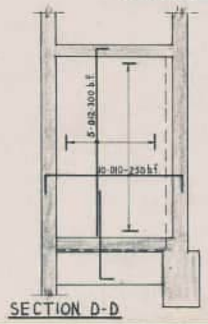
SECTION A-A



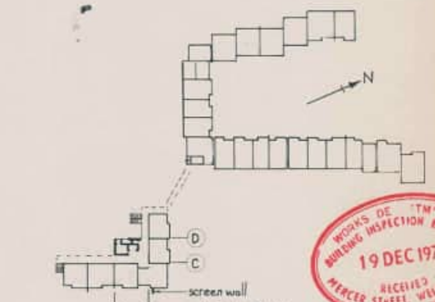
SECTION B-B



SECTION C-C



SECTION D-D



KEY PLAN

WORKS DEPARTMENT BUILDING INSPECTION BRANCH
19 DEC 1975
RECEIVED
MERCER STREET, WELLINGTON

PUKEHINAU FLATS
WILLIS ST AND ARO ST
TOWER BLOCK A

CONTRACT NUMBER 2469
Scale 1:50
MISCELLANEOUS WALLS
SHEET No. 18
IN SET OF: 48

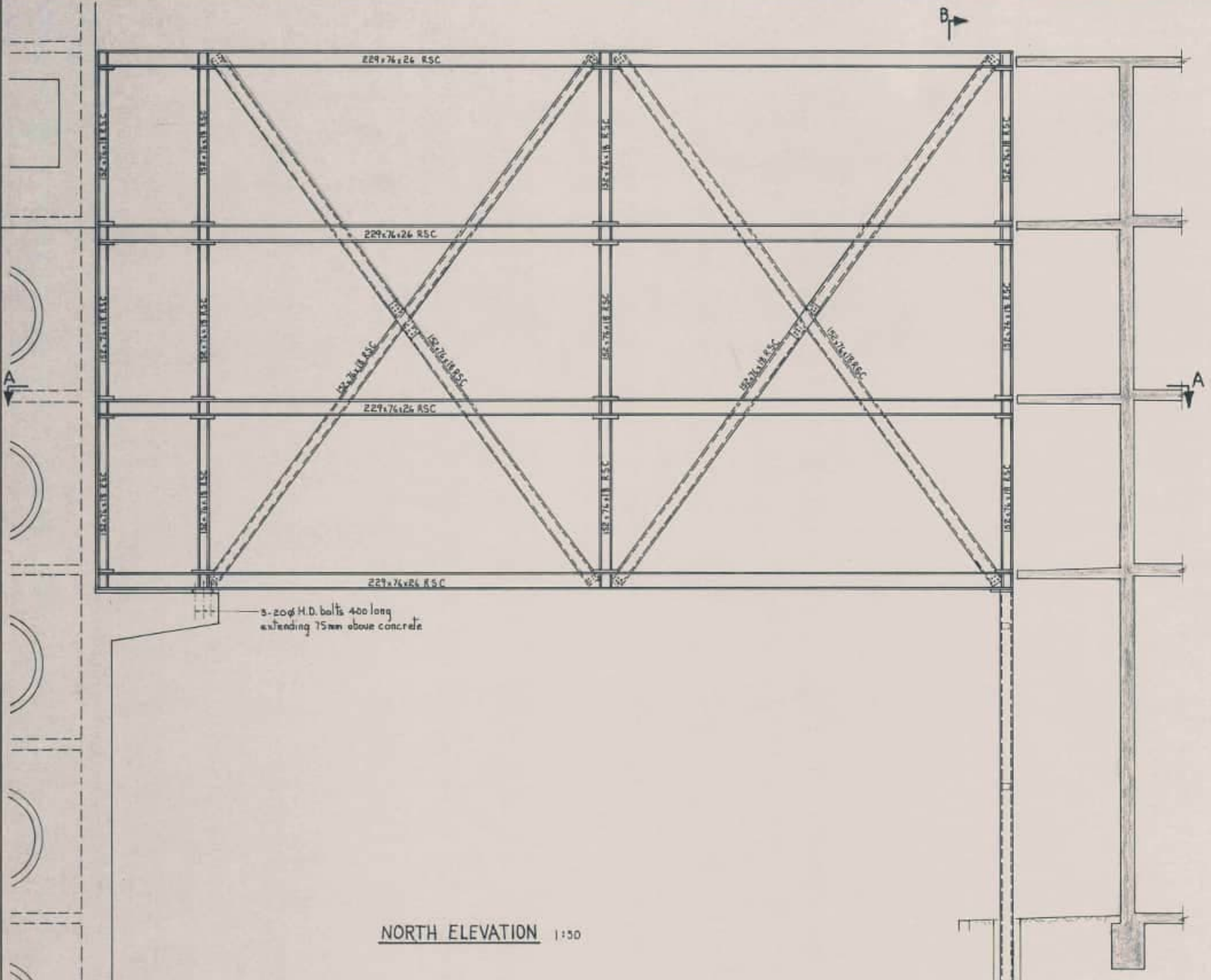
WELLINGTON CITY CORPORATION
WORKS DEPARTMENT
STRUCTURAL BRANCH

A. D. MARTIN CITY ENGINEER

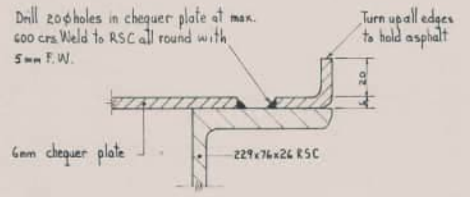
TRACING NO. STRL 253/18

DESIGNED	T P N	Dec '74
DRAWN	T P N	April '75
TRACED		
CHECKED	RH	

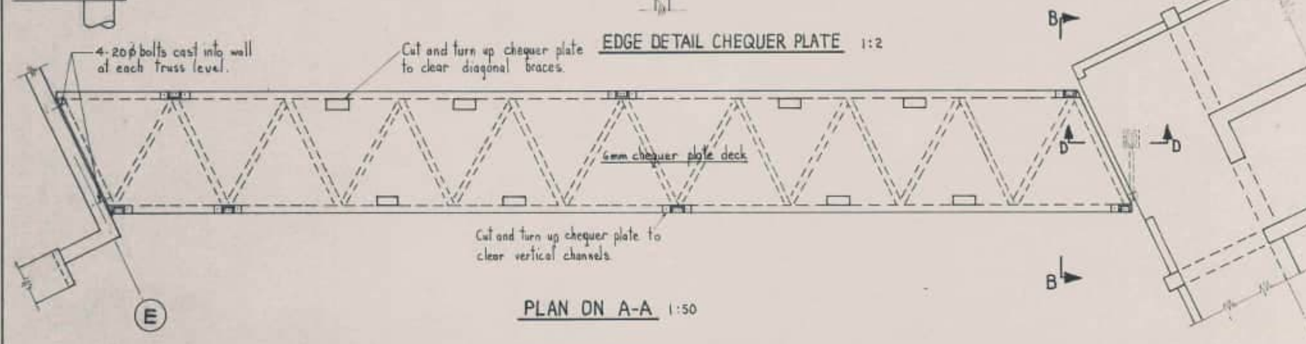
APPROVED
CHIEF STRUCTURAL ENGINEER



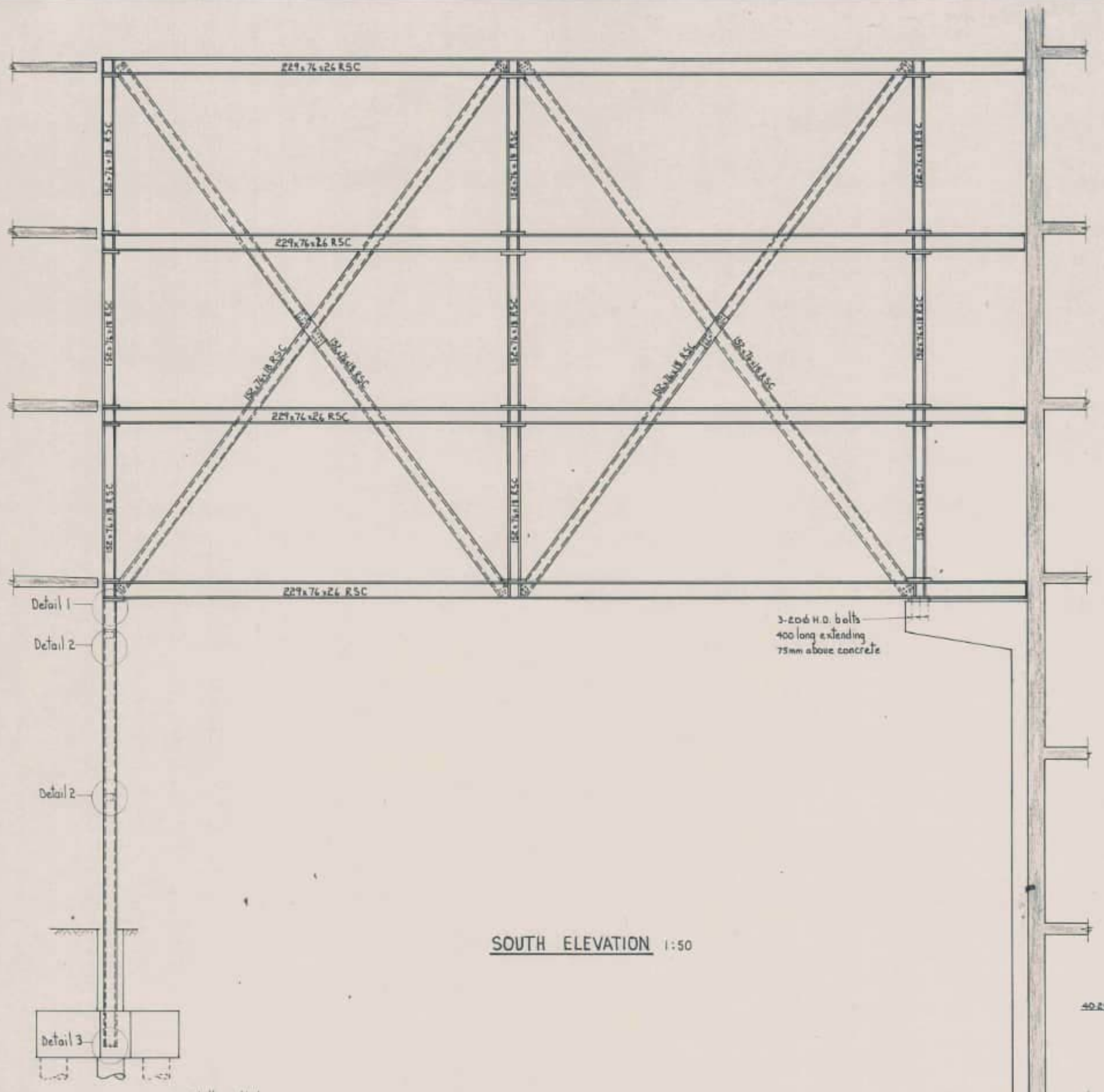
NORTH ELEVATION 1:50



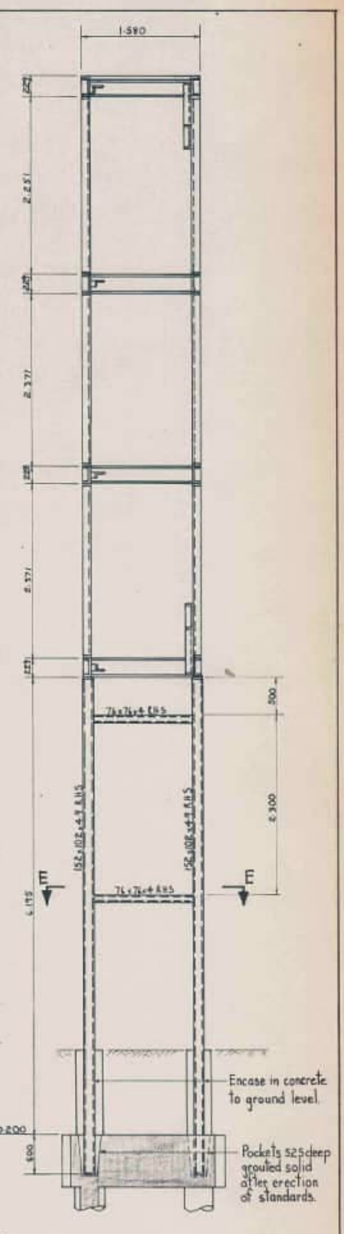
EDGE DETAIL CHEQUER PLATE 1:2



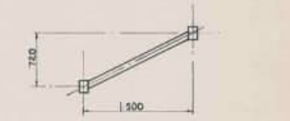
PLAN ON A-A 1:50



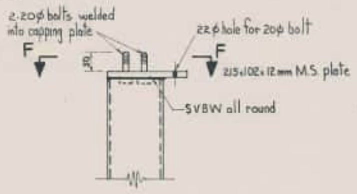
SOUTH ELEVATION 1:50



SECTION B-B 1:50

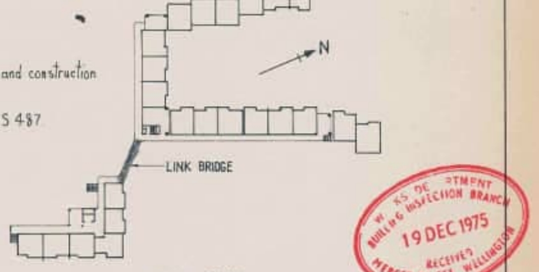


SECTION E-E 1:50



DETAIL 1 1:10

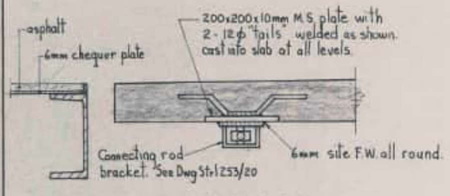
PLAN ON F-F 1:10



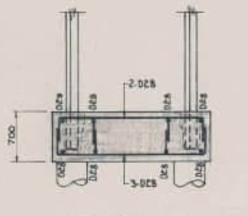
KEY PLAN

DETAIL 2 1:10

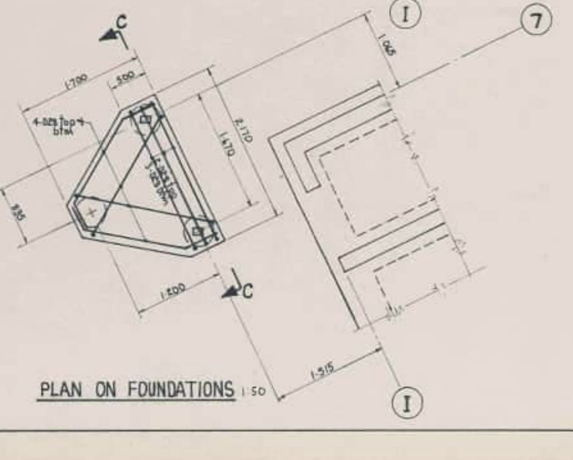
VIEW ON G-G 1:10



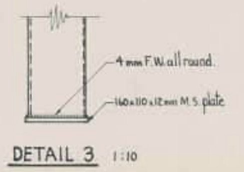
SECTION D-D 1:10



SECTION C-C 1:50



PLAN ON FOUNDATIONS 1:50



DETAIL 3 1:10

NOTES

1. Piles to be 400mm nominal diameter bulbed at base cast in situ reinforced concrete as detailed on Dwg Strl 253/2. 3N° shown:– (+)
2. Concrete in piles and foundations to have a minimum crushing strength of 25MPa at 28 days.
3. Reinforcement to be mild steel structural grade.
4. Cover to reinforcement to be 75mm in piles 50mm in foundations.
5. Use 50mm blinding concrete under foundation pad.
6. All structural steelwork to be mild steel to NZSS 309 and all fabrication and construction to comply with NZSS 1900 Chap 9.4.
7. Welding to be carried out by qualified tradesmen and to conform with NZSS 487
8. Dimensions shall be verified on site before fabrication commences.

W KS DE RTMENT
BUILDING INSPECTION BRANCH
19 DEC 1975
RECEIVED
MERCER STREET, WELLINGTON

PUKEHINAU FLATS
WILLIS ST AND ARO ST
LINK BRIDGE

WELLINGTON CITY CORPORATION
WORKS DEPARTMENT
STRUCTURAL BRANCH

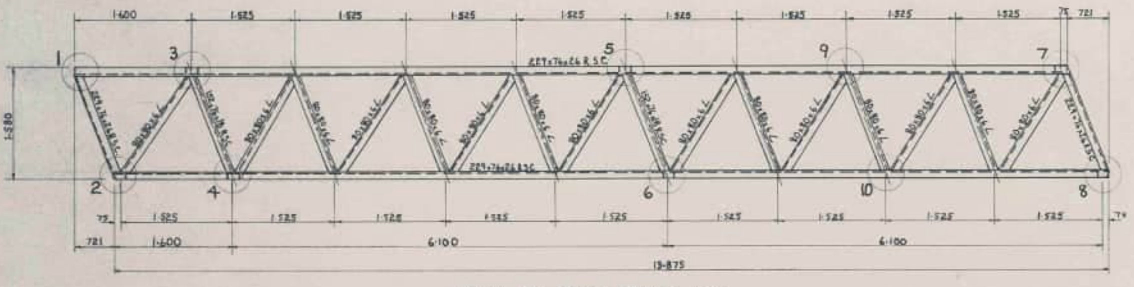
A. D. MARTIN, CITY ENGINEER

CONTRACT NUMBER 2469
SCALE 1:50 1:10 1:2
GENERAL ARRANGEMENT
LINK BRIDGE
SHEET No 19
IN SET OF: 48

TRACING NO. STRL 253/19

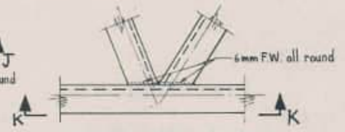
DESIGNED	TPN	Aug 75
DRAWN	TPN	Sept 75
TRACED		
CHECKED	RJP.	Oct 75

APPROVED K S Mulholland
CHIEF STRUCTURAL ENGINEER

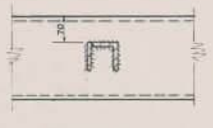


PLAN ON ROOF TRUSS 1:50

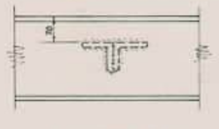
TYPICAL JOINT DETAIL 9



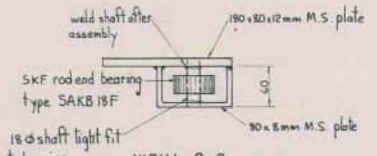
TYPICAL JOINT DETAIL 10



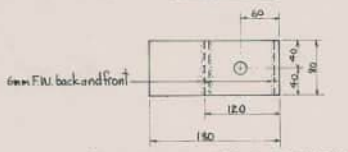
SECTION J-J



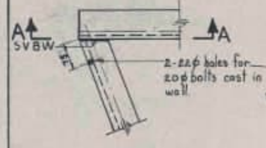
SECTION K-K



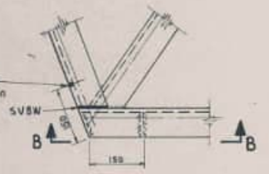
VIEW 3-3 1:5



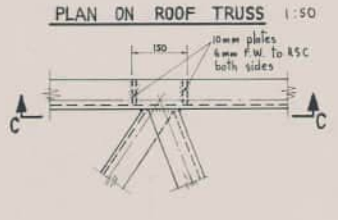
BRACKET ASSEMBLY BRIDGE END 1:5



DETAIL 1

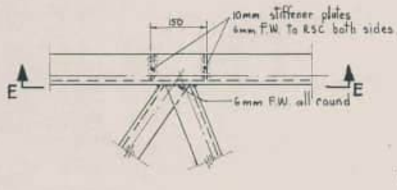


DETAIL 2

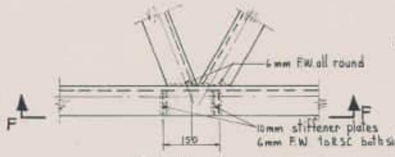


DETAIL 3

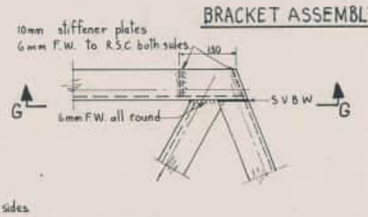
DETAIL 4



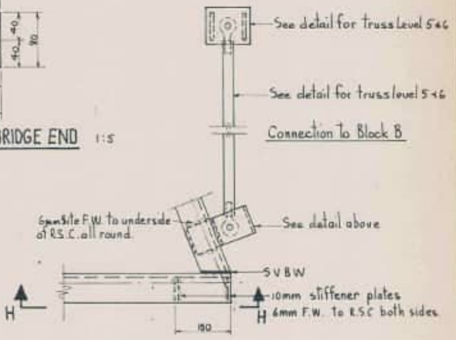
DETAIL 5



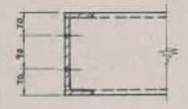
DETAIL 6



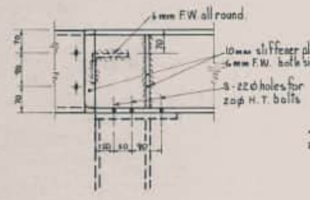
DETAIL 7



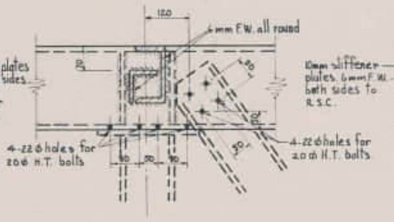
DETAIL 8



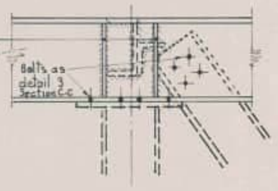
SECTION A-A



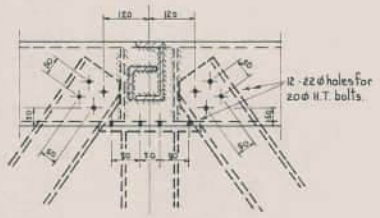
SECTION B-B



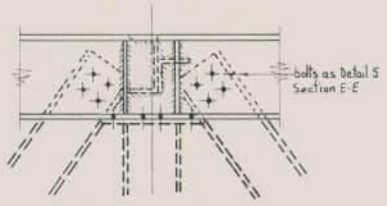
SECTION C-C



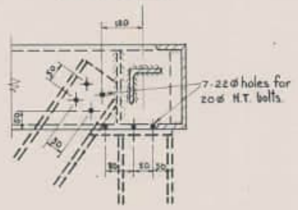
SECTION D-D



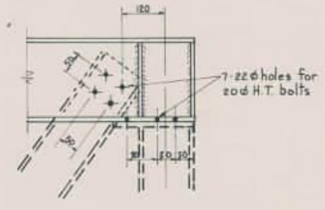
SECTION E-E



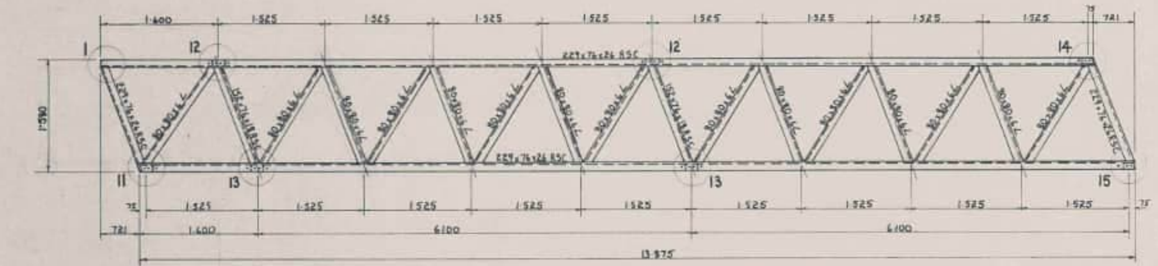
SECTION F-F



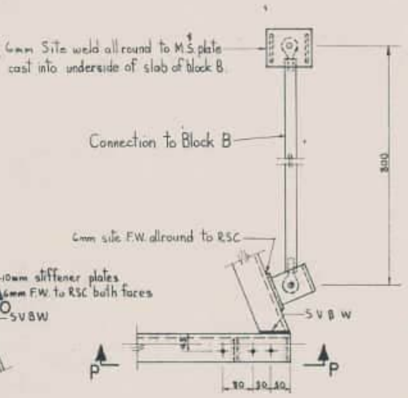
SECTION G-G



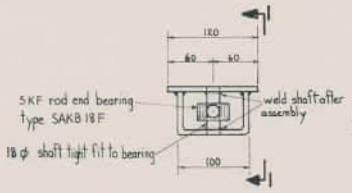
SECTION H-H



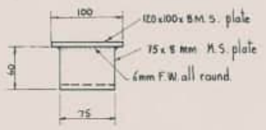
PLAN ON DECK TRUSSES LEVELS 5 and 6 1:50



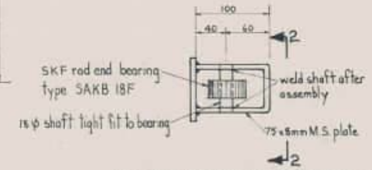
DETAIL 15



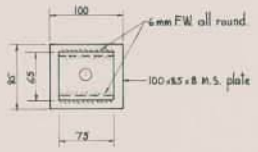
BRACKET ASSEMBLY BLOCK B END 1:5



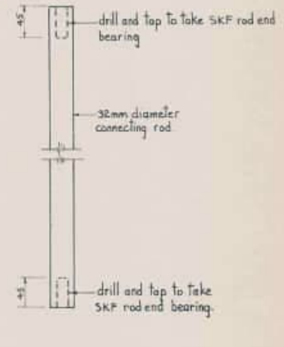
VIEW 1-1 1:5



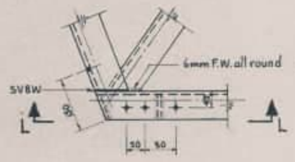
BRACKET ASSEMBLY BRIDGE END 1:5



VIEW 2-2 1:5

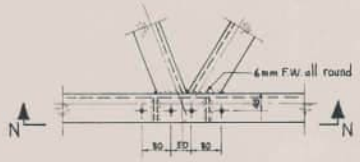


CONNECTING ROD

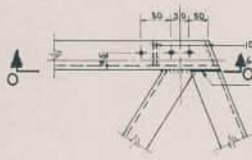


DETAIL 11

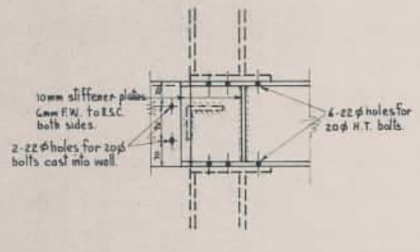
DETAIL 12



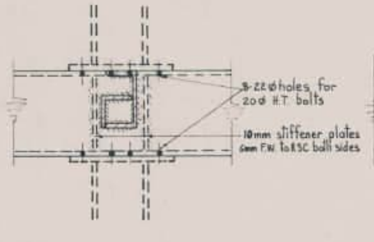
DETAIL 13



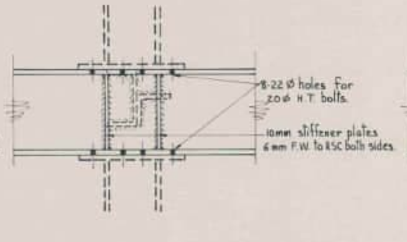
DETAIL 14



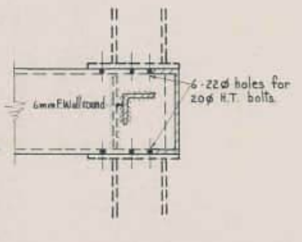
SECTION L-L



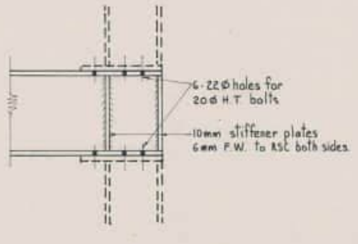
SECTION M-M



SECTION N-N



SECTION O-O

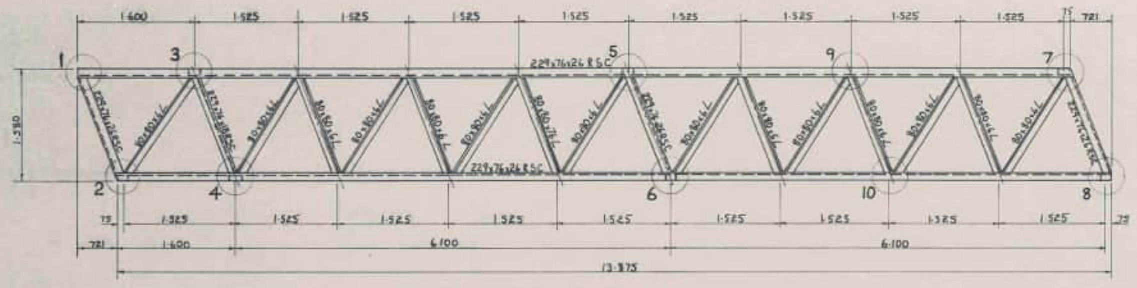


SECTION P-P

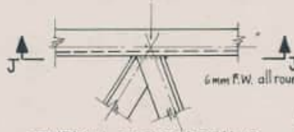
NOTES

1. All steelwork to be mild steel to NZSS 309, and all fabrication and construction to comply with NZSS 1900 Chap. 9.4.
2. All welding shall be carried out by qualified tradesmen and shall conform with the requirements of NZSS 487.
3. All bolts shall be galvanised.
4. Dimensions shall be verified on site before fabrication commences.
5. For general layout see Dwg Strl 253/19.

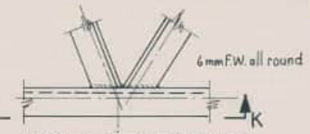
PUKEHINAU FLATS WILLIS ST AND ARO ST LINK BRIDGE	CONTRACT NUMBER 2469 Scale 1:10 1:5 1:50 TRUSS DETAILS	SHEET No. 20 IN SET OF 48
WELLINGTON CITY CORPORATION WORKS DEPARTMENT STRUCTURAL BRANCH A. D. MARTIN, CITY ENGINEER	TRACING NO. STRL 253/20	
	DESIGNED	TPN	Aug 75
	DRAWN	TPN	Sept 75
	TRACED		
	CHECKED	RJP	Oct 75
	APPROVED	G I Mulholland CHIEF STRUCTURAL ENGINEER	



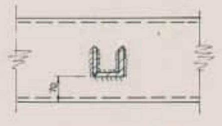
PLAN ON DECK TRUSS LEVEL 4 1:50



TYPICAL JOINT DETAI 9

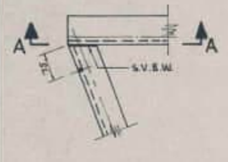


TYPICAL JOINT DETAIL 10

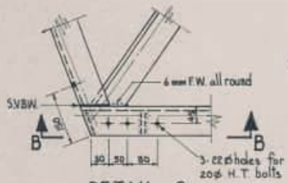


SECTION J-J

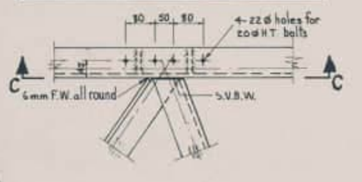
SECTION K-K



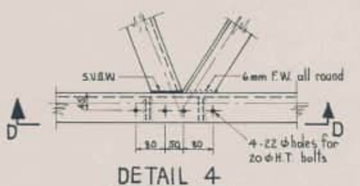
DETAIL 1



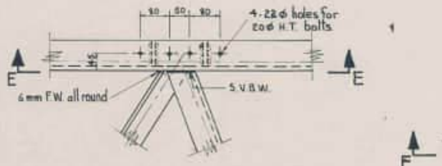
DETAIL 2



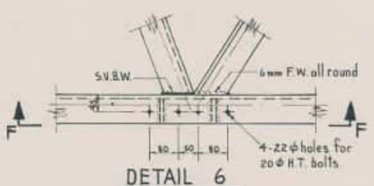
DETAIL 3



DETAIL 4

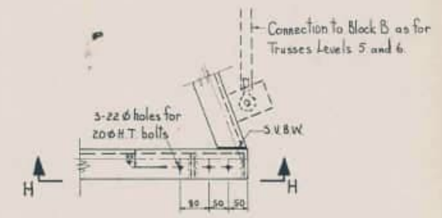


DETAIL 5

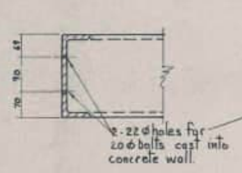


DETAIL 6

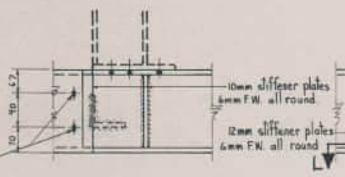
DETAIL 7



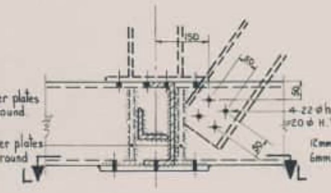
DETAIL 8



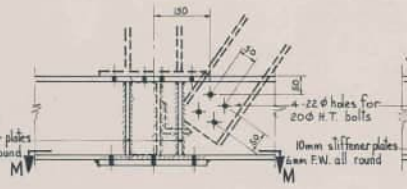
SECTION A-A



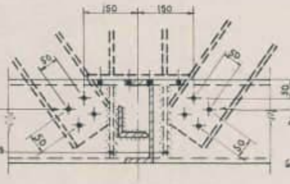
SECTION B-B



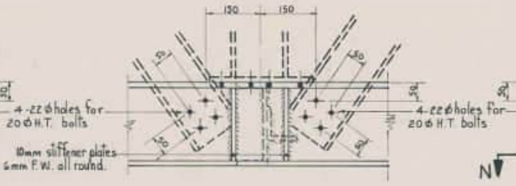
SECTION C-C



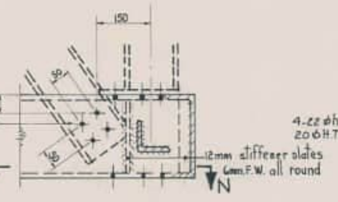
SECTION D-D



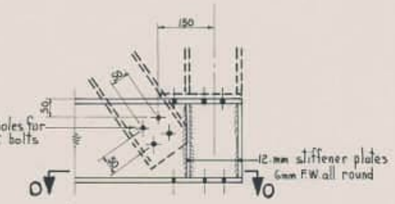
SECTION E-E



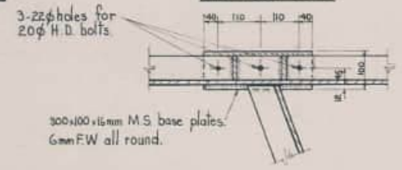
SECTION F-F



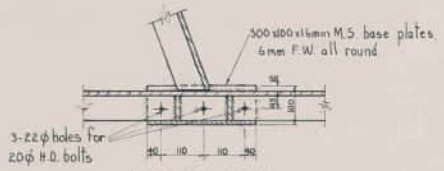
SECTION G-G



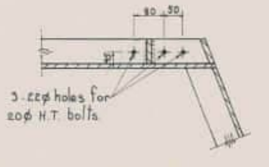
SECTION H-H



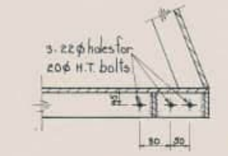
SECTION L-L



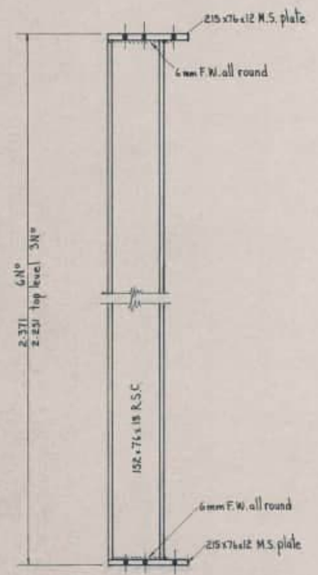
SECTION M-M



SECTION N-N

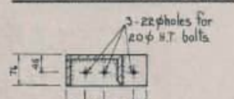


SECTION O-O

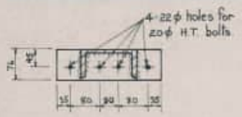


ELEVATION END COLUMNS

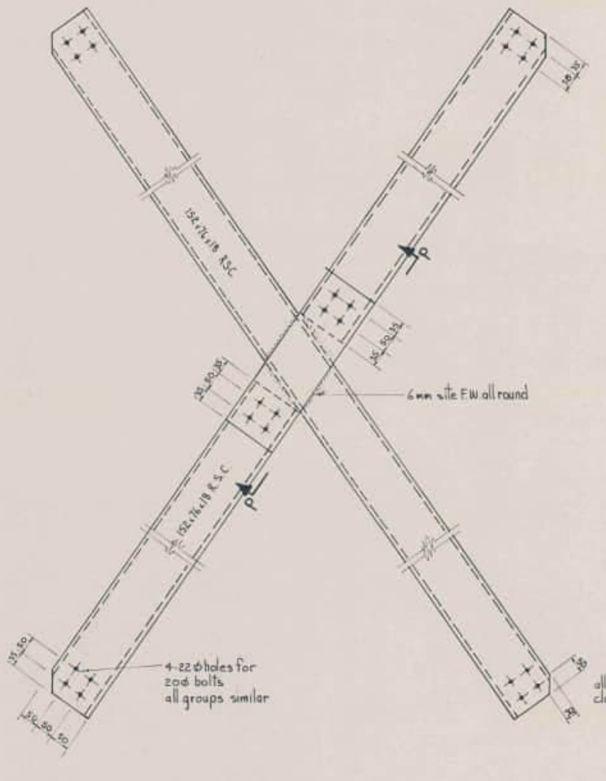
ELEVATION INTERNAL COLUMNS



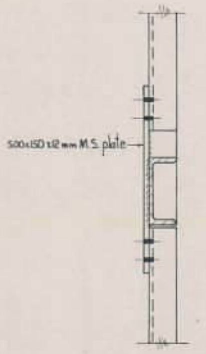
PLAN ON END PLATES



PLAN ON END PLATES



DETAIL OF CROSS BRACING 4 N°



SECTION P-P

NOTES

1. All steelwork to be mild steel to NZSS 309 and all fabrication and construction to comply with NZSS 1900 Chap. 9.4.
2. All welding shall be carried out by qualified tradesmen and shall conform with the requirements of NZSS 487.
3. All bolts shall be galvanised.
4. Dimensions shall be verified before fabrication commences.
5. For general layout see drawing Strl 253/19.

PUKEHINAU FLATS WILLIS ST AND ARO ST LINK BRIDGE	CONTRACT NUMBER 2469 Scale 1:10 1:50 DETAILS OF BOTTOM TRUSS AND BRACING	SHEET No. 21 IN SET OF: 48
WELLINGTON CITY CORPORATION WORKS DEPARTMENT STRUCTURAL BRANCH A. D. MARTIN, CITY ENGINEER	TRACING NO. STRL 253/21	
	DESIGNED	T.P.N.	Aug 75
	DRAWN	T.P.N.	Sept 75
	TRACED		
	CHECKED	RP	Oct 75.
	APPROVED	CHIEF STRUCTURAL ENGINEER	