KOTD DSA Report
HUP2-T0-Seismic Assessments

5 Kemp Street

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Prepared for Wellington City Council

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Report Amendment Register

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Executive Summary

Scope and Basis of Assumptions

Robert Bird Group NZ Limited (RBG) has been engaged by Wellington City Council (WCC) to complete a detailed seismic assessment (DSA) of the block of four residential buildings on 5 Kemp Street, Kilbirnie, Wellington. **This DSA focuses on Block D** and has been undertaken as part of Phase 2 of the Housing Upgrade Programme.

The four buildings are collectively known as the Kōtuku Apartments and were designed between 1967 and 1969. These buildings are four-storey concrete structures of varying lengths but similar configurations. The buildings are founded on a relatively flat site with poor soil capacity of subsoil class D classification. Currently, all four buildings are being used for housing.

In 2016, the buildings underwent seismic strengthening based on a 2014 design by Opus International Consultants Limited. These structural strengthening alterations have been considered in this DSA. For example, the increased section sizes for certain ground beams were used to determine the seismic ratings for these elements.

Reinforced concrete cantilever walls are the building's primary structural system for resisting loads. These walls are extensive in the "Transverse" direction but are only along the two building edges in the "Longitudinal" direction. These concrete walls extend the entire height of the building.

Results Summary

Refer to Table 1 below for a summary of the %NBS scores assigned to the critical elements of each structural component.

Overall, the reinforced concrete ground beams underneath the transverse walls govern the seismic rating of Block D. As highlighted in Table 1, **Block D's seismic score is 25%NBS(IL2).** This rating places Block D as potentially earthquake prone. Note that 33%NBS corresponds to potentially earthquake prone, but this determination must be made by Wellington City Council as the territorial authority.

This DSA has been carried out in accordance with the November 2018 revision of section C5 for concrete buildings of the 2017 New Zealand Society for Earthquake Engineering (NZSEE) document The Seismic Assessment of Existing Buildings. As this building has been found to fall short of the performance level described for an Earthquake Prone Building (EPB), the original concrete guidelines from 2017 should be used. However, guidance from Engineering New Zealand has noted that changes made in the November 2018 revision mostly affect buildings with precast floors, concrete frame structures, and concrete buildings with a reasonable ductile response. Block D falls outside of these characteristics. Hence, we have considered our results gained from considering the 2018 revision of section C5 to be representative for the building.

Table 1: Summary of Building Seismic Performance

System	Direction	*%NBS (IL2)*	Commentary, Failure Mechanism
Reinforced Concrete Cantilever Shear Walls	Longitudinal	67%NBS (*)	Plain round bar wall rocking
	Transverse	45-75%NBS	Flexure and tension failure
	Transverse	40%NBS	Out-of-plane capacity for top level walls
Floor Diaphragm	Longitudinal	100%NBS	Governed by tension tie capacity
Ground Beams	**Transverse**	**25%NBS (**)**	**Brittle shear failure caused by wall end uplifting, leading to loss of gravity support and wall dropping off from the pile cap.**
Pile Caps	Both directions	100%NBS	Typical 3-pile pile caps.
	Both directions	85%NBS	Flexure (2-pile pile cap on grid AA only)
Concrete Piles	Longitudinal	100%NBS	
	Transverse	40-65%NBS 45-60%NBS	Geotechnical tension capacity Geotechnical compression capacity
Stairs	Both directions	>67%NBS	Based on secondary load paths and allowing loads to be redistributed.

(*) This is based on plain round bar wall rocking assessed with SLaMA.

(**) This element governs the overall %NBS rating of Block D.

Recommendations

RBG recommends conducting a geotechnical site investigation to verify the geotechnical parameters, subsoil class of the site, ground bearing and pile capacities as part of the strengthening design. We do not expect the ground investigation to significantly alter the assessment outcomes and change the %NBS rating of Block D. However, it will provide more certainty for scoping the strengthening design.

Seismic Retrofit Concepts

The concept seismic strengthening design for the critical structural elements of Block D is discussed in section 7. Three concept strengthening options are included with relevant sketches in Appendix D.

For Option 1, we propose that a new raft slab be poured to tie the foundation together. This will allow the building to behave like a 'rigid box' when the piles fail during an earthquake and allow the walls with plain round bars to rock on the foundation. The raft slab will also provide some bearing resistance. This concept relies on the gravity load of the building to provide overturning resistance. Our initial study suggests this strengthening can achieve 67%NBS. Further design and geotechnical investigation inputs are required to confirm the achievable capacity.

For Option 2, we propose additional tension ground anchors to provide more tension hold-down capacity to the foundation. These anchors will be located directly under the transverse walls inside the building, providing hold-down and minimising the shear demands to the foundation beams. Internal access will be required for the drilling rig and installation of the anchors; the timber floor will need to be removed and reinstated.

Option 3 is like Option 2 but the proposed ground anchors will instead be located outside of the building. This option has better buildability. However, we expect that the foundation beams will need to be strengthened and become very heavily reinforced to be capable of transferring the wall forces out to the new anchors.

For all three options, we also propose fibre-reinforced polymer (FRP) wrap be installed to the base of the singly-reinforced transverse walls. We expect the plain round bars in the walls to fail in bond slip, which could lead to significant concrete spalling and the wall subsequently losing gravity support. FRP will provide confinement to the concrete so that the walls will be able to rock more reliably and provide gravity support to the floors after an earthquake.

Note that the presented concept strengthening schemes bypass strengthening to the minimum baseline level of 34%NBS and instead intend to lift the building's performance directly to the higher performance level of 67%NBS; we reason that once the structural weaknesses are addressed, the building will achieve 67%NBS.

Glossary

Detailed Seismic Assessment (DSA)	A quantitative seismic assessment carried out in accordance with Part A and Part C of the Engineering Assessment Guidelines.
Design Features Report (DFR)	A document that details the important decisions and outcomes regarding the design of a structure, including any proposed strengthening works.
Earthquake-prone Building (EPB)	As explained in Section A5.1.1 of the Engineering Assessment Guidelines; a building or part of a building that will have its ultimate capacity exceeded in a moderate earthquake. Additionally, if the building or part of a building were to collapse, the collapse would be likely to cause injury or death or damage to other properties. Whether a building or part of a building is considered earthquake prone is decided by the territorial authority that oversees the district where the building is.
Importance Level (IL)	Categorisation defined in the New Zealand Loadings Standard, AS/NZS 1170.0:2002 used to define the ULS shaking for a new building based on the consequences of failure. A critical aspect in determining new building standard.
Initial Seismic Assessment (ISA)	A seismic assessment carried out in accordance with Part A and Part B of the Engineering Assessment Guidelines.
Ultimate Limit State (ULS)	A limit state defined in the New Zealand loadings standard NZS 1170.5:2004 for the design of new buildings.
New Building Standard (NBS)	Intended to reflect the expected seismic performance of a building relative to the minimum life safety standard required for a similar new building on the same site by Clause B1 of the New Zealand Building Code.
(XXX)%NBS	The ratio of the ultimate capacity of a building as a whole or of an individual member/element and the ULS shaking demand for a similar new building on the same site, expressed as a percentage.
(New Zealand) Building Code	Section B1 of the New Zealand Building Code (Schedule 1 to the Building Regulations 1992).
Non-structural element	An element within the building that is not considered to be part of either the primary or secondary structure.
Secondary structural element	A structural element that is not part of the primary structure.

Contents

Appendices

1. Introduction

1.1 Scope of Assessment

Robert Bird Group (New Zealand) Limited (RBG) has been engaged by Wellington City Council (WCC) to complete seismic assessments and provide concept strengthening designs – if needed – for specific buildings within its housing portfolio. The purpose of this work is to upgrade WCC's housing portfolio to meet the seismic strength standard detailed in the Deed of Grant (Minimal Housing Standard) Programme as part of a wider upgrade to meet HUP2 requirements.

As part of this programme, RBG's work scope entails completing a detailed seismic assessment (DSA) of the block of four residential buildings on 5 Kemp Street, Kilbirnie, Wellington. These buildings are collectively known as the Kōtuku Apartments, and individually as Blocks A to D. This DSA focusses on Block D, which is highlighted in Figure 1.

Figure 1: Kōtuku Apartments arrangement, Block D in red

Referring to Figure *2*, Block D is a four-storey rectangular concrete structure. It was designed between 1967 to 1969 and is currently being used for residential purposes.

Figure 2: Site elevation of Kōtuku Apartments, Block D

The objective of this DSA is to establish the degree of life safety risk that damage to the building poses to its occupants. This assessment has been undertaken in accordance with the 2017 Engineering Assessment Guidelines for existing buildings, including the November 2018 revision of section C5 for concrete buildings.

Strictly speaking, since this building has been found to fall short of the performance level described for an Earthquake Prone Building (EPB), only the original concrete guidelines from 2017 should be used. However, guidance from Engineering New Zealand has noted that changes made in the November 2018 revision mostly affect buildings with precast floors, concrete frame structures, and concrete buildings with a reasonable ductile response. Block D falls outside of these characteristics. Hence, we have considered our results gained from considering the 2018 revision of section C5 reasonable to report.

1.1.1 Explanatory Statement

For clarity, RBG would like to convey the following details:

- The assessment is based on the information available to RBG at the time of the assessment and assumes that the construction drawings are an accurate record of the constructed building.
- This report is not a dilapidation report. It does not include assessment of the current building condition or repairs that may be required except where these may be pertinent to the seismic capacity.
- Geotechnical and foundation desktop assessment has been completed by other engineers and has been relied on for this assessment.
- RBG is not able to give any warranty or guarantee that all possible damage, defects, or conditions have been identified. The work done and advice given by RBG has been provided on a 'reasonable grounds' basis.
- This report has been prepared on behalf of and for the exclusive use of the Client, WCC, and is subject to and issued in accordance with the agreement between WCC and RBG. RBG accepts no liability or responsibility whatsoever for any use of or reliance upon this report by any third party. Any copying of this report to external parties requires the permission of the Client and RBG.

1.2 Regulatory Environment and Design Standards

EPBs are defined by the Building Amendment Act 2016 as buildings with ultimate capacities that are likely to be exceeded in a 'moderate earthquake,' hence posing a life safety risk to occupants. A 'moderate earthquake' is defined as approximately one-third as strong (but of the same duration) as the shaking assumed when designing a new building. Thus, the lower threshold to designate a building as earthquake prone is referred to by the shorthand of "33%NBS".

The 2017 NZSEE Engineering Assessment Guidelines detail a method for assessing existing buildings against the contemporaneous building standards, especially NZS1170.5:2004. This benchmark of performance may not reflect changes in seismic design or assessment methodologies after 2017. This provides a way to rate existing buildings to understand the seismic risk posed to it relative to a new building in 2017. The primary focus of this procedure is life-safety risk. 'Probable' capacities and consideration of structural mechanisms that can form are allowed, provided these mechanisms do not constitute a significant life-safety hazard.

Territorial authorities (TAs) ultimately determine whether a building is earthquake prone. ISAs or DSAs prepared by engineers may be used by TAs to assist in this determination. TAs may request an engineering assessment from a building owner if the ISA process has flagged the building as potentially earthquake prone. In this case, the building owner will be given a timeframe to complete the assessment.

If a building has been identified by a TA as earthquake prone, that TA must issue an EPB notice that states the earthquake rating and deadline for completing seismic work on the building (amongst other items). For a 'normal' building in Wellington, this deadline typically entails 15 years. Buildings not identified as earthquake prone by a TA do not fall within the 2016 Building Amendment Act for EPBs. Hence, there is no legal obligation to strengthen such buildings.

Besides the 2017 NZSEE Engineering Assessment Guidelines, this DSA utilises the following design standards:

- NZS1170.0: 2002
- NZS1170.5: 2004
- NZS3101: 2006

1.3 Assessment Methodology

The DSA procedure adopted for this report is as follows:

1. Review existing information in the form of drawings, calculations, and reports.
2. Establish the site seismic parameters and response spectra to calculate the seismic loads for an equivalent new building (100%NBS threshold). This will form a baseline for assessing performance.
3. Complete an initial simple lateral mechanism analysis (SLaMA) to understand the displacement and global ductility capacities of the buildings.
4. Calculate the base shear demands and floor forces using the equivalent static analysis (ESA) procedure.
5. Model and analyse the building and individual components in 3D using force-based procedures.
6. Complete structural calculations for key structural components.
7. Prepare a DSA report to summarise building component capacities, identify structural weaknesses, provide an overall %NBS score for the building.

Block D is of a regular shape on all levels, and all shear walls are distributed relatively evenly throughout the building. Hence, Block D does not have any notable mass or stiffness irregularities. A check to NZS1170.5 was done to confirm the building is not torsionally sensitive.

1.3.1 Information Sources

RBG has been provided with the original architectural and structural specification and drawings to undertake this DSA, as detailed above. Refer to Table 2 for the sources of information used in this DSA.

Table 2: Sources of Information

Originator	Document	Date
Architectural Department of Wellington City Corporation	Architectural Construction Drawings, specification	1968
Stewart G. Rees & Associates	Structural Construction Drawings, specification	1968
Romulus Consulting Group	Kotuku Flats Structural Assessment Report	Jan 2008
Opus International Consultants Limited	Structural Alterations Design Features Report	Feb 2014
Beca	Geotechnical Desktop Study Report	Jan 2024

1.3.2 Loading Assumptions

Important permanent loads used to calculate the seismic weight of Block D are summarised in Table 3. Similarly, the superimposed dead loads and live loads are summarised in Table 4.

Table 3: Permanent loads for building assessment

Material	Permanent Load (G)
Standard Lightweight Roof	0.7kPa
5” Concrete Floor Slab and Beams	3.3 kPa
5”-6” Concrete Floor Corridor	3.4kPa
5” Concrete Stair Flight and Rail	4.9kPa
5” Concrete Stair Landing	3.0kPa
6” Concrete Walls and Lining	3.9kPa
8” Concrete Walls and Lining	5.1kPa
Lightweight Handrail Along Corridor	0.4kPa
Internal Light Timber Frame Wall	0.25kPa
External Light Timber Frame and Lightweight Cladding	0.5kPa

Table 4: Superimposed dead loads and live loads in accordance with NZS1170.1

Use	Level/Area	Superimposed Dead Load	Live Load (Q)
Residential Dwelling	1 to 3	0.1kPa	1.5 kPa
Residential Deck/Balcony	1 to 3	-	4.0 kPa
Other Stairs	1 to 3	-	4.0 kPa

The total seismic weight of Block D was found to be approximately 7,200kN. This weight was found considering a live load seismic combination factor of 0.3, in accordance with NZS1170.0. An area reduction factor of 0.5 was considered for the residential dwelling and deck areas, but not for the stairs, as per NZS1170.1 requirements.

The seismic parameters used for calculating earthquake loads are outlined in Table 5 below:

Table 5: Seismic parameters for building assessment

Parameter	Value	Notes
Design Working Life	50 years	-
Importance Level	2	-
Site Subsoil Class	D	2024 Beca Geotechnical Desktop Investigation Report
Return Period Factor	1	-
Hazard Factor	0.40	Wellington
Near Fault Factor	1.0	-
Period	0.75s in longitudinal direction 0.41s in transverse direction	-
Structural Ductility and Performance Factor	μ 1.25, Sp 0.9	Selection of these parameters has been based on: • Potential rocking of the walls at low loads. • Potential geotechnical failures at low loads. The presence of plain round bars with low capacity for inelastic mechanisms.

1.3.3 Material Properties

The material properties used in this assessment are based on the information in the architectural and structural construction drawings and specification, and in accordance with values outlined in Section C5 of the Engineering Assessment Guidelines. Refer to Table 6 below for the adopted probable strengths used in the DSA calculations.

Table 6: Material probable strength for building assessment

Material	Probable Strength
Concrete	f'_c = 36 MPa
Reinforcing	f_y= 324 MPa f_u = 475 MPa

1.3.4 Modelling Philosophy

A 3D model of Block D was created on ETABS and subjected to lateral loads based on the seismic parameters outlined in Table 5. See Figure 3 for a screenshot of the ETABS model developed for Block D.

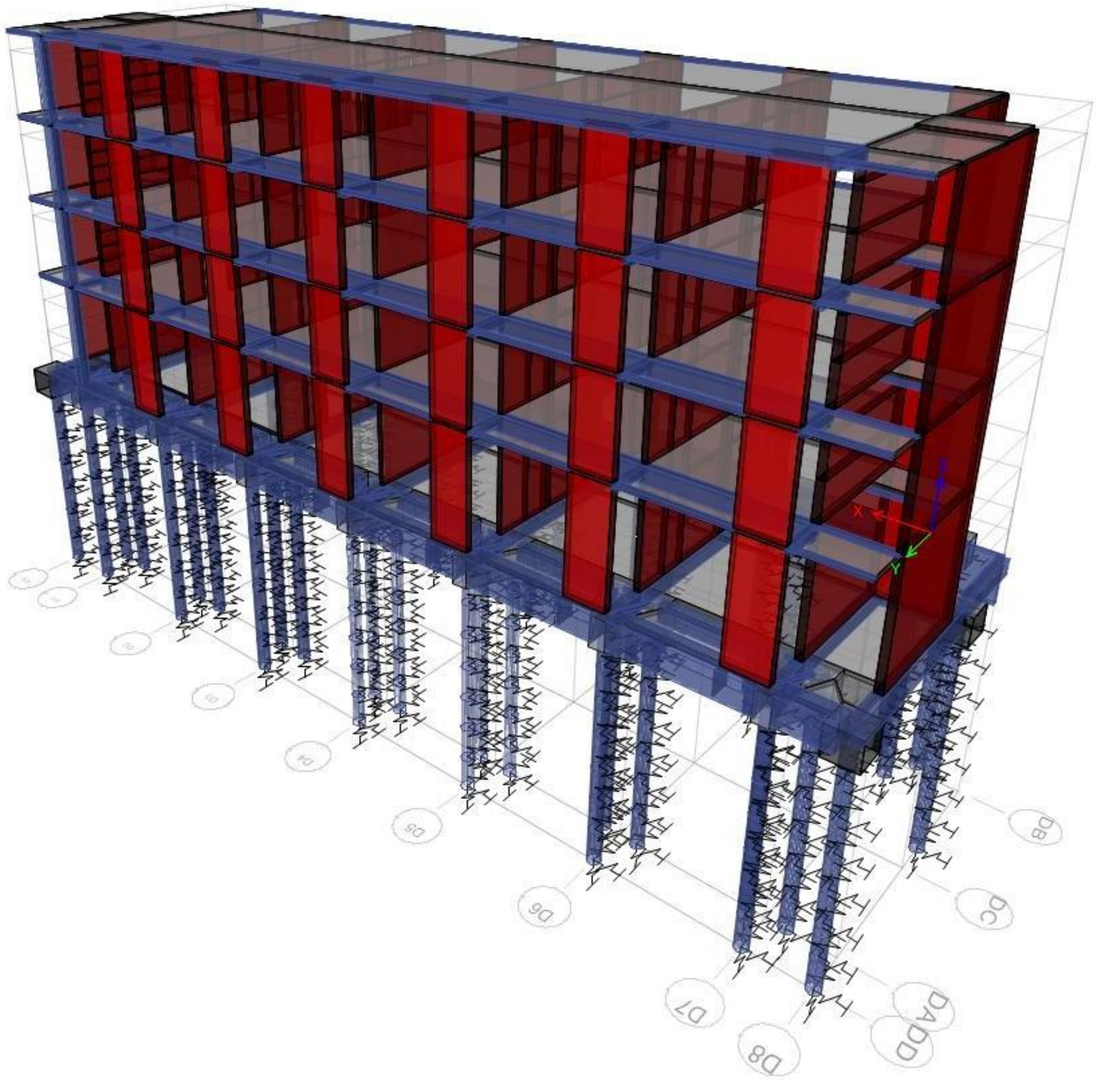


Figure 3: Block D 3D ETABS model

The seismic load was calculated using the automatic calculation function for ESA in ETABS. A hand calculation was carried out to double check the results from ETABS. The weight of the water tank was considered in these calculations.

In the ETABS model for Block D, stiffness modifiers for cracked sections were assigned to all concrete members.

There is no proper continuity of horizontal reinforcement between the transverse walls and the short walls in the longitudinal direction. Therefore, small gaps between these walls were modelled to decouple these walls and reflect the detailing of the reinforcement between them.

Piles were modelled as frame elements supported by lateral springs at 1m spacing and a vertical spring at the bottom.

There is less than a 5% difference between the building weight and storey shears from the ETABS model and hand calculations undertaken for Block D. Hence, we have reasonable confidence that these two values represent the building with sufficient accuracy.

1.4 Building Description

Block D on 609 Evans Bay Parade (herein termed 5 Kemp Street) was designed between 1967 and 1969 by the architectural division of the town planning department in WCC (then known as 'Wellington City Corporation') and consulting engineers Stewart G. Rees & Associates. Together with Blocks A, B, and C, the original intention of the design was 104 single person units as part of the Kōtuku Flats Development Scheme. RBG has been provided with the architectural and structural drawings, specifications but not the calculation records of the original design. Given the temporal context of the Kōtuku Apartments as designed in the late 1960s, it is suspected that the design was based on the NZ Standard Model Building By-Law (NZS 1900:1964).

Construction on the Kōtuku Apartments likely took place in the late 1960s to early 1970s, based on the contract for execution of work signed between Wellington City Corporation and O.V.L Builders Limited on June 27, 1969.

In 2014, Opus International Consultants Limited designed alterations to seismically strengthen the Kōtuku Apartments These alterations were conducted in 2016 and included strengthening the ground beams supporting the longitudinal walls on both sides of Block D, and strengthening the ground floor transverse walls where door penetrations were added after the original construction of the Kōtuku Apartments. The design was completed to give the buildings an equivalent strength rating of 70%NBS(IL2). Note that these alterations were completed to the standard of the 2006 NZSEE document Assessment and Improvement of the Structural Performance of Buildings in Earthquake (NZSEE 2006). In 2017, this document was superseded by NZSEE 2017.

Block D of the Kōtuku Apartments is not listed in the MBIE EPB register.

Referring to Figure 4, Block D is a four-storey building with concrete intertenancy walls. The roof is lightweight and comprises steel on timber purlins. There is a water tank on the roof. From level 1 to 3, the floor type is an in-situ concrete slab and beam. The ground floor is timber on concrete ground beams.

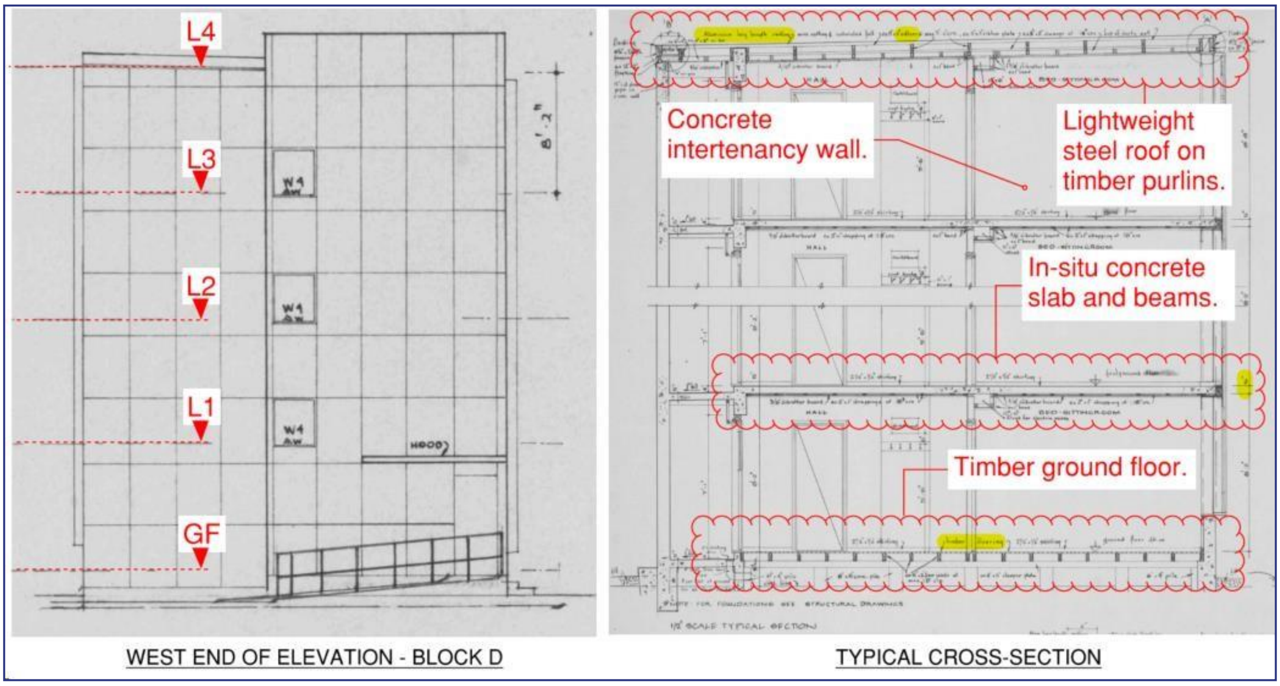


Figure 4: Block D elevation and typical cross-section

Block D mainly uses reinforced concrete walls to resist vertical gravity loads. These walls are generally 6 or 8 inches thick, with many of the 6-inch-thick walls acting as intertenancy walls. Gravity loads are transferred into the ground through concrete ground beams and bulb pile foundations, the former of which the walls sit on.

See Table 7 for a summary of key details for Block D.

Table 7: Building Summary Information

Item	Details
Building name	Block D, Kōtuku Apartments
Street Address	609 Evans Bay Parade, Wellington
Age	Approximately 55 years
Description / Building Occupancy	Residential
Importance Level	2
Building Footprint / Floor Area	Footprint area approx. 252m^2
No. of storeys / basements	4 / no basements
Structural system	Cast in-situ reinforced concrete cantilever shear walls
Earthquake resisting system	Cast in-situ reinforced concrete cantilever shear walls
Foundation system	Reinforced concrete ground beams and bulb piles
Stair system	Cast in-situ concrete
Other notable features	Water tank on western side of roof
Past seismic strengthening	2014-2016 by Opus International Consultants Limited
Construction information	Built around 1969
Likely Design Standards	NZS 1900:1964, Model Building By-Law
Heritage Status	N/A
Seismic Risk Area	Moderate to high (Wellington Fault is approx. 5km away, Evans Bay Fault is 0.5km away)
Priority building status	N/A
Other	N/A

1.5 Geotech Site Conditions

The following sections summarise key ground conditions onsite and the foundation system of Block D, as detailed in a report by Beca, who WCC commissioned to conduct a desktop study of the 5 Kemp Street site. For more information, refer to Appendix F for Beca's geotechnical desktop study report.

1.5.1 Site Description

The site location is 5 Kemp Street, Kilbirnie, Wellington. The site is relatively flat and within a residential suburb. The site is confined by Kemp Street to the north and east, Evans Bay Parade to the west, and residential houses to the south.

Referring to the GNS Science active faults database, several faults are located near the site, with the most major being the active Wellington Fault approximately 5km to the west. The proximity of the site to a major fault necessitates the usage of near-fault factors in the NZ standard NZS1170.5: 2004.

1.5.2 Site Subsoils

The site geology contains reclaimed land comprising domestic waste, sand, and rock. Beca expects the reclaimed land to be underlain by Rakaia Terrane greywacke that is highly to completely weathered, and very to extremely weak sandstone typically with lesser mudstone. The groundwater level across the 5 Kemp Street site is approximately 2.3m below ground level.

The nearest investigation data available is 100m north of the site and from the New Zealand Geotechnical Database. The typical profile encountered comprised very loose to medium dense sands and gravels, and in-situ rock of completely to highly weathered greywacke. This rock was encountered about 6.5 to 17m below ground level.

GIS data from WCC classifies the site as site subsoil class E. However, analysis based on site subsoil class D has been recommended by Beca based on the anticipated depth to rock and strength of the overlying soils.

1.5.3 Potential Seismic Geohazards

The main geohazards present on 5 Kemp Street are liquefaction and ground shaking. The details of these two phenomena specific to the site are described further below.

Liquefaction is a phenomenon in which soil acts like a liquid – thereby exhibiting a loss of strength – when dynamically disturbed during an earthquake. Based on hazard maps from WCC, Beca has placed 5 Kemp Street at high risk of liquefaction. This designation results from the presence of loose cohesionless soils in the site's uppermost 6.5m thick reclaimed land layer. Additionally, Beca has evaluated this layer to be liquefiable when saturated. The geotechnical desktop study for 5 Kemp Street describes post-liquefaction settlement and lateral displacement as two potential consequences should liquefaction occur.

For more specific discussion on the expected effect that liquefaction may have on the building, refer to section 2.2.1.

Beca has noted that the site has experienced strong to very strong shaking in several earthquakes including the 2013 Lake Grassmere and 2016 Kaikōura earthquakes. Furthermore, given the presence of several faults near the site, the geotechnical desktop study describes the risk of ground shaking on 5 Kemp Street as high.

Despite the high risk of liquefaction posed to the 5 Kemp Street site, Beca designates a moderate risk of lateral spreading towards Evans Bay Beach as the site is relatively flat and 300m away from the closest water body.

1.5.4 Foundations

The foundation system of the Kōtuku Apartments consists of 192 reinforced concrete driven bulb piles with pile caps and ground beams. Bulb piles are a type of deep foundation that are larger at the base to increase the capacity of the pile through directly bearing on the ground.

The bulb piles are of unknown diameter. However, Beca advises assuming a constant pile diameter of 15 inches (0.38m) along the length of the piles. This pile diameter has been suggested based on the steel casing used to install the piles, which were of a 15-inch diameter. The piling specification indicates that the piles were to be driven to a depth of 25 feet (7.62m) below ground level.

1.6 Previous Assessments

Romulus Consulting Group carried out a structural seismic assessment of Kōtuku Apartments in 2008 and rated the buildings to have low risk of collapse at 64% of the code requirements at the time. The report proposed strengthening the front and rear ground beams.

RBG has also been provided with the 2014 structural alterations DFR prepared by Opus International Consultants Limited. The alterations were completed to the standard of NZSEE 2006 and NZS 3101: 2006.

1.7 Structural Systems – Longitudinal and Transverse

The main lateral load resisting system of Block D in both the longitudinal and transverse directions is reinforced concrete cantilever shear walls. In the longitudinal direction, shorter cantilever shear walls resist lateral loads from earthquakes. For earthquake loading in the transverse direction, the lateral resisting system predominantly consists of the intertenancy walls. Refer to Figure 5 for the shear wall arrangement that forms the lateral resisting system for Block D.

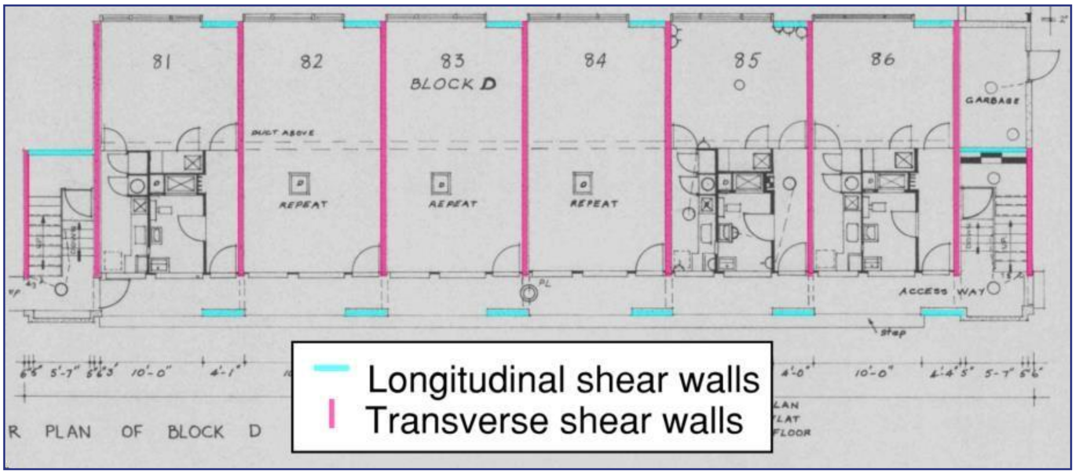


Figure 5: Lateral resisting system shear wall arrangement

The reinforced concrete cantilever shear walls run the full height of all buildings and act as intertenancy walls. Reinforced concrete floor slabs on all levels except for the ground floor – which is a light timber floor – are typically 5 inches (127mm) thick and act as diaphragms that distribute earthquake loads to the reinforced concrete cantilever shear walls in both directions of each building.

Lateral earthquake loads from the cantilever shear walls are carried down to the ground via reinforced concrete ground beams and bulb pile foundations.

2. Results of Seismic Assessment

RBG conducted an initial SLaMA to understand the structural mechanism and displacement capacities of Block D. The shear walls are reinforced with plain round bars with straight splices. This arrangement does not have much ductility capacity, meaning there is potential for the shear wall reinforcement to undergo bond slip failure before yielding in an earthquake. Hence, we expect the flexural capacity of the walls to be limited.

Considering the limitations on ductility capacity posed by the shear walls generally having plain round bars with straight splices, a displacement-based approach was determined as appropriate to evaluate the wall rocking capacity in the longitudinal direction.

Walls in the transverse direction are singly reinforced and wall rocking is not expected to be a reliable rocking mechanism as the wall bases are likely to experience significant concrete spalling, which can lead to loss of gravity support. Our SLaMA also suggested that the foundation beams will fail in shear prior to other mechanisms. Hence, we adopted a force-based approach for the transverse direction.

As mentioned in section 1.4, the building underwent seismic strengthening around 2014. These structural strengthening alterations have been considered in this DSA. For example, the increased section sizes for the ground beams that were strengthened were used to determine the seismic ratings for these elements.

2.1 Hierarchy of Structural Damage

In longitudinal direction (see Figure 6):

1. The corner piles under the stair cores are expected to see damage first due to the limited geotechnical capacity. This is expected to be uplifting of the pile against the soil. Note that as this failure mechanism has a geotechnical nature, we expect the pile to remain structurally intact and load can be redistributed.
2. The primary mechanism of the longitudinal system will be the rocking of the cantilever shear walls above the foundation beam. It has been assessed that the wall will rock prior to the failure of the foundation.

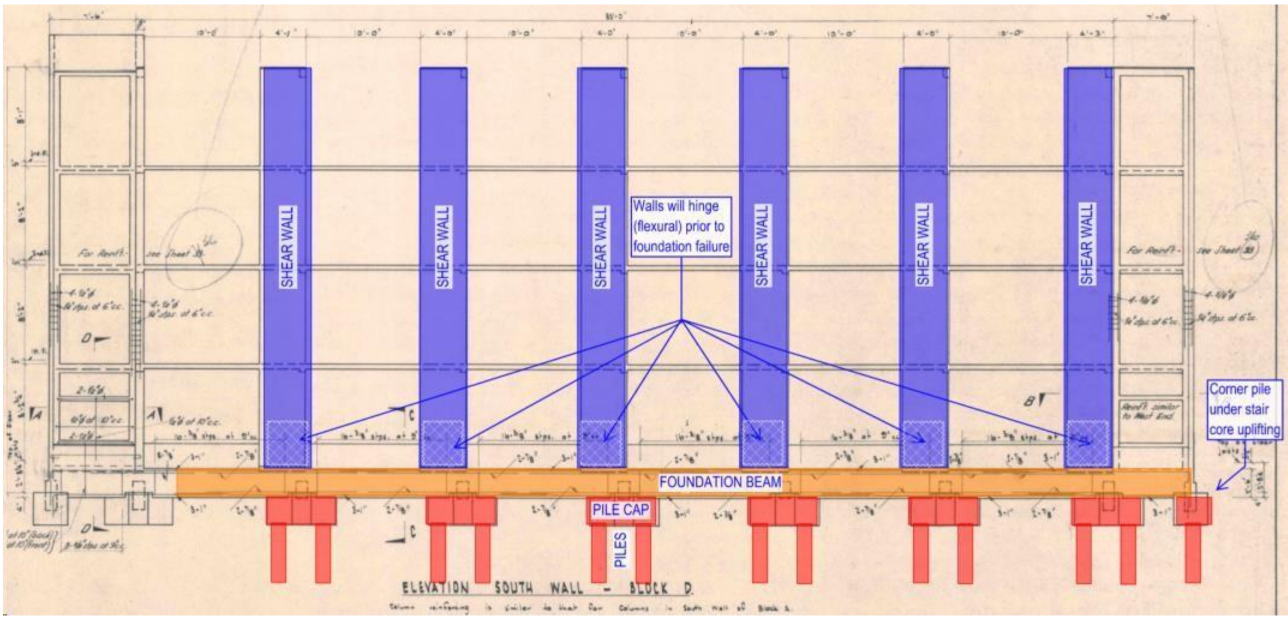


Figure 6: Typical longitudinal wall elevation

While the above-mentioned item 1 could occur first during a significant earthquake, it is unlikely to lead to significant life-safety risks. The piles under the stairs would be lifted and the shear wall above would be rocking and providing gravity support, leading to redistribution of seismic loads from this wall to other shear walls. We have assessed that it is acceptable for these piles to exceed its geotechnical capacity and seismic loads redistributed; for a further discussion on load redistribution regarding the stair cores, refer to section 3.1.

In transverse direction (see Figure 7):

1. Similar to the seismic performance of the building in the longitudinal direction, the corner piles under the stair core are expected to see damage first due to the limited geotechnical capacity. This is expected to be uplifting of the pile against the soil.
2. The foundation ground beams in the transverse direction are expected to experience shear failure. There is minimal vertical wall reinforcement directly anchored to the pile cap. The in-plane moment demands from the wall will have to be transferred via shear in the foundation beam to the piles. This beam's shear failure limits the overall capacity.
3. The bulb pile foundations under the middle walls have a geotechnical tension capacity that is only marginally higher than the foundation beam. It is possible that the mechanism is a combination of pile tension and beam shear failure, with overall capacity limited by the foundation system.

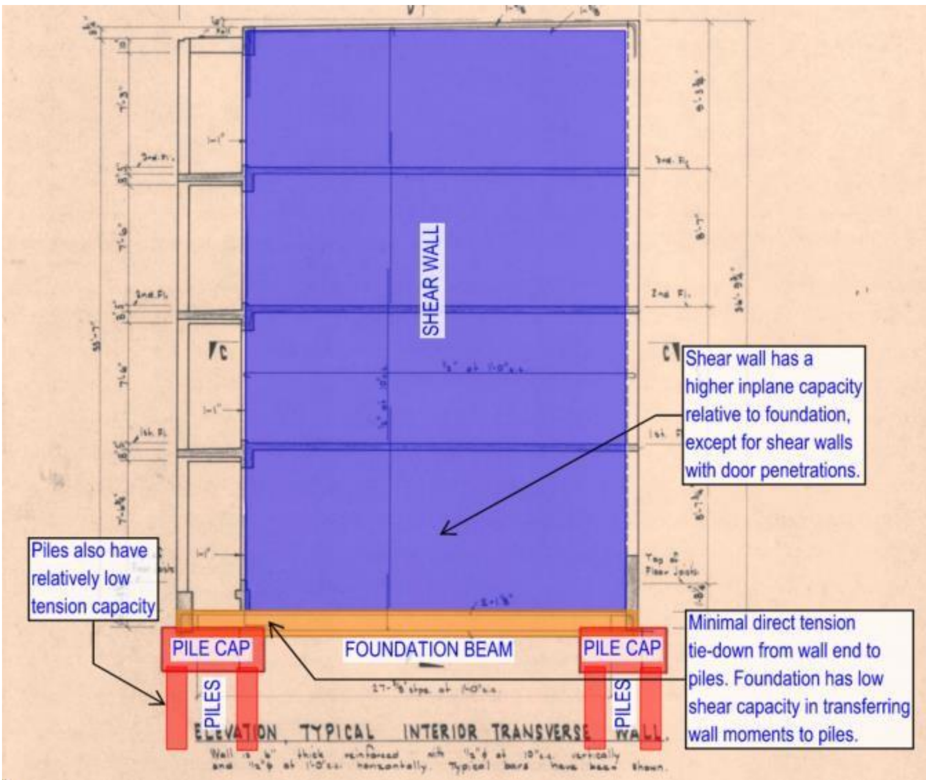


Figure 7: Typical transverse wall elevation

As discussed earlier, the failure of the stair piles is unlikely to lead to significant life-safety risks during an earthquake event and is considered acceptable; the seismic loads can be redistributed.

The damage in ground beams raised in above item 2 is a brittle failure and has no other load path to support the wall. Once the beam under the transverse wall fails, the shear wall above would lose lateral and gravity resistance and progressively tilt in one direction. As this failure mechanism occurs, the transverse walls may also push the pile caps outwards and drop off from the pile cap. This would lead to excessive vertical settlement, significant structural damage and floors losing gravity support.

2.2 %NBS Results Summary

Overall, our assessment indicated that Block D has a seismic rating of **25%NBS(IL2).** As explained in section 2.1.1, this rating is governed by the probable capacity of the reinforced concrete ground beams underneath the transverse walls. Refer to Figure 8 for the %NBS ratings of different elements summarised visually.

Table 8 below summarises the %NBS ratings for Block D in each direction of the structure for different structural systems, and the overall critical element. The %NBS scores have been summarised according to grouping of structural elements with similar demand and capacity. Table 8 shall be read in conjunction with Figure 9 to Figure 12, which illustrate the locations of the element groups.

Table 8: Summary of Building Seismic Performance

System	Direction	*%NBS (IL2)*	Commentary, Failure Mechanism
Reinforced Concrete Cantilever Shear Walls	Longitudinal Group 1	34%NBS	Flexure
	Longitudinal Group 2	45%NBS	Flexure
	Longitudinal Group 3	30%NBS (*)	Flexure and tension
	Transverse Group 4	70%NBS	Flexure and tension
	Transverse Group 5	30%NBS	Flexure and tension
	Transverse Group 6	40%NBS	Tension
	Transverse Group 7	18%NBS (*)	Tension
	Transverse walls	40%NBS	Out-of-plane capacity for top level walls.
Floor Diaphragm	Longitudinal	95%NBS	Shear
	Transverse	100%NBS	
Ground Beams	Longitudinal B1	90%NBS	Shear
	Transverse B6	30%NBS	Shear
	Transverse B8	**25%NBS (**)**	Shear
Pile Caps	Both directions	100%NBS	Flexure (typical 3-pile pile caps)
Concrete Piles Group 1 (Under Middle Walls)	Longitudinal	100%NBS	
	Transverse	40%NBS	Geotechnical tension capacity
		40%NBS	Geotechnical compression capacity
Concrete Piles Group 2 (Under Stair Walls)	Longitudinal	20%NBS (*)	Geotechnical tension capacity
		30%NBS (*)	Geotechnical compression capacity
	Transverse	20%NBS (*)	Geotechnical tension capacity
		30%NBS (*)	Geotechnical compression capacity
Stairs	Both directions	>67%NBS	Based on secondary load paths.

(*) The walls and piles under the stair cores were initially assessed to have relatively low %NBS ratings. We reason that it is acceptable for these walls and piles to exceed their capacity and have the seismic loads re-distributed (refer to discussions in sections 2.1 and 3.1). Hence, these ratings do not govern the overall building %NBS.

(**) This element governs the overall %NBS rating of Block D.

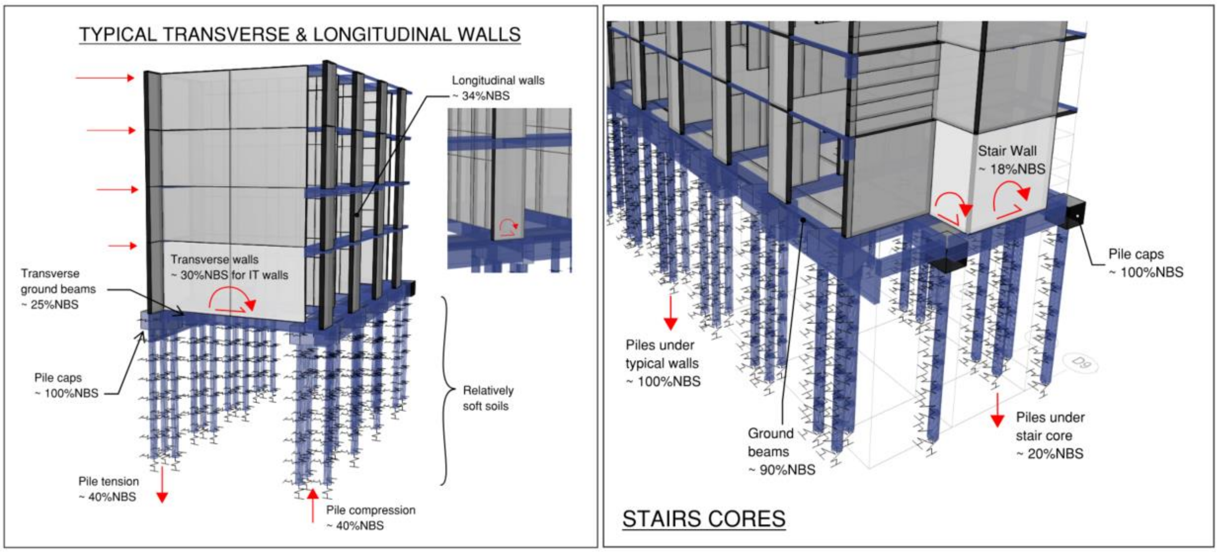


Figure 8: %NBS ratings for Block D elements

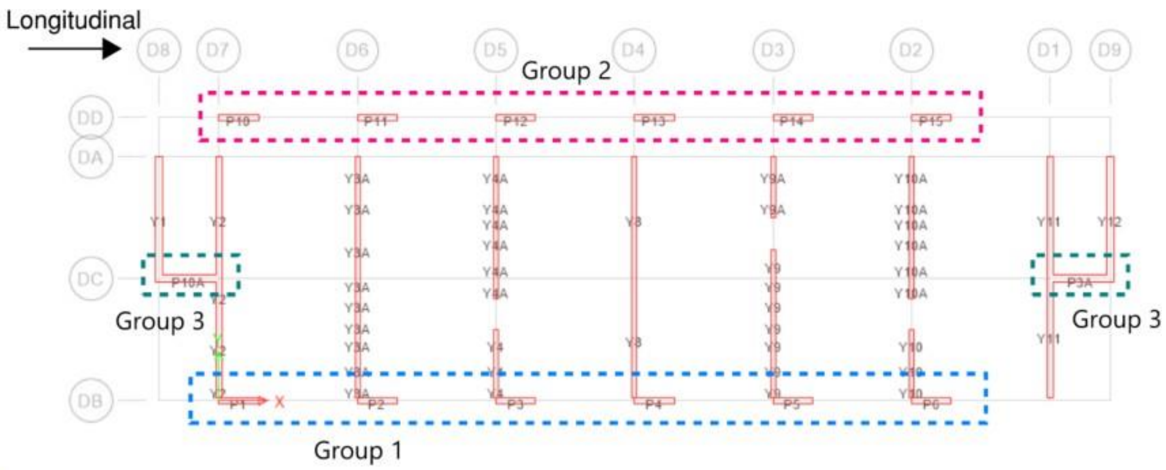


Figure 9: Wall layout in longitudinal direction

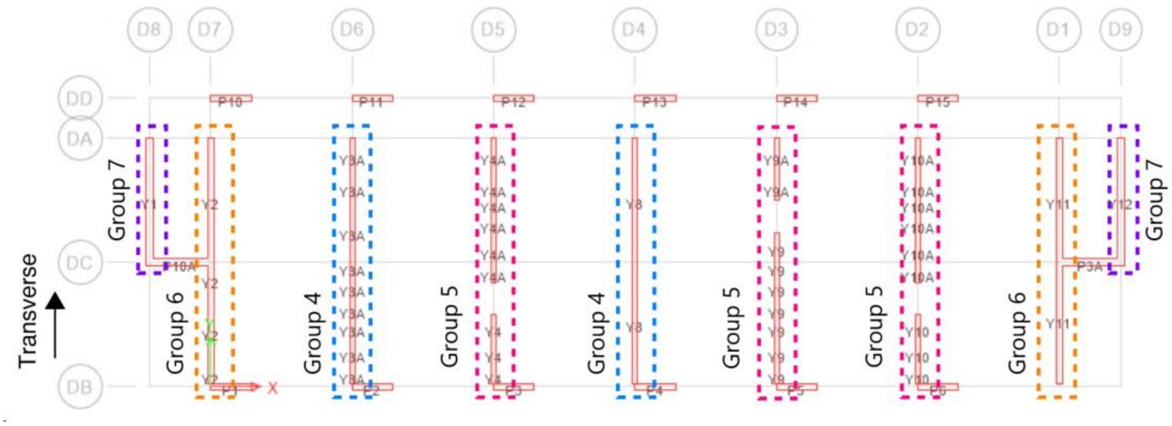


Figure 10: Wall layout in transverse direction

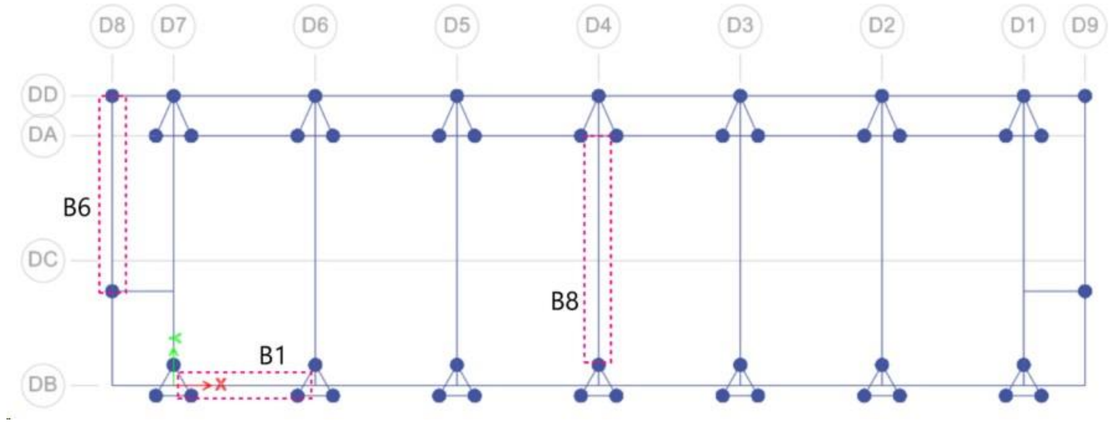


Figure 11: Highlighted ground beam layout

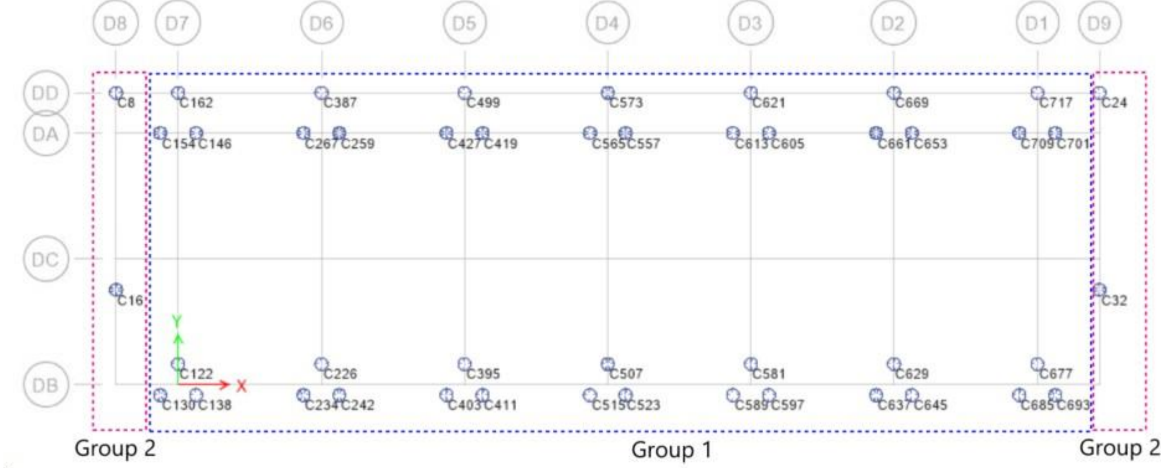


Figure 12: Piling layout

2.2.1 Liquefaction

As discussed in Section 1.5.3, liquefaction risk has been assessed and discussed in Beca's geotechnical desktop study report. During a liquefaction scenario, the piles will have very limited lateral capacity (geotechnical and structural) in base shear takeout. The piles will not have adequate structural capacity to transfer the base shear through the liquefied layer to be resisted by the rock below.

A qualitative assessment has been undertaken to evaluate the potential consequences of liquefaction. We expect that the piles will fail in shear and flexure/tension. The building has shear walls in a regular arrangement in both directions and the walls are supported on a grillage of foundation beams, tying the building base together. The building is likely to slide and rock on the damaged piles and ground. Excessive settlement and different settlement on the building can be expected. However, as the building in well tied by foundation beams and diaphragms, the building is unlikely to undergo disproportionate collapse. Additionally, the building is expected to have residual gravity support, so liquefaction is not considered to be a life-safety risk.

Accordingly, this assessment and the results summarised above are based on a pre-liquefaction scenario. The proposed geotechnical site investigation as part of the strengthening design will provide more insight to the liquefaction risks.

2.2.2 %NBS Amendment Following Peer Review

Peer reviewer AECOM recommended carrying out a modal response spectrum analysis (MRSA). They recommended this because they expected to see a lower base shear using this approach, which could potentially improve the %NBS rating of the building.

The MRSA results suggest that base shear demands in the transverse and longitudinal directions are 17% and 3% lower respectively. The %NBS increase to the individual components is not linear as there is interaction with gravity loads as well as axial load and moment interaction.

Overall, our assessment with MRSA indicated that the building has a seismic rating of 25%NBS(IL2). This happens to be consistent with our original conclusion detailed earlier in section 2 based on our ESA results, where the overall capacity is governed by the brittle shear failure of the ground beams. However, load distribution has changed slightly, leading to slightly higher capacity to the piles and transverse walls. Longitudinal wall capacity has reduced due to the slightly higher moment demands owing to higher mode effects of the short and slender cantilever walls.

As the longitudinal walls are doubly reinforced and have closed stirrups providing some nominal confinement, our SLaMA results indicated these walls can rock prior to foundation failure and can be a dependable mechanism. We have updated the longitudinal wall results for this consideration.

See below for a summary of the final %NBS ratings for the building considering MRSA and SLaMA.

Table 9: Summary of Building Seismic Performance

System	Direction	*%NBS (IL2)*	Commentary, Failure Mechanism
Reinforced Concrete Cantilever Shear Walls	Longitudinal	67%NBS (*)	Plain round bar wall rocking
	Transverse	45-75%NBS	Flexure and tension failure
	Transverse	40%NBS	Out-of-plane capacity for top level walls
Floor Diaphragm	Longitudinal	100%NBS	Governed by tension tie capacity

Ground Beams	**Transverse**	**25%NBS (**)**	**Brittle shear failure caused by wall end uplifting, leading to loss of gravity support and wall dropping off from the pile cap.**
Pile Caps	Both directions	100%NBS	Typical 3-pile pile caps.
	Both directions	85%NBS	Flexure (2-pile pile cap on grid AA only)
Concrete Piles	Longitudinal	100%NBS	
	Transverse	40-65%NBS 45-60%NBS	Geotechnical tension capacity Geotechnical compression capacity
Stairs	Both directions	>67%NBS	Based on secondary load paths and allowing loads to be redistributed.

(*) This is based on plain round bar wall rocking assessed with SLaMA.

(**) This element governs the overall %NBS rating of Block D.

Following the additional MRSA study RBG undertook, peer reviewer AECOM closed the outstanding peer review comments for Block D in May 2024, prior to the issue of this final report.

3. Secondary Elements

3.1 Stairs

As explained in section 2, the piles under the stair walls are not considered to govern the building's overall seismic rating. The primary reason for this conclusion is that seismic loads initially attracted by the stair core can be redistributed if the piles supporting the stairwells fail. This lateral load redistribution is elaborated further below.

The piles under the stair walls have relatively low geotechnical tension capacity. If the tension on the piles exceeds this capacity, the piles will likely uplift. Subsequently, a secondary load path will be activated in which loads from the stairs and stair core walls re-distribute to the adjacent shear walls. This load redistribution means that the stairs should still be sufficiently supported to allow building occupants to evacuate via the stairwells. Accordingly, we do not consider the failure of the piles under the stair walls to pose a high risk to life safety.

Following an earthquake in which the piles fail under tension, the piles under the stair core may settle to a position deeper than before the earthquake. However, as the governing failure mechanism of these piles are associated with their geotechnical capacity, we expect the piles to remain structurally intact. This means that these piles may still be able to support the stairwells post-earthquake.

Further to the above discussion about the redistribution of lateral loads associated with the stairs, the stair flights and landings also have some redundancy in supporting gravity loads. For example, if the interface between the flights and landings detaches, the flights can cantilever off the transverse stair walls. Additionally, if the interface between the stair landing and longitudinal stair wall disconnects, the stair landing may still be supported by the transverse stair walls. Thirdly, if the stair landing detaches from the stair walls on all three of its sides, it may be supported by the stair flights.

Considering the redundancy in supporting gravity loads described above, the seismic rating of stairs is 100%NBS. Therefore, the stairs are not considered a critical structural element.

See Figure 13 below for the locations of the two stairwells in Block D.

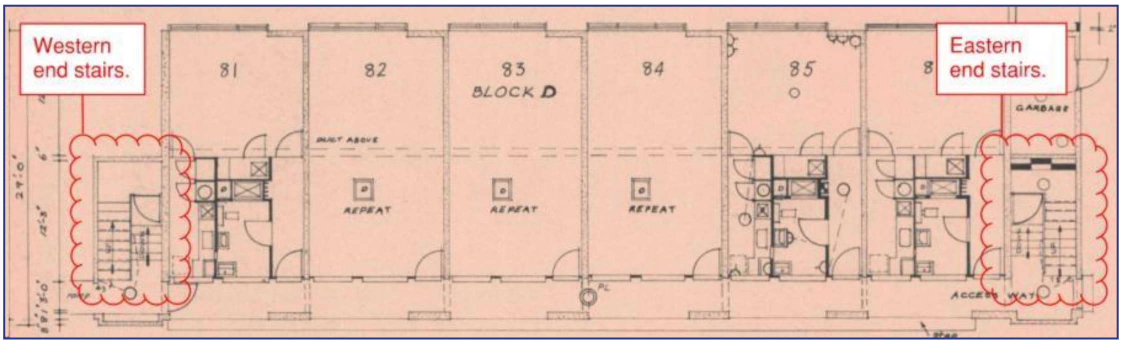


Figure 13: Block D stairs

4. Non-Structural Elements

Block D does not have non-structural elements for which analysis was undertaken for in this DSA.

5. Risks from Adjacent Buildings

Block D is not immediately adjacent to Blocks A, B, C, or the neighbouring properties. Consequently, there are no adjacent buildings that are expected to pose a notable risk to Block D.

6. Assessment of Seismic Risk

6.1 Seismic Risk and Performance Levels

As detailed in section 1.2, the lower threshold to assign a building as earthquake prone is about 33%NBS(IL2). Thus, RBG considers Block D an EPB due to its overall rating of 25%NBS(IL2).

Referring to Table 10, RBG associated Block D with a Grade D rating, with a degree of high life-safety risk.

Table 10: Relative Earthquake Risk

Building Grade	Percentage of New Building Strength (%NBS)	Approx. Risk Relative to a New Building	Life-Safety Risk Description
A+	> 100	< 1	Low risk
A	80 – 100	1 to 2 times	Low risk
B	67 – 79	2 to 5 times	Low or medium risk
C	34 – 66	5 to 10 times	Medium risk
D	20 – 33	10 to 25 times	High risk
E	< 20	More than 25 times	Very high risk

7. Concept Seismic Strengthening

Concept strengthening needs to address the weaknesses identified in the assessment calculations with two possible performance levels:

- Ensure adequate performance for life-safety at 34%NBS as a minimum baseline to ensure this building is not potentially earthquake prone.
- Ensure adequate performance for life-safety at 67%NBS as the client's preferred minimum level of performance.

Note that the following concept strengthening schemes bypass strengthening to the 34%NBS performance level and instead lift the building performance directly to the 67%NBS performance level. We have chosen to propose concept strengthening schemes that will strengthen the building to 67%NBS because once the structural weaknesses are addressed, the building will achieve 67%NBS.

Three concept seismic strengthening options are proposed in sections 7.2 to 7.4. Refer to Appendix D for concept strengthening sketches showing the location and details of the strengthening works proposed.

For Option 1, a raft slab is proposed to tie together the foundation and to provide additional bearing support the building when the pile fails. The raft slab would also act as a base for the plain round bar walls to rock as the round bars slip. Raft slab will also increase the redundancy of the building to accommodate differential settlement during liquefaction scenario.

For Options 2 and 3, the overall concept seismic strengthening idea proposed for the building involves strengthening the foundation so that the cantilever shear walls have a sufficiently solid base to rock about during an earthquake. We also propose controls to prevent concrete spalling off the singly-reinforced cantilever shear walls, as this could cause a significant loss of gravity support as the walls rock in an earthquake.

There are four key aspects to the three concept seismic strengthening options proposed:

1. Confirmation of potentially higher pile capacities, ground bearing capacity and liquefaction risks through a proposed geotechnical site investigation.
2. Increasing the shear capacity of the ground beams in the transverse direction.
3. Increasing the tension capacity of the piles under the middle walls.
4. Providing concrete confinement to the transverse reinforced concrete cantilever shear walls.

7.1 Geotechnical Site Investigation

RBG expects that the geotechnical compression capacity of the piles will be higher than detailed in this report once a site investigation has been completed, as indicated by the pile test load on the original specification. We expect this to involve bore hole investigation, and geotechnical engineer to confirm the site subsoil class, site geology, ground bearing capacity, pile capacity, liquefaction risk and inputs for ground anchor design.

This investigation must be completed before strengthening design start. Results of the investigation will be used to validate the DSA, as well as form the basis for strengthening design. Refer to geotechnical engineer for further information.

7.2 Option 1: Concrete Raft Slab

In this concept, we propose the existing timber ground floor is replaced by a new concrete raft slab. The concrete raft slab will tie the foundations together better, allowing the building to behave like a 'rigid box' when the piles fail during an earthquake, and allowing the walls with plain round bars to rock on the foundation.

The raft slab will also provide some bearing resistance. This will provide the building with a more robust system and will be more resilient to liquefaction effects.

As the timber floor level is about 500 mm above the top of the existing ground beams, the gap beneath the concrete raft slab will need to be backfilled with a granular material to allow for concrete to be poured over it.

Note that in this concept design, the foundation piles will be allowed to fail and the building to rock. This concept relies on the gravity load of the building to provide overturning resistance. Initial study suggests that can achieve 67%NBS. Further design and geotechnical investigation inputs are required to confirm the achievable capacity.

For the transverse shear walls concept strengthening design in this proposed concept design, see section 7.5.

7.3 Option 2: Internal Ground Anchors

The ground beams in the transverse direction of the building are associated with brittle shear failure due to tension loads from the transverse shear walls. To provide a load path for tension forces from the transverse walls to travel down to the pile caps and piles without causing the concrete to fail in a brittle manner, we propose the following strengthening works:

- New foundation block adjacent to the pile caps along both longitudinal sides of the building. These foundations will sit within the building footprint to either side of each transverse ground beam and will be tied into the existing ground beams using steel dowels.
- Each concrete block will have a ground anchor installed. The pair of ground anchors are designed to carry the tension from each transverse wall, respectively.

We note that this concept would involve removing the existing timber floor at ground level to install the ground anchors. Accordingly, early contractor involvement will be necessary to address the inherent buildability intricacies this concept may involve.

Allowance for the existing piles to share some of the tension has not been considered, as the anchors embedded deep into the rock are expected to be stiffer than the piles in tension. The new ground anchors have been designed for the full tension at 67% ULS from each transverse wall, whilst the existing piles provide compression support.

For the transverse shear walls concept strengthening design in this proposed concept design, see section 7.5.

7.4 Option 3: External Ground Anchors

Like the concept in section 7.3, this second design would involve installing ground anchors to carry the tension from the walls into the ground below the building. The key difference is that instead of placing these ground anchors within the building footprint, the ground anchors will be placed externally adjacent to the existing pile caps. To accommodate these new ground anchors, the existing ground beam will have to be strengthened with new concrete sections added to either side. These new sections will be very heavily reinforced and will extend past the existing pile caps to provide anchorage to the new ground anchors.

For the transverse shear walls concept strengthening design in this proposed concept design, see section 7.5.

7.5 Options 1 to 3: Transverse Shear Walls

For all three options, we propose FRP wrap to the base of the singly-reinforced transverse walls. The plain round bars in the wall are expected to fail in bond slip; FRP will provide confinement to the concrete and allow the walls to rock more reliably, providing gravity support to the floors after an earthquake.

Concrete spalling may occur when the walls rock and bars slip in the wall, and this can lead to a loss of gravity support. To strengthen the transverse walls against losing gravity support when rocking, we propose the following works:

- Wrapping the walls with glass FRP on each face of each transverse wall to improve confinement strength. For walls without door openings, only the end thirds of the walls will be wrapped because we expect the effect of rocking to be less significant near the middle of the wall.
- Install glass anchors drilled through the transverse walls to secure the FRP wrap.

8. Future Seismic Hazard

8.1.1 Revised National Seismic Hazard Model

In 2022, GNS Science released a revision of the National Seismic Hazard Model (NSHM), which is a set of updated guidelines for assessing the risk of earthquakes across the country. The model considers new scientific data and an improved understanding of seismic activity. It replaces the previous model developed in 2002.

The revised NSHM is expected to have a significant impact on the Building Code in New Zealand. The updated guidelines will result in higher seismic design standards for buildings, which will require more robust and earthquake-resistant construction methods.

The increase in seismic hazard anticipated with the revised NSHM in New Zealand varies depending on the location and type of earthquake. According to the Earthquake Commission and GNS Science, the expected increase in seismic hazard ranges from around 10% to 30% in some parts of the country, compared to the previous seismic hazard model. However, in other areas, such as the lower North Island, the increase in seismic hazard could be more significant, up to 50% or more.

The revised NSHM considers the likelihood of a major earthquake occurring in the Hikurangi subduction zone off the east coast of the North Island. This area is now considered to be at a higher risk of a large earthquake than previously thought, and the new NSHM reflects this increased risk.

Overall, the anticipated increase in seismic hazard with the new NSHM is significant and underscores the importance of ensuring buildings are earthquake-resistant and resilient.

MBIE is responsible for updating the Building Code in response to the NSHM. The Building Code sets minimum standards for building construction and design, and the updated code will reflect the latest seismic hazard information. The incorporation of the NSHM will require a determination from MBIE that will balance levels of risk and the cost/benefit of increasing seismic design loads.

As of February 2024, a draft Technical Specification TS 1170.5 has been released for feedback. TS 1170.5 is a result of Engineering New Zealand and MBIE collaborating to incorporate the 2022 revision of the NSHM into New Zealand’s building regulations. The feedback period was set to close on 14 March 2024.

Engineering NZ has advised that the proposed Technical Specification will not affect %NBS scoring (and thus earthquake prone thresholds) as defined by EPB legislation effective from 1 July 2017, which relates NBS to the level of earthquake shaking. This does not necessarily reflect the future demands of building owners and tenants (or insurers) for a higher level of seismic strength/resilience, and this should be considered whenever reviewing seismic assessment information and/or strengthening advice.


Robert Bird Group

Appendix A
Sources of Information

HUP2-T0-Seismic Assessments

A-1 Property Documents

Relevant drawings: (refer Appendix E)

- 1968 Architectural Construction Drawings, Architectural Department of Wellington City Corporation
- 1968 Structural Construction Drawings, Stewart G. Rees & Associates
- Specifications
- 2014 Design Features Report, Opus International Consultants Limited

Other relevant documents:

- KOTD Initial Review Form, amendment C (refer Appendix B)
- Beca Geotechnical Desktop Study Report for 5 Kemp Street (refer Appendix F)

A-2 Standards and Guidelines

The following standards and guidelines have been used in this DSA:

- NZSEE Engineering Assessment Guidelines 2017, including 2018 revision of section C5 for concrete buildings.
- NZS1170.0: 2002
- NZS1170.5: 2004
- NZS3101: 2006

Appendix B
Initial Assessment Form

HUP2-T0-Seismic Assessments

0 DOCUMENT CONTROL

N0541-RBG-KOTD-XX-DN-ST-00001

	Issue/Amendment	**Author**	**Approver**	**Date**
A	For Peer Review	[redacted] s(7)(2)(a)		18.01.24
B	For Peer Review			25.01.24
C	For Peer Review			17.04.24

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: 609 Evans Bay Parade - KOTD

Site plan

Structural Description: Describe the building	
Building Age/Year Constructed	Original construction drawings dated 1968. Structural alteration design and drawings dated 2014.
Previously strengthened? Y/N	Alteration and strengthening designed in 2014 to achieve 70%NBS(IL2). Strengthening scope included: • Strengthening the ground beams supporting longitudinal walls on

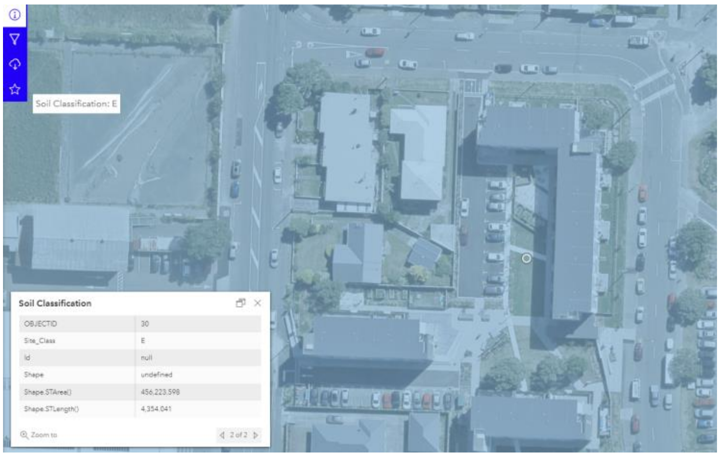
	both sides. • Strengthening the transverse walls at ground floor where there are new door penetrations.
Location	609 Evans Bay Parade, Wellington
No. levels	4
Plan Area (sq.m.)	Footprint area: approx. 252m^2; Gross floor area: approx. 987m^2 (252m^2 + 3x245m^2)
Structural Form	Concrete structure
Roof Type	Light weight roof (steel roofing on timber purlins)
Floor Type	1st, 2nd, 3rd floor: In situ concrete slab and beam. Ground floor: timber floor and timber bearers on concrete ground beams
Foundation Type	Concrete bulb piles (Franki piles) and pile caps with ground beams
Stair Type (Precast, Steel, etc)	In situ concrete
Seismic Gaps (mm)/Pounding	N/A
Appendages/Parapets/Canopies	Canopies at ground floor
Precast Walls (reo type)	Nil
Veneers Present	Nil

Lateral Load-Resisting Mechanism (in each direction - confirm with drawings): Describe the lateral load resisting system in each direction	
Longitudinal:	In situ reinforced concrete shear walls
Transverse:	In situ reinforced concrete shear walls

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:	Two-step process is adopted to specify the shear demands of the building. Step 1: Calculating by hand (or using spreadsheet) the building weights, seismic coefficients, the base shear demands and floor forces using equivalent static method. Step 2: ETABS analysis to assess the building performance. The demands from ETABS model are verified with precursor calculations. Equivalent static method and ETABS analysis are proposed to assess the capacity of the building and foundation. A force-based approach will be followed up to evaluate the demand and capacity of the different structural components. The buildings and shear walls generally have plain round bars with straight splices (as noted on the material specification). Shear walls with this arrangement generally do not have much ductility capacity. Hence, SLaMA procedure does not provide much value to the DSA process. Rigid diaphragm is considered in the analysis for the assessment of the lateral system and foundation.
Analysis method of diaphragms:	Loadings are based on pseudo-Equivalent Static Analysis (pESA). As the shear wall layouts are regular, hand calculation using deep beam approach is considered.

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	
Shear walls with plain round bars	μ = 1.25
Squat walls	μ = 1.25
Foundation (Ground beams, piles and pile caps)	μ = 1.25

Assessment Loadings: Loads to be used as part of assessment:	
Seismic Loadings	
Building Importance Level:	2
Site Subsoil Class:	D/E (the buildings are located at soil class E as per data from WCC website. It is needed to be confirmed by geotechnical desktop study)



Annual Probability of Exceedance:	1/500
Return Period Factor, Ru:	1
Near Fault Factor, N(T,D):	1
Hazard Factor, Z:	0.4
Code of the Day:	NZS1170.5:2004
S_p	0.9
Design Working Life (yrs):	50
Dead Loads/Superimposed Dead Loads	
Light weight roof	0.35 kPa
5” concrete floor slabs + ceiling	3.1 kPa
5”-6” corridor slab	3.4 kPa
Concrete stair flight	4.9 kPa
Concrete stair landing	3.0 kPa
6” Concrete walls + lining	3.9 kPa
8” Concrete walls + lining	5.1 kPa
Internal wall	0.25 kPa (per m^2 elevation)
External wall or cladding	0.50 kPa (per m^2 elevation)
Live Loads:	
Residential dwelling	1.5 kPa
Residential balcony	4.0 kPa
Common stairs	4.0 kPa

Deflection Criteria	
ULS Deflection Limit (%)	2.5%
Reason for Limit	Ultimate limit state

Material Properties:				
Material Rename material as appropriate		**Design Strength (MPa)**	**Strength Mod Factor**	**Assessment Strength (MPa)**
Reinforcement	Plain or Deformed bars?	Plain bars		
	Probable yield strength	NZS 197*	-	324 MPa
	Probable tensile strength	NZS 197*	-	475 MPa
Concrete	Foundations	17.2MPa*	1.5	36MPa
	Slab on Grade	17.2MPa*	1.5	36MPa
	Precast Panels			N/A
	Shear Walls	17.2MPa*	1.5	36MPa
	Columns	17.2MPa*	1.5	36MPa
	Beams	17.2MPa*	1.5	36MPa
Structural Steel	Beams			N/A
	Columns			N/A
	CHS			N/A
	Plate			N/A
	Other members			N/A
Bolts				N/A
Weld Strength				N/A

* The reinforcement and concrete material strength are documented on the project specification dated in 1968.

Stiffness Reduction Factors in ETABS software	
	These stiffness reduction factors are adopted for ULS, complied with NZS3101:2006, Table C6.5
Columns	Moment of inertia about 2 axis and 3 axis: 0.55 to 0.80 ($N^*/A_g f'_c$ = 0.2 to 0.5) Torsional constant: 0.1
Beams	Moment of inertia about 2 axis and 3 axis: 0.43 Torsional constant: 0.1
Walls	f22 = 0.36 ($N^*/A_g f'_c$ < 0.5) (in-plane bending) f12 = 0.83 (ie 5/6 A_g - NZS3101, cl.C6.9.1) m11 = m22 = m12 = 0.1
Slabs, diaphragms	In-plane = rigid Out-of-plane: m11 = m22 = m12 = 0.25

Foundation Assessment Criteria:	
Geotechnical Report Available?	A geotechnical desktop study is being undertaken
Foundation type:	Concrete piled foundation
Soil type:	D
Geotechnical Investigation:	Geotechnical investigation
Ult. Bearing Pressure:	Pile foundation
Sliding Resistance:	Pile foundation

Pending Code/Guideline Changes to Take into Account :

Are there any upcoming code changes to take into account?

New NSHM – refer to DSA report.

Kick-off Meeting:

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

Task / Note	Actioned By Who?

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

Site appears to be underlain by sandy marine deposit and is potentially prone to liquefaction. A geotechnical desktop study is being undertaken to confirm the risks.

Additional Project-Site Investigation Scope

A desktop geotechnical study is needed to confirm below key soil parameters for the assessment.

- Appropriate subsoil class for the site.
- Axial pile capacity, including compression and tension capacity.
- Lateral pile capacity. Provision of 1 typical p-y curve of the pile.
- Base shear takeout from the pile caps and ground beams by the passive soil resistance, and passive lateral earth pressure coefficient (Kp).
- Advice on risks of liquefaction and lateral spread, and potential impacts to pile capacity due to liquefaction.

Appendix C
Assessment Summary

HUP2-T0-Seismic Assessments

A-3 Engineering Assessment Summary

The below summary tables are presented as per MBIE report guidelines:

1. Building Information	
Building Name/ Description	Block D, Kōtuku Apartments
Street Address	609 Evans Bay Parade
Territorial Authority	Wellington City Council
No. of Storeys	4
Area of Typical Floor (approx.)	Approx. 252m^2
Year of Design (approx.)	1969
NZ Standards designed to	NZS 1900:1964
Structural System including Foundations	Reinforced concrete cantilever shear walls as both the gravity and lateral structural systems. Reinforced concrete ground beams, pile caps, and bulb pile foundations.
Does the building comprise a shared structural form or shares structural elements with any other adjacent titles?	No.
Key features of ground profile and identified geohazards	Ground profile comprises layers of domestic waste, sand, and rock. Site subsoil class E from WCC GIS data, but subsoil class D is recommended for analysis. Moderate to high seismic risk due to nearby Wellington and Evans Bay Faults. High risk of liquefaction and ground shaking. Moderate risk of lateral spreading towards Evans Bay.
Previous strengthening and/ or significant alteration	2016 strengthening alterations carried out by Opus International Consultants Limited. Alterations comprised of strengthening ground beams and transverse walls.
Heritage Issues/ Status	N/A
Other Relevant Information	Building was renovated and seismically strengthened to 70% NBS (IL2) in 2016.

2. Assessment Information	
Consulting Practice	Robert Bird Group
CPEng Responsible, including: • Name • CPEng number • A statement of suitable skills and experience in the seismic assessment of existing buildings[1]	s(7)(2)(a) [redacted] - CPEng #1032824 - Practice area statement: Structural design management, assessment, design and construction monitoring of low and medium rise buildings and civil infrastructure. Nelson has over 18 years of experience at the time the assessment was undertaken and has extensive local seismic experience. He was heavily involved in the recovery works after the Christchurch Earthquake in 2011, the 2013 Seddon Earthquake and 2016 Kaikoura Earthquake. He has undertaken numerous seismic inspections, seismic assessments and strengthening across NZ, including assessments complying to 2017 Engineering Assessment Guidelines (EPB methodology).
Documentation reviewed, including: • date/ version of drawings/ calculations[2] • previous seismic assessments	• 1968 Architectural Construction Drawings, Architectural Department of Wellington City Corporation • 1968 Structural Construction Drawings, Stewart G. Rees & Associates • Specifications • 2014 Design Features Report, Opus International Consultants Limited
Geotechnical Report(s)	2024 Beca 5 Kemp Street Desktop Study Report
Date(s) Building Inspected and extent of inspection	N/A
Description of any structural testing undertaken and results summary	N/A
Previous Assessment Reports	Kotuku Flats Structural Assessment Report (Jan 2008), Romulus Consulting Group
Other Relevant Information	- KOTD Initial Review Form, amendment B (refer Appendix B) - Beca Geotechnical Desktop Study Report for 5 Kemp Street (refer Appendix C)

[1] This should include reference to the engineer's Practice Field being in Structural Engineering, and commentary on experience in seismic assessment and recent relevant training
[2] Or justification of assumptions if no drawings were able to be obtained

3. Summary of Engineering Assessment Methodology and Key Parameters Used	
Occupancy Type(s) and Importance Level	Residential. IL2.
Site Subsoil Class	E (WCC GIS data), D (Beca geotechnical desktop study report, for analysis)
For an ISA:	
Summary of how Part B was applied, including: • Key parameters such as μ, S_p and F factors • Any supplementary specific calculations	
For a DSA:	
Summary of how Part C was applied, including: • the analysis methodology(s) used from C2 • other sections of Part C applied	• Review existing information in the form of drawings, calculations, and reports. • Establish the 100%NBS threshold by assessing the site seismic parameters and calculating the response spectra for the buildings. • Complete an initial simple lateral mechanism analysis (SLaMA) to understand the displacement and global ductility capacities of the buildings. • Calculate by spreadsheet the base shear demands and floor forces using the equivalent static analysis (ESA) procedure. • Model and analyse the buildings and individual components in 3D using force-based procedures. • Complete structural calculations for key structural components. • Prepare a DSA report to summarise building component capacities, identify structural weaknesses, provide an overall %NBS score for the building.
Other Relevant Information	

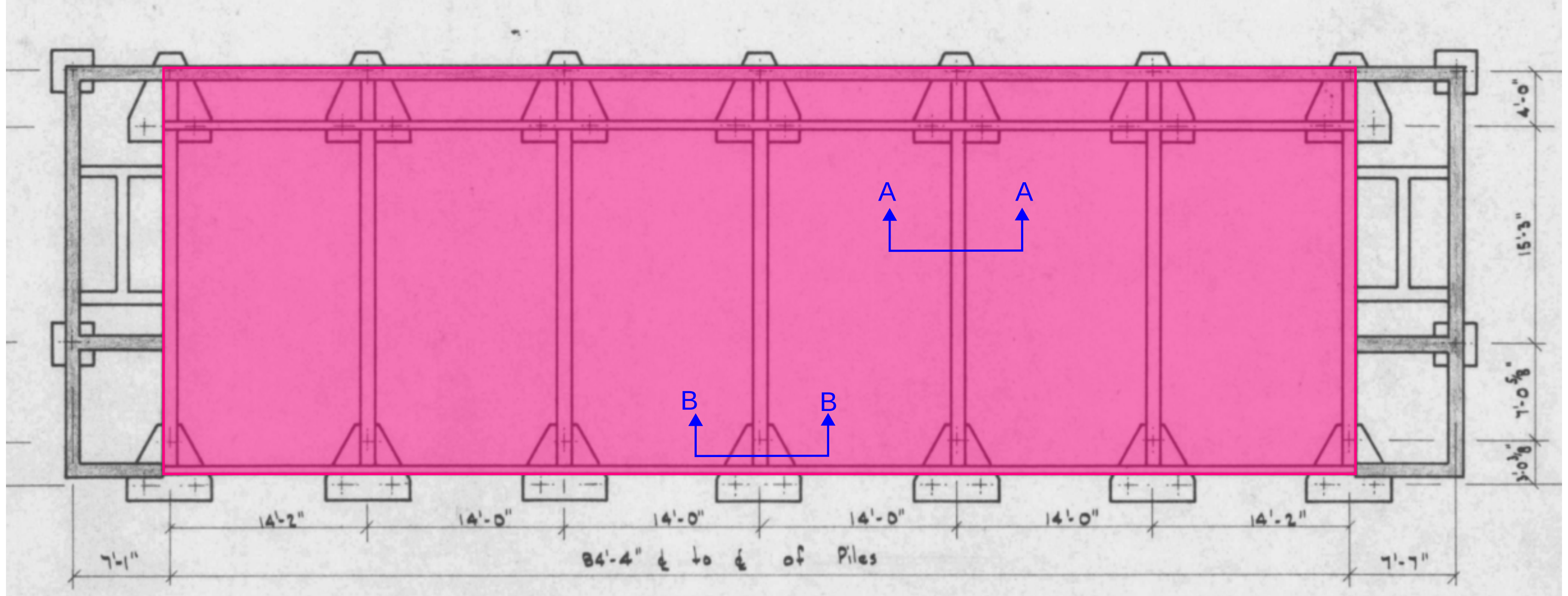
4. Assessment Outcomes		
Assessment Status (Draft or Final)	Final	
Assessed *%NBS* Rating	25%NBS(IL2)	
Seismic Grade and Relative Risk (from Table A3.1)	Grade D, High Risk	
For an ISA:		
Describe the Potential Critical Structural Weaknesses		
Does the result reflect the building's expected behaviour, or is more information/ analysis required?	Yes – the ISA is sufficient Or No - a DSA is recommended[3]	
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)**
For a DSA:		
Comment on the nature of Secondary Structural and Non-structural elements/ parts identified and assessed	Secondary structure: Concrete stairs cast in-situ, with flights cantilevered from the walls, landings supported by three sides, low risk. Concrete water tank at roof with walls extended from the shear walls on three sides, concrete slabs between walls, low risk. Non-structural elements/parts: Light-weight partition, cladding and hand rail: low risk	
Describe the Governing Critical Structural Weakness	Transverse ground beams.	
If the results of this DSA are being used for earthquake prone decision purposes, and elements rating <34*%NBS* have been identified (including Parts)[4]:	**Engineering Statement of Structural Weaknesses and Location** Refer Table 8.	***Mode of Failure and Physical Consequence* Statement(s)** Refer Table 8.
Recommendations (*optional for EPB purposes*)	Strengthening is needed for the foundations and walls.	

[3] Indicate what form should the DSA take/ what the specific areas to focus on are

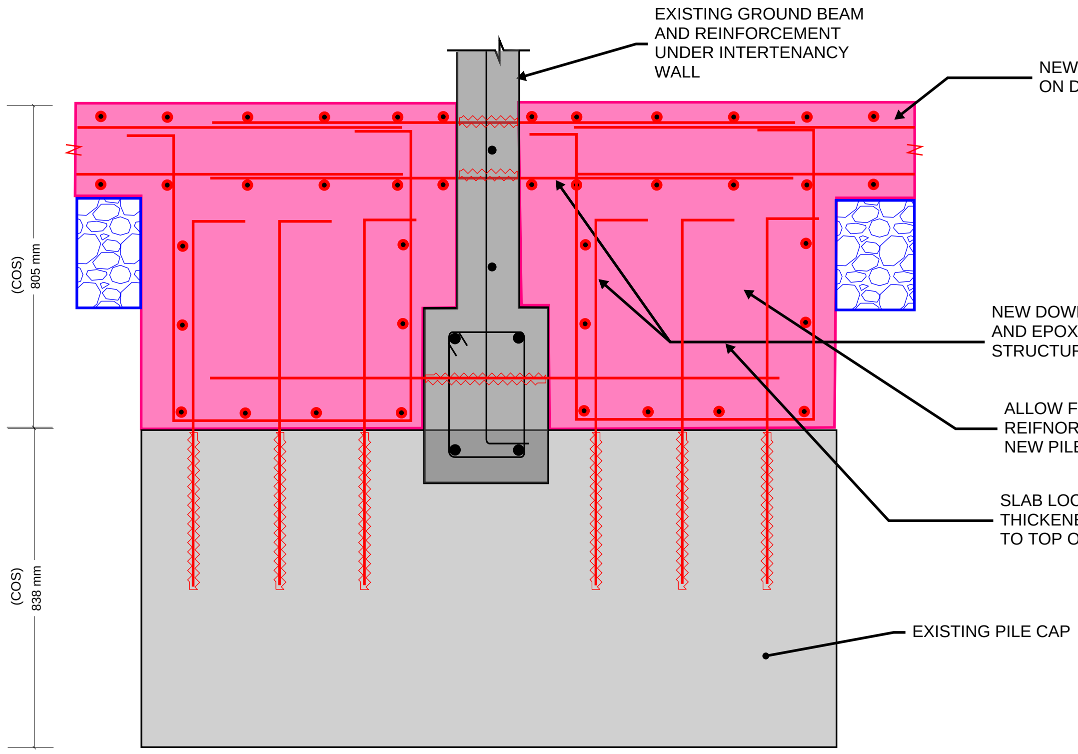
[4] If a building comprises a shared structural form or shares structural elements with other adjacent titles, information about the extent to which the low scoring elements affect, or do not affect the structure.

Appendix D
Seismic Retrofit Concepts

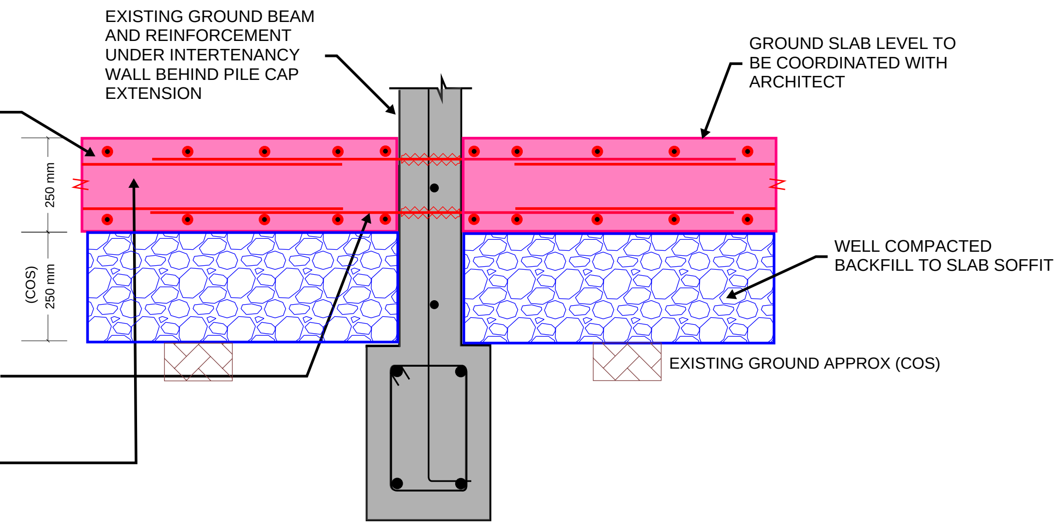
HUP2-T0-Seismic Assessments



RAFT SLAB STRENGTHENING LAYOUT - OPTION 1



SECTION B-B



SECTION A-A

NOTES

CONCEPT STRENGTHENING

- THIS STRENGTHENING CONCEPT WILL TIE THE FOUNDATION BEAMS/WALLS AND ALLOW THE BUILDING TO BEHAVE AS A 'RIGID BOX' WHEN THE PILES FAIL DURING AN EARTHQUAKE.
- OVERTURNING STABILITY OF THE BUILDING WILL BE PROVIDED BY THE GRAVITY LOAD OF THE STRUCTURE, INTIAL STUDY SUGGESTED THE BUILDING CAN ONLY ACHIEVE <55%NBS. FURTHER DESIGN IS REQUIRED TO CONFIRM THE CAPACITY.

DETAILING & CONSTRUCTABILITY

- THE CONCEPT SCHEME REQUIRES EXISTING TIMBER FLOOR TO BE REMOVED AND A NEW INSITU CONCRETE RAFT SLAB TO BE POURED INSIDE THE GROUND LEVEL OF THE BUILDING. BUILDABILITY, ACCESS AND TEMPORARY WORK WILL NEED TO BE DISCUSSED WITH THE CONTRACTOR.
- ALLOW FOR GRANULAR BACKFILL TO RAFT SLAB SOFFIT LEVEL.
- FOR DRILLING OF DOWELS INTO EXISTING STRUCTURE, ALLOW FOR REINFORCEMENT SCANNING AND CUTTING OF EXISTING REINFORCEMENT IS NOT ALLOWED.

MATERIAL PROPERTIES

- CONCRETE GRADE 30 MPa TO BE USED.
- REINFORCEMENT GRADE 500E TO BE USED.
- BOLTS TO BE G8.8 SS UNLESS STATED OTHERWISE.

GEOTECHNICAL CONSIDERATIONS

- ALLOW SITE INVESTIGATION AND BORE HOLE TO BE UNDERTAKEN BEFORE START OF STRENGTHENING DESIGN. REFER TO GEOTECHNICAL ENGINEER FOR SITE INVESTIGATION SCOPE.
- THE SITE INVESTIGATION WILL CONFIRM SEISMIC SOIL CLASS, SITE GEOLOGY, PILE CAPACITY AND INFORMATION FOR GROUND ANCHOR DESIGN.
- REFER TO APRIL 2024 BECA GEOTECHNICAL DESKTOP STUDY FOR PRELIMINARY GEOTECHNICAL CONSIDERATIONS.

LEGEND

EXISTING TIMBER GROUND FLOOR TO BE REMOVED. NEW 250thk RC RAFT SLAB TO BE POURED ON DPM ON WELL-COMPACT GROUND.

PRINT DRAWINGS IN COLOUR

Rev	Revision Description	By	App	Date
A	DRAFT FOR REVIEW	EL	AS	29/4/24

RobertBirdGroup
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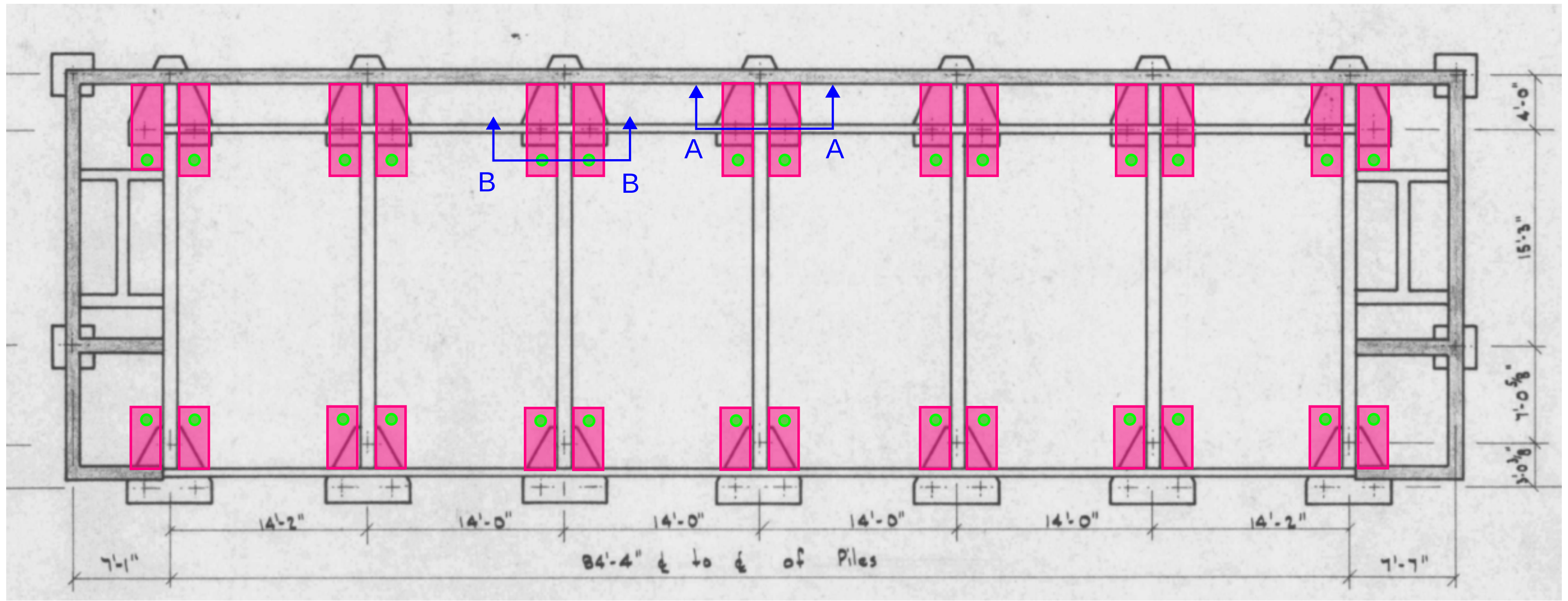
Web: www.robertbird.com
NZBN 9429 0421 10316

Client
WELLINGTON CITY COUNCIL

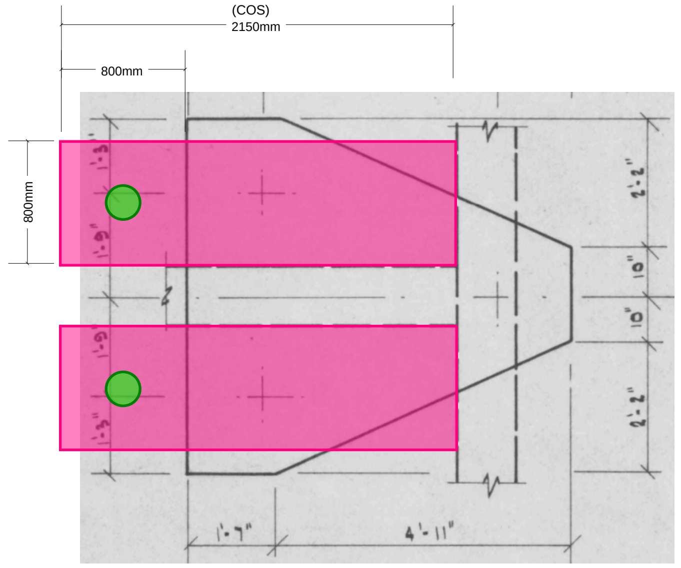
Project
N0541 - HUP2-T0-SEISMIC ASSESSMENTS

Title
5 KEMP STREET - KOTD CONCEPT STRENGTHENING DESIGN - FOUNDATION OPTION 1

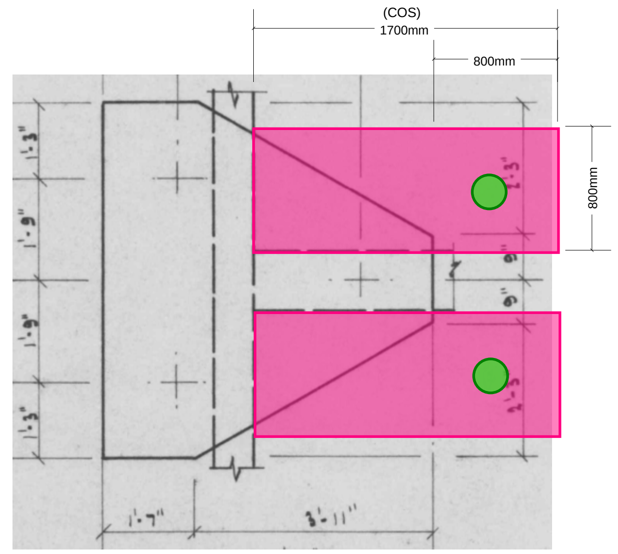
Scale at A3: NTS
Drawn: EL
Date: 24/4/2024
Designer: EL
Drawing Number: N0541-RBG-KOTD-XX-SK-ST-00003
Revision: A



FOUNDATION STRENGTHENING LAYOUT - OPTION 2



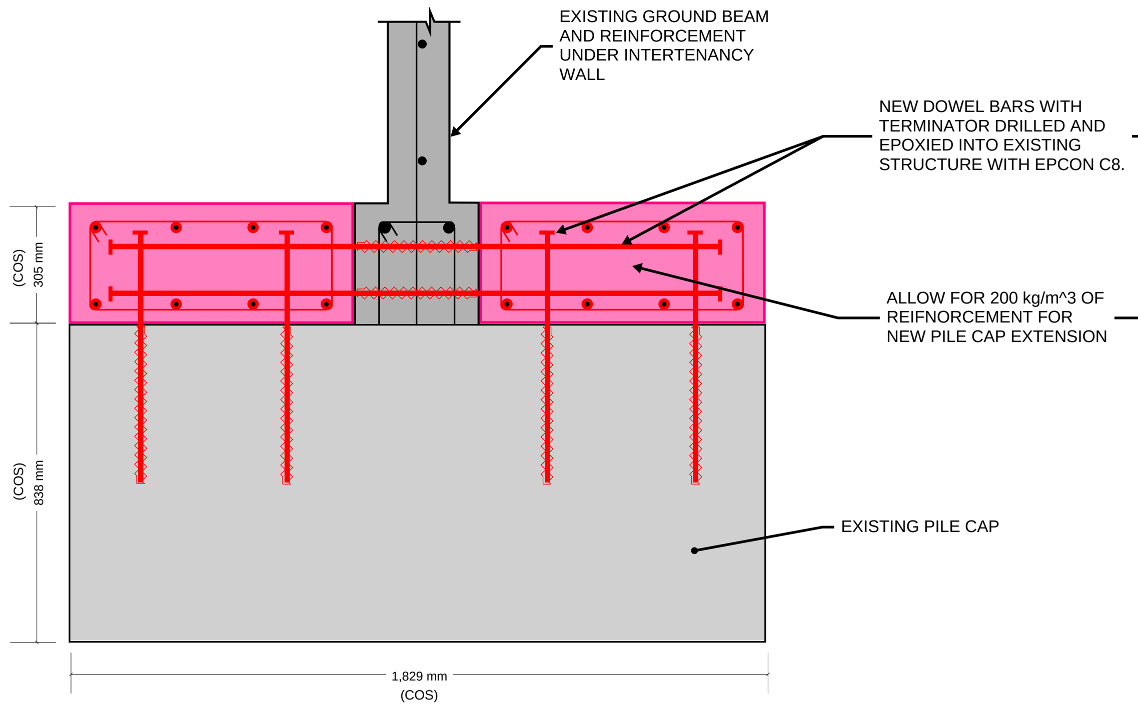
DETAIL 1 - REAR PILE CAP



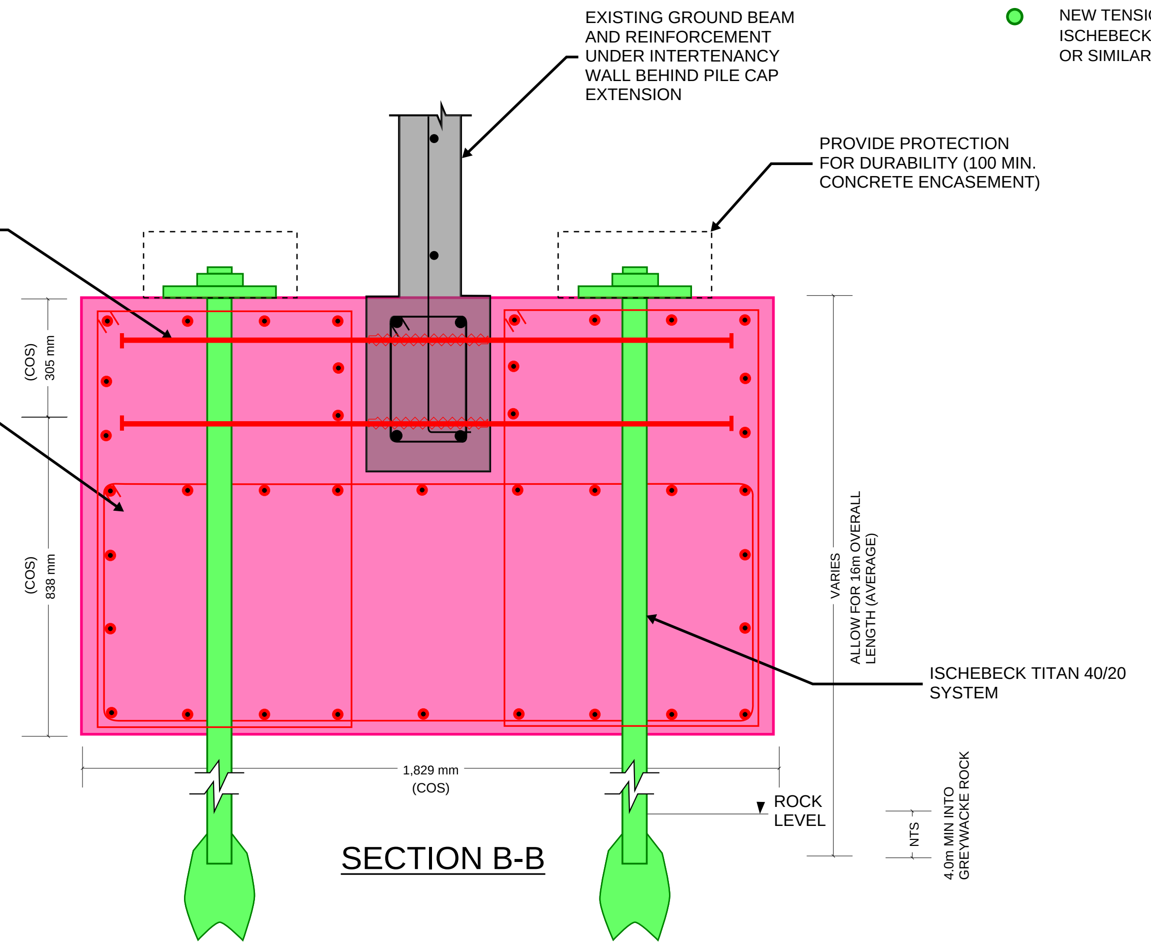
DETAIL 2 - FRONT PILE CAP

LEGEND

- NEW PILE CAP EXTENSION. REFER TO SECTION FOR DETAILS.
- NEW TENSION GROUND ANCHOR. ISCHEBECK TITAN 73/56 SYSTEM OR SIMILAR APPROVED.



SECTION A-A



SECTION B-B

NOTES

DETAILING & CONSTRUCTABILITY

- GROUND ANCHORS TO BE EMBEDDED INTO THE GREYWACKE ROCK. GEOTECHNICAL ENGINEER ADVISES THAT THE TOP OF THE ROCK IS AT 6.5-17m BGL.
- GROUND ANCHORS SHALL BE ISCHEBECK TITAN SYSTEM OR SIMILAR APPROVED, INSTALLED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATION.
- THE CONCEPT SCHEME REQUIRES ANCHOR DRILLING RIG TO BE LOCATED INSIDE THE GROUND LEVEL OF THE BUILDING. BUILDABILITY, ACCESS AND TEMPORARY PLATFORM WILL NEED TO BE DISCUSSED WITH THE CONTRACTOR. ALLOW FOR EXISTING TIMBER FLOOR, FACADE WALL TO BE REMOVED FOR ACCESS AND REINSTATED.
- FOR DRILLING OF DOWELS INTO EXISTING STRUCTURE, ALLOW FOR REINFORCEMENT SCANNING AND CUTTING OF EXISTING REINFORCEMENT IS NOT ALLOWED.

MATERIAL PROPERTIES

- CONCRETE GRADE 30 MPa TO BE USED.
- REINFORCEMENT GRADE 500E TO BE USED.
- BOLTS TO BE G8.8 SS UNLESS STATED OTHERWISE.
- ALLOW FOR STEELWORK COATING PROTECTION SUITABLE FOR UNDERGROUND EXPOSURE.

GEOTECHNICAL CONSIDERATIONS

- ALLOW SITE INVESTIGATION AND BORE HOLE TO BE UNDERTAKEN BEFORE START OF STRENGTHENING DESIGN. REFER TO GEOTECHNICAL ENGINEER FOR SITE INVESTIGATION SCOPE.
- THE SITE INVESTIGATION WILL CONFIRM SEISMIC SOIL CLASS, SITE GEOLOGY, PILE CAPACITY AND INFORMATION FOR GROUND ANCHOR DESIGN.
- REFER TO APRIL 2024 BECA GEOTECHNICAL DESKTOP STUDY FOR PRELIMINARY GEOTECHNICAL CONSIDERATIONS.

PRINT DRAWINGS IN COLOUR

Rev	Revision Description	By	App	Date
A	DRAFT FOR REVIEW	EL	AS	29/4/24

RobertBirdGroup
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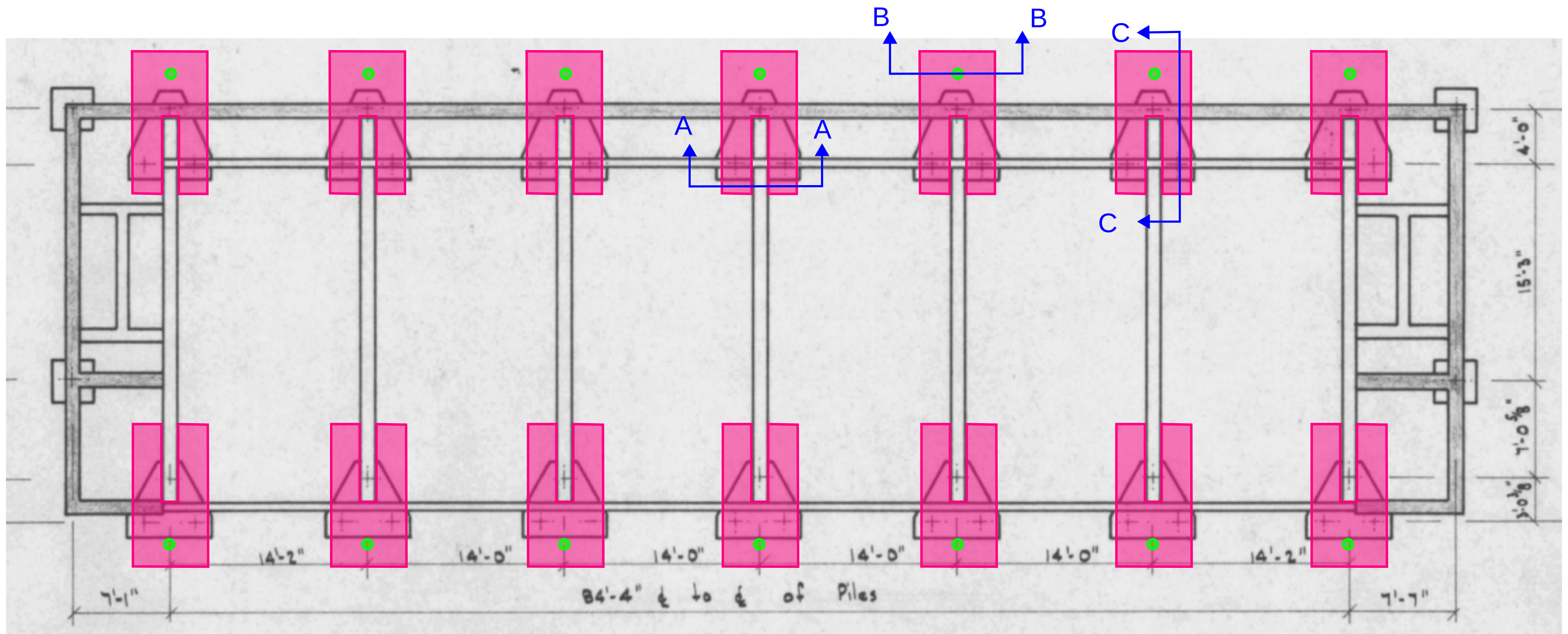
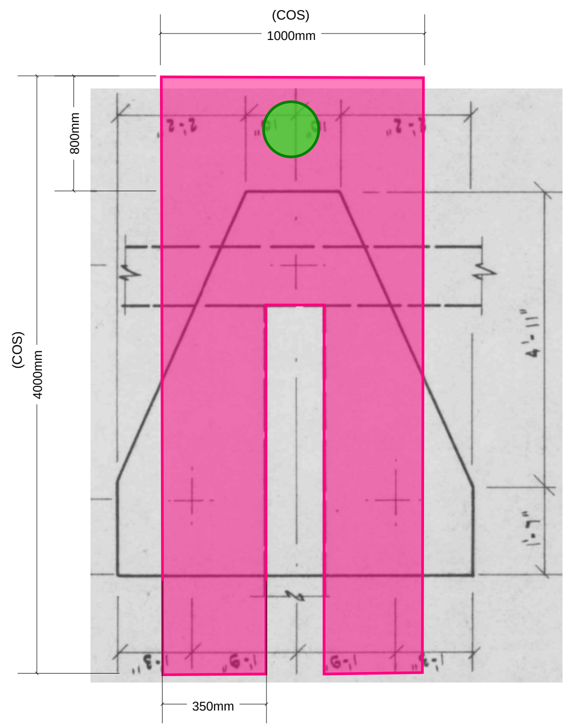
NZBN 9429 0421 10316

Client	Scale at A3	Drawn
WELLINGTON CITY COUNCIL	NTS	EL
Project	**Date**	**Designer**
N0541 - HUP2-T0-SEISMIC ASSESSMENTS	29/4/2024	EL
Title	**Drawing Number**	**Revision**
5 KEMP STREET - KOTD CONCEPT STRENGTHENING DESIGN - FOUNDATION OPTION 2	N0541-RBG-KOTD-XX-SK-ST-00001	A



FOUNDATION STRENGTHENING LAYOUT - OPTION 3



DETAIL 1 - TYP PILE CAP

NOTES

DETAILING & CONSTRUCTABILITY

- GROUND ANCHORS TO BE EMBEDDED INTO THE GREYWACKE ROCK. GEOTECHNICAL ENGINEER ADVISES THAT THE TOP OF THE ROCK IS AT 6.5-17m BGL.
- GROUND ANCHORS SHALL BE ISCHEBECK TITAN SYSTEM OR SIMILAR APPROVED, INSTALLED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATION.
- THE CONCEPT SCHEME REQUIRES INTERNAL ACCESS THROUGH THE EXISTING TIMBER FLOOR FOR CONCRETE WORK INSIDE THE GROUND LEVEL OF THE BUILDING. ALLOW FOR LOCALISED TIMBER FLOOR TO BE REMOVED FOR ACCESS AND REINSTATED.
- DRILLING OF GROUND ANCHOR CAN LARGELY BE DONE EXTERNALLY.
- FOR DRILLING OF DOWELS INTO EXISTING STRUCTURE, ALLOW FOR REINFORCEMENT SCANNING AND CUTTING OF EXISTING REINFORCEMENT IS NOT ALLOWED.

MATERIAL PROPERTIES

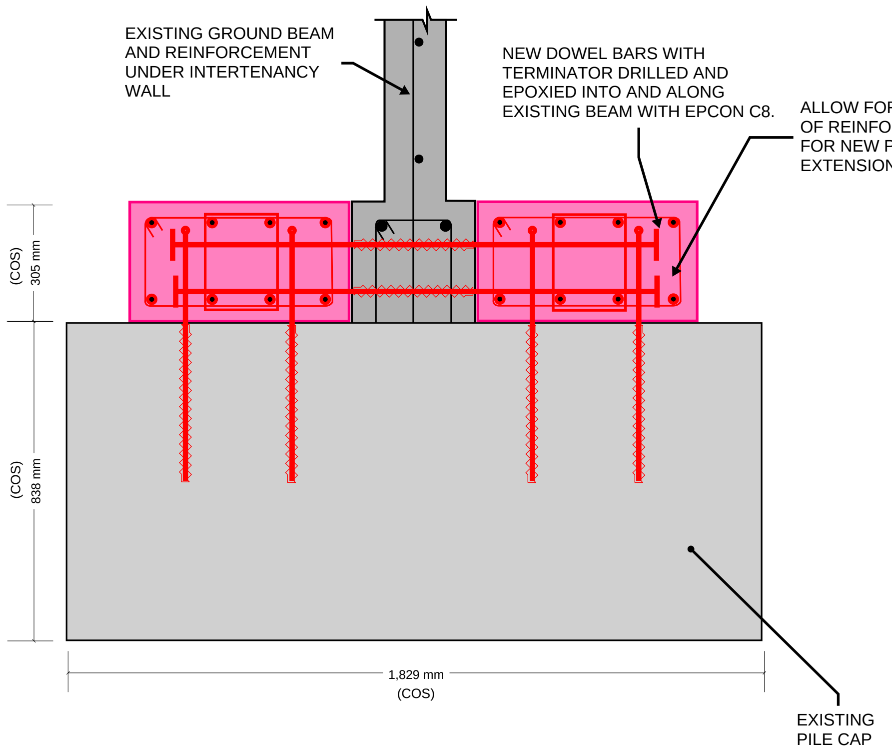
- CONCRETE GRADE 30 MPa TO BE USED.
- REINFORCEMENT GRADE 500E TO BE USED.
- BOLTS TO BE G8.8 SS UNLESS STATED OTHERWISE.
- ALLOW FOR STEELWORK COATING PROTECTION SUITABLE FOR UNDERGROUND EXPOSURE.

GEOTECHNICAL CONSIDERATIONS

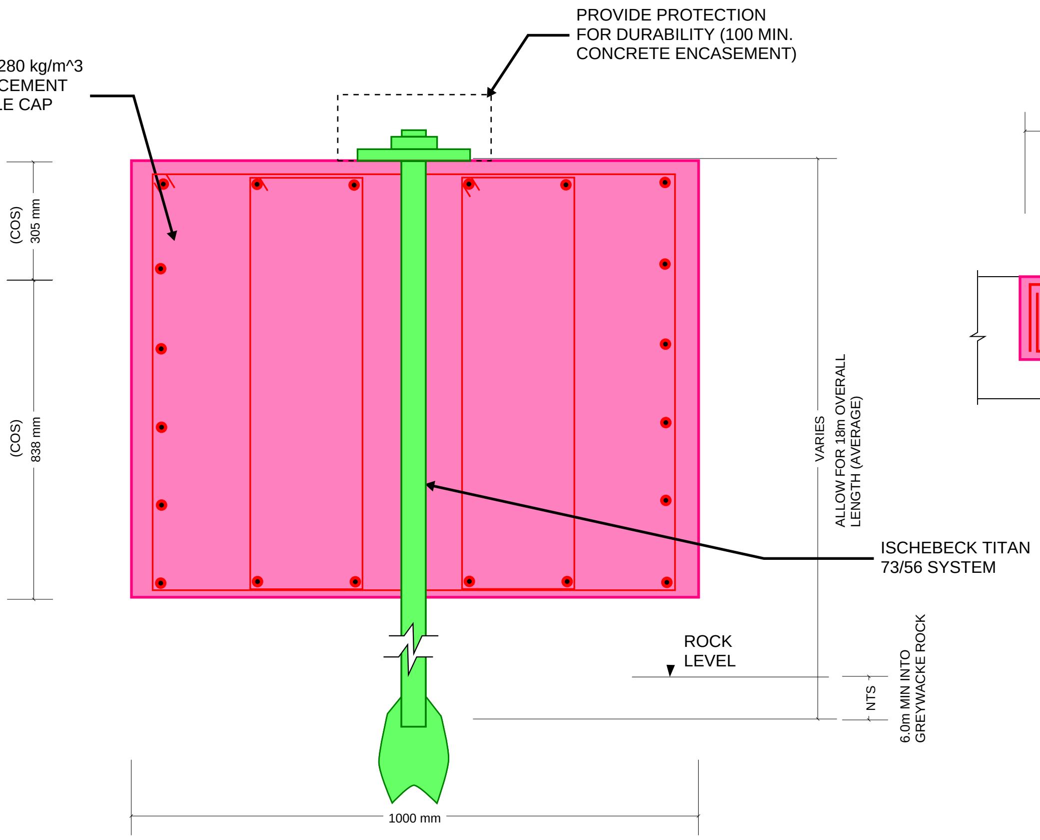
- ALLOW SITE INVESTIGATION AND BORE HOLE TO BE UNDERTAKEN BEFORE START OF STRENGTHENING DESIGN. REFER TO GEOTECHNICAL ENGINEER FOR SITE INVESTIGATION SCOPE.
- THE SITE INVESTIGATION WILL CONFIRM SEISMIC SOIL CLASS, SITE GEOLOGY, PILE CAPACITY AND INFORMATION FOR GROUND ANCHOR DESIGN.
- REFER TO APRIL 2024 BECA GEOTECHNICAL DESKTOP STUDY FOR PRELIMINARY GEOTECHNICAL CONSIDERATIONS.

LEGEND

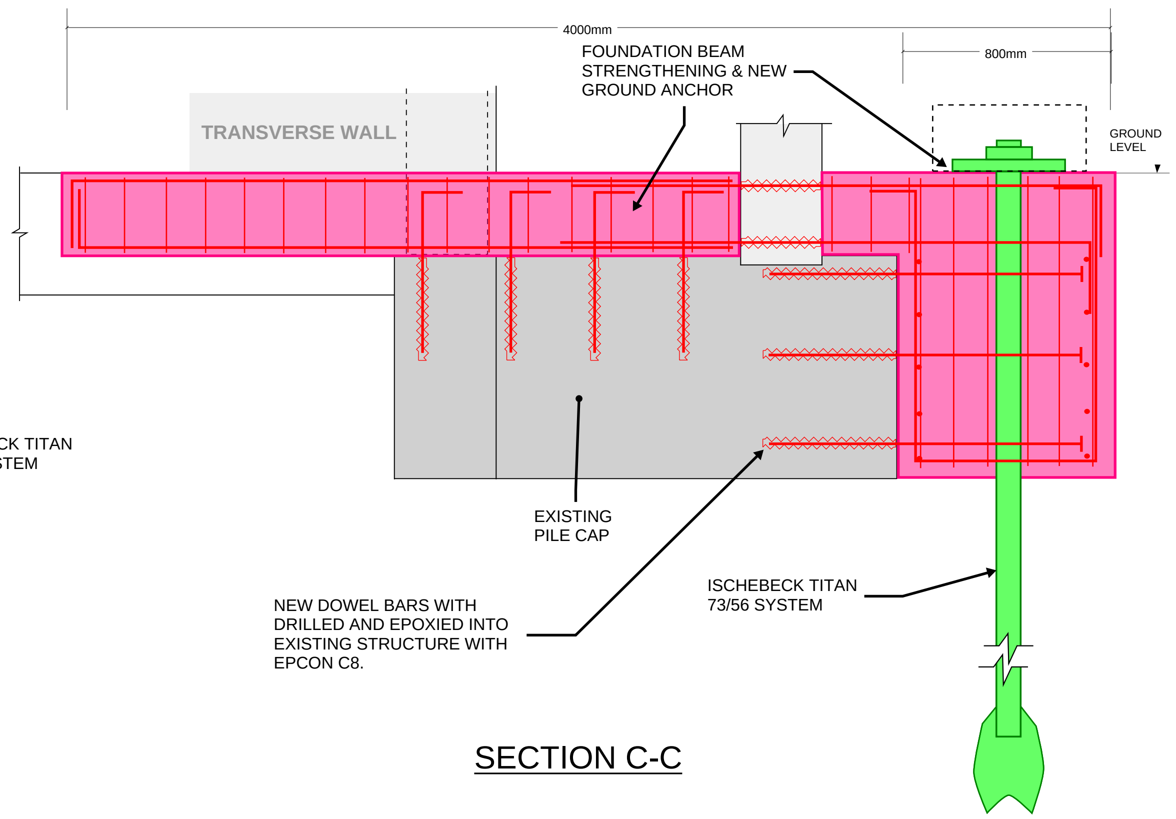
- FOUNDATION BEAM STRENGTHENING. REFER TO SECTION FOR DETAILS.
- NEW TENSION GROUND ANCHOR. ISCHEBECK TITAN 73/56 SYSTEM OR SIMILAR APPROVED.



SECTION A-A



SECTION B-B



SECTION C-C

PRINT DRAWINGS IN COLOUR

Rev	Revision Description	By	App	Date
A	DRAFT FOR REVIEW	EL	AS	29/4/24

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NZBN 9429 0421 10316

Client
WELLINGTON CITY COUNCIL

Project
N0541 - HUP2-T0-SEISMIC ASSESSMENTS

Title
5 KEMP STREET - KOTD CONCEPT STRENGTHENING DESIGN - FOUNDATION OPTION 3

Scale at A3	Drawn
NTS	EL
Date	**Designer**
29/4/2024	EL

Drawing Number	Revision
N0541-RBG-KOTD-XX-SK-ST-00002	A

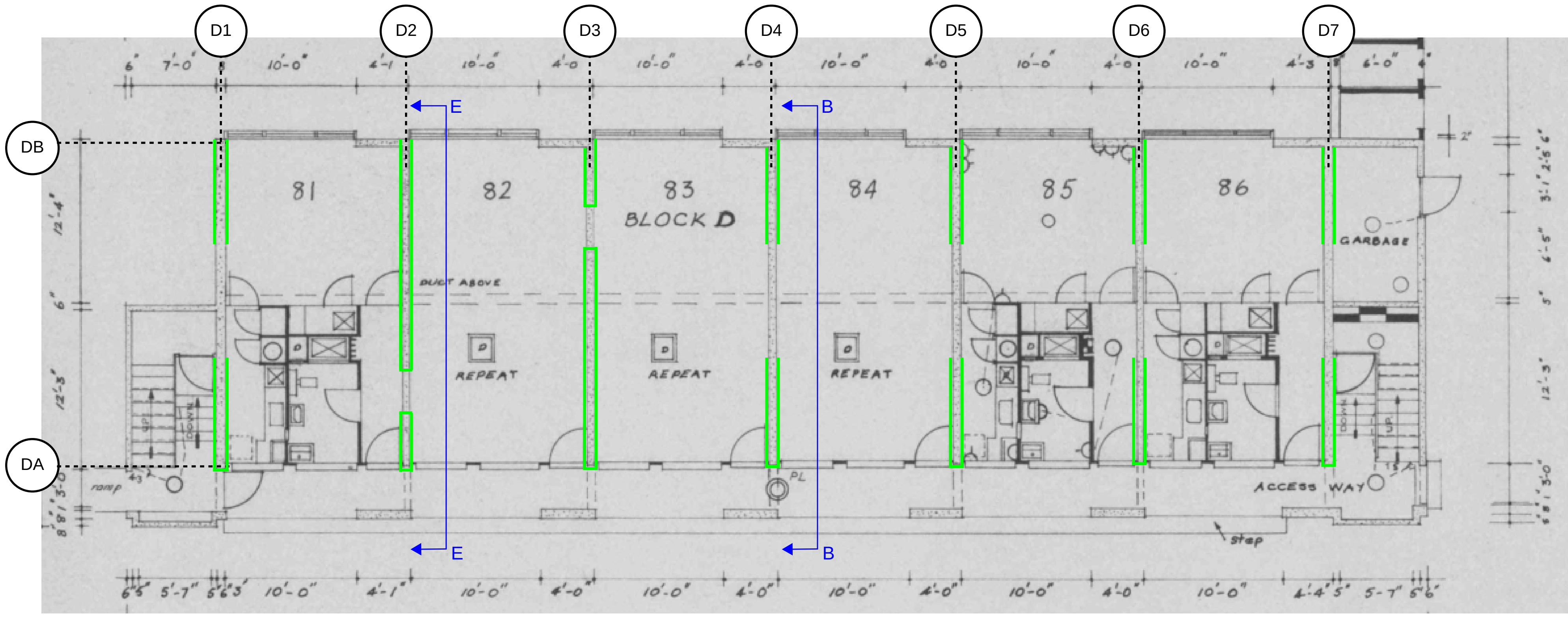
NOTES

- THIS STRENGTHENING DETAIL APPLIES FOR ALL 3 STRENGTHENING CONCEPT OPTIONS.
- FOR WALLS WITH NO DOOR PENETRATIONS, THE FRP WRAP HAS BEEN SPECIFIED FOR ONLY THE END THIRDS.
- ALLOW SCANNING OF EXISTING REINFORCEMENT IN THE WALL BEFORE INSTALLATION OF FRP AND GLASS ANCHORS. NO CUTTING OF THE EXISTING REINFORCEMENT.
- FRP INSTALLED TO MANUFACTURER'S SPEC.
- WALL FINISHES AND FIRE REQUIREMENTS, REFER TO ARCHITECT.

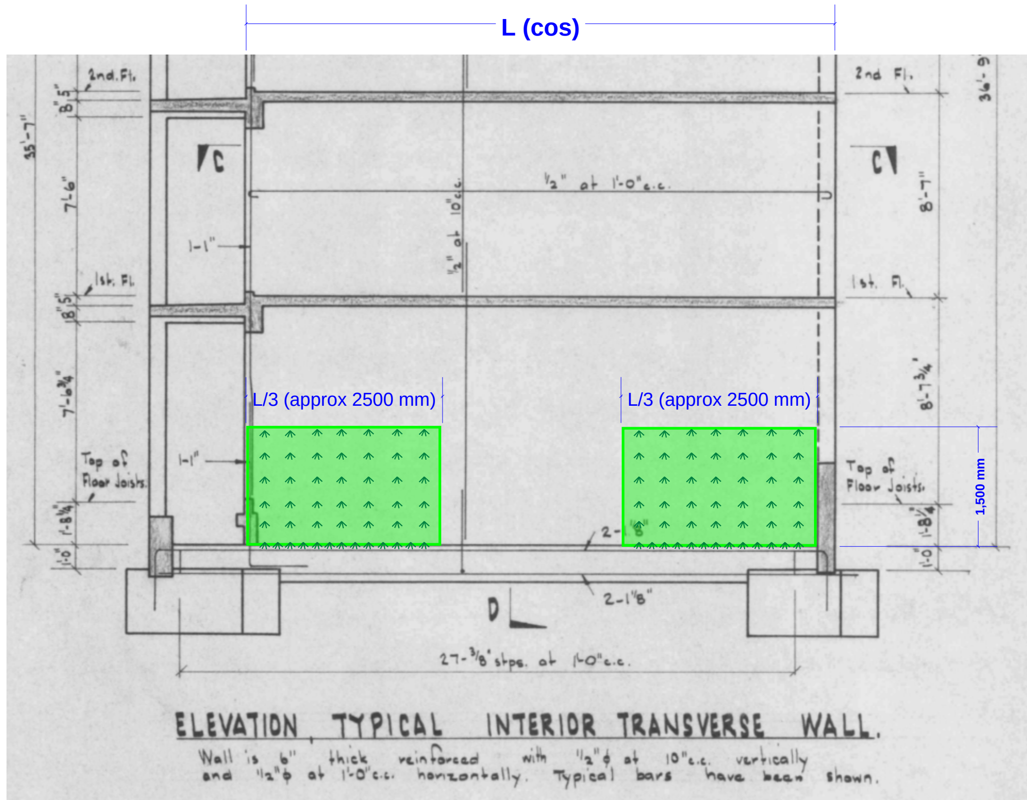
LEGEND

TYFO SEH-51A FRP WRAP OR SIMILAR APPROVED TO EACH WALL FACE

TYFO SEH GLASS ANCHORS

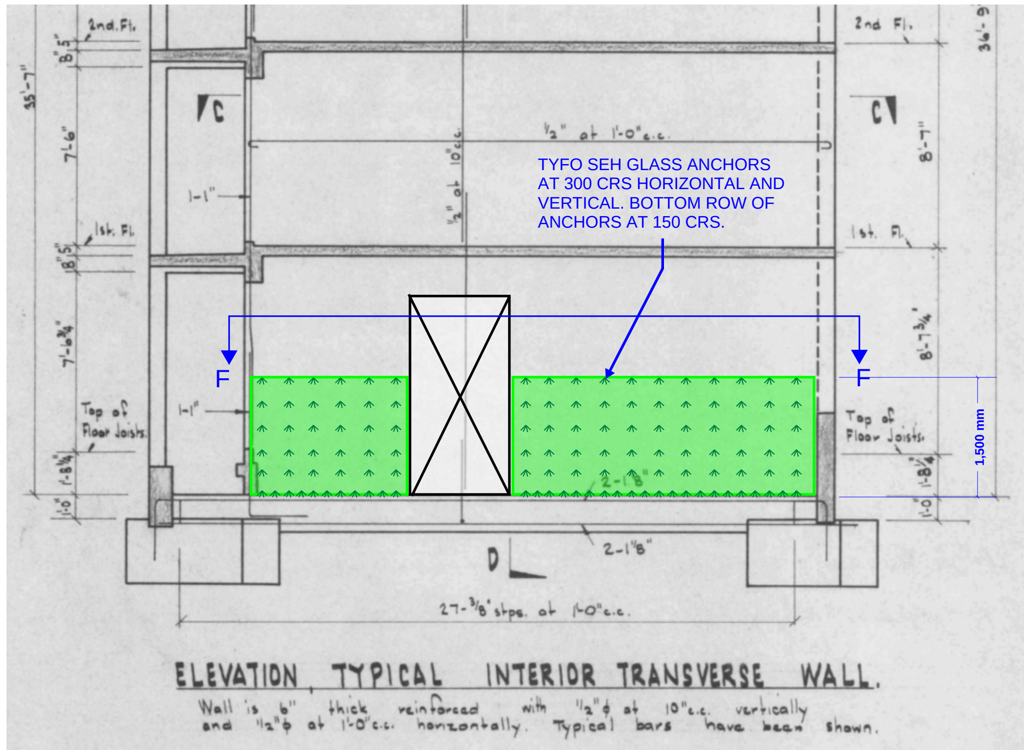


WALL FRP CONFINEMENT LAYOUT



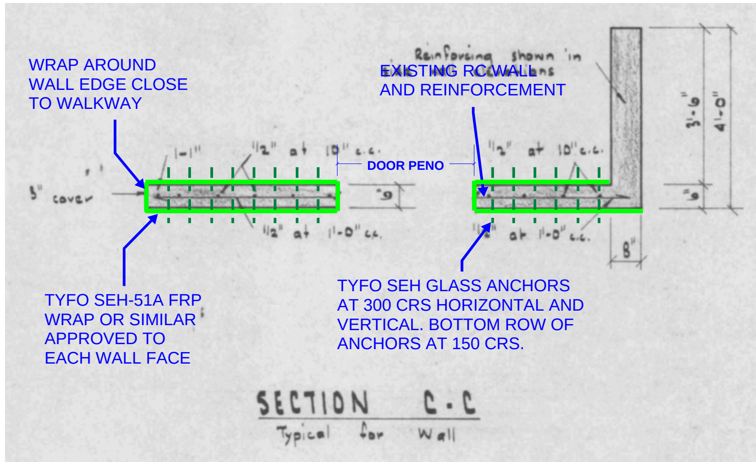
ELEVATION B-B

TYPICAL SHEAR WALL CONFINEMENT STRENGTHENING



ELEVATION E-E

DOOR PLACEMENT INDICATIVE ONLY OF WALLS WITH DOOR OPENINGS



SECTION F-F

PRINT DRAWINGS IN COLOUR

Rev	Revision Description	By	App	Date
A	DRAFT FOR REVIEW	EL	AS	29/4/24

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Client
WELLINGTON CITY COUNCIL

Project
N0541 - HUP2-T0-SEISMIC ASSESSMENTS

Title
5 KEMP STREET - KOTD CONCEPT STRENGTHENING DESIGN - SHEAR WALL (OPTION 1 TO 3)

Scale at A3	Drawn
NTS	EL
Date	**Designer**
29/4/2024	EL

Drawing Number	Revision
N0541-RBG-KOTD-XX-SK-ST-00004	A

Appendix E
Original Drawings, Specification, and 2014 Opus Design Features Report

HUP2-T0-Seismic Assessments

KOTUKU FLATS

KEMP STREET - KILBIRNIE

104 SINGLE PERSON UNITS

WELLINGTON CITY CORPORATION
ARCHITECTURAL DIVISION
TOWN PLANNING DEPARTMENT

STEWART G. REES & ASSOCIATES
CONSULTING ENGINEERS

CONTRACT No. 2278.

SET No. 1

TOWN PLANNING DEPARTMENT
ARCHITECTURAL DIVISION
ORIGINAL CONTRACT DOCUMENT
C.M. Muir CITY ARCHITECT

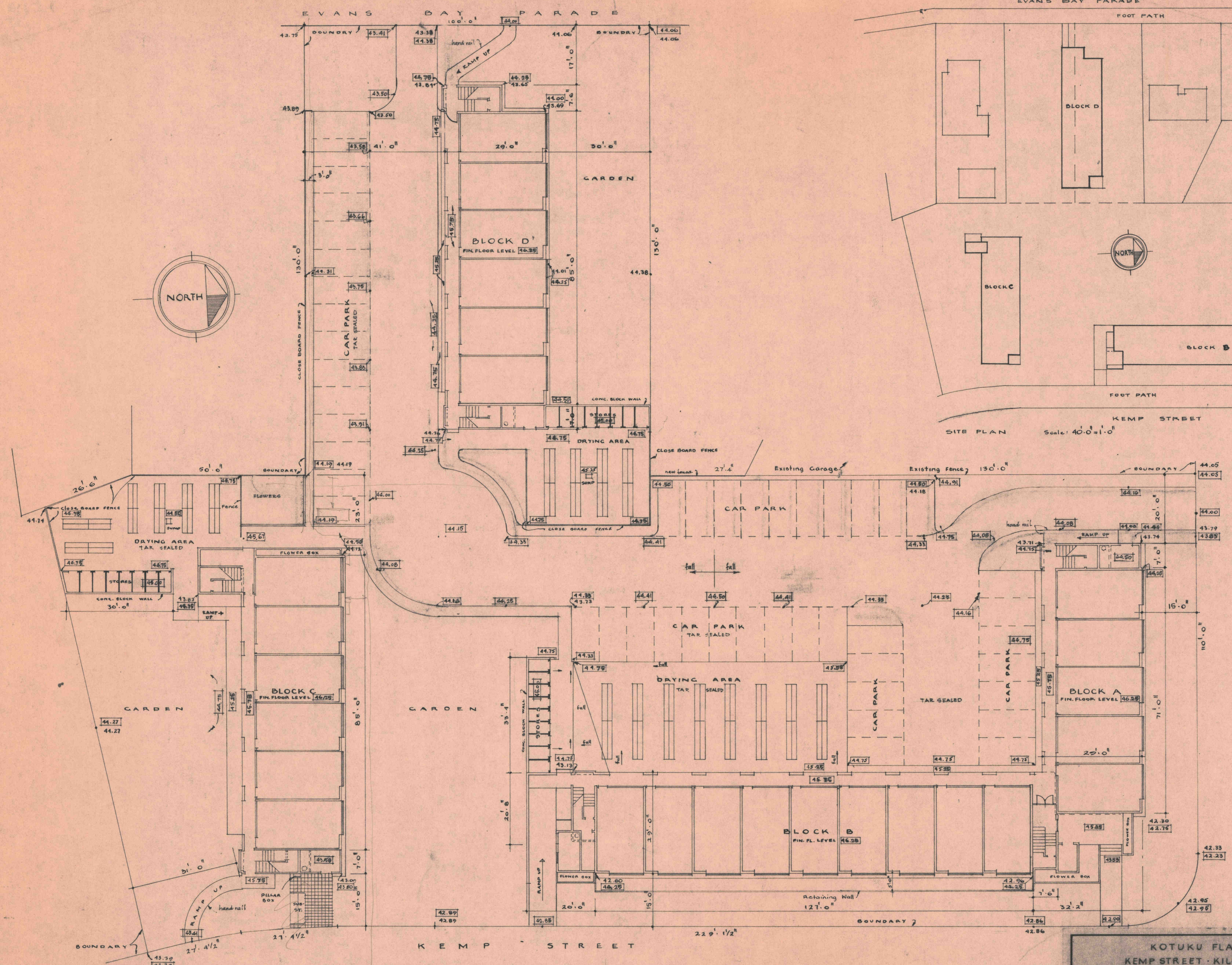
DRAWING INDEX

ARCHITECTURAL DRAWINGS AM. 247/1 to 44

No. 1 Site & Anciliary Plan
No. 2 ⅛" Scale Ground Floor Plan Of Block A & B
No. 3 ⅛" Scale Ground Floor Plan Of Block C & D
No. 4 ⅛" Scale Roof Plan Block A & B
No, 5 ⅛" Scale Roof Plan Block C & D
No. 6 Elevations Of Block A & B
No. 7 West Elevation Of Block A & B, Elevations Of Block C
No. 8 ⅛" Scale Elevations Of Block D
No. 9 ½" Scale Floor Plans
No. 10 ½" Scale Floor Plans
No. 11 Bathroom Details
No. 12 ½" Scale Typical Cross Section For Blocks A, B, C & D
No. 13 Plan Of Stair Block A West End & Blocks C & D East End But Reversed
No. 14 Stair Details Blocks A West End & Blocks C & D East End But Reversed
No. 15 Stair Details Block B North End, Ground Floor Plan Section Elevation
No. 16 Stair Details, Block B North End Plans & CROSS Section
No. 17 Stair Details Block B North End Longitudinal Sections Etc.
No. 18 Stair Details Block B South End Ground Floor Plan & Sections
No. 19 Stair Details Block B South End Typical Floor Plan & Third Floor Plan
No. 20 Stair Details Block B South End Sections C - C, D - D & E - E
No. 21 Stair Plans Block C West End
No. 22 Stair Details Block C West End Sections.
No. 23 Stair Details Block D West End Floor Plans
No. 24 Stair Details Block D West End Sections
No. 25 Curtain Wall Details (Window Type W 1)
No. 26 Details Of Metal Windows
No. 27 Details Of Timber Windows
No. 28 Doors & Door Frame Details
No. 29 Rubbish Chute Details
No. 30 Miscellaneous Details
No. 31 Miscellaneous Details
No. 32 Miscellaneous Details
No. 33 Sewer & Drainage Plan Block A & B
No. 34 ⅛" Scale Sewer & Drainage Plan Block C
No. 35 Sewer & Drainage Block D
No. 36 Cold Water Reticulation Block A & B
No. 37 Cold Water Reticulation Block C
No. 38 Cold Water Reticulation Block D
No. 39 Hot & Cold Water Reticulation Diagrams For Blocks A, B, C, & D
No. 40 Plan Of Sealed Area
No. 41 Details Of Sump, Kerbs, Channels, Ramp Etc.
No. 42 Ground Levels Under Blocks
No. 43 Metal Lettering
No. 44 Metal Lettering

STRUCTURAL DRAWINGS 879/1 to 37

No. 1 Blocks A & B Foundation Plan
No. 2 Pilecap Reinforcing Details
No. 3 Blocks A & B Ground Floor Slab Plans
No. 4 Interior Transverse Wall For All Blocks
No. 5 Block A South Wall
No. 6 Block A North Wall
No. 7 Block A East Wall
No. 8 Block A West Wall
No. 9 Interior Longitudinal Wall At East End Of Block A
No. 10 Block A Slab Plan & Sections
No. 11 Interior Longitudinal Beams At 1st, 2nd & 3rd Floors
No. 12 Longitudinal Roof Beams To Blocks A, B, C & D
No. 13 Block A Stairs At West End
No. 14 Block A Stairs At West End
No. 15 Stair Walls Block A West End. Block C & D East End
No. 16 Sections To Stair Walls At West End Of Blocks A & D
No. 17 Block B East & West Wall Foundation Beams
No. 18 Block B West Wall
No. 19 Block B East Wall
No. 20 Block B North & South Walls
No. 21 Block B Slab Plan & Sections
No. 22 Block B Stairs At North End
No. 23 Block B Stairs At North End
No. 24 Block B Stairs At South End
No. 25 Block B Stair Walls At South End
No. 26 Block B Stairs At South End
No. 27 Blocks C & D Foundation Plan
No. 28 Block C South Wall
No. 29 Block C & D North Wall
No. 30 Block C West Wall
No. 31 Walls Stairways West End Block C
No. 32 Block C Slab Plan
No. 33 Block D South Wall
No. 34 Block D Slab Plan
No. 35 Block D Stairs At West End
No. 36 Block D Stairs At West End
No. 37 Block D West End Details - Water Tank



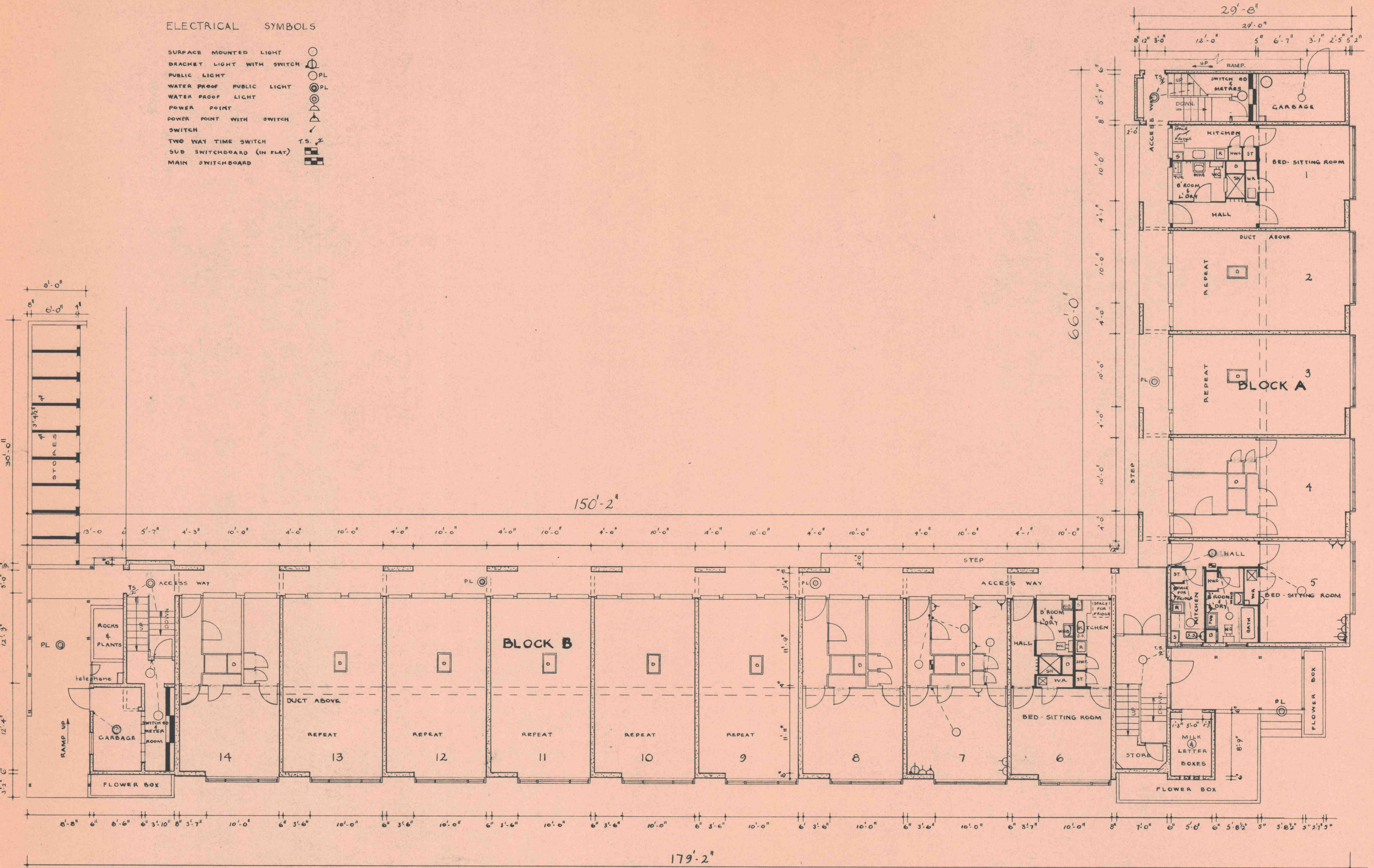
NOTES:

1. EXISTING LEVELS SHOWN THUS 45.00
   FINAL LEVELS SHOWN THUS $\boxed{45.00}$
2. FOR EXTENT OF SEALING AND KERBS SEE SHEET No. 40

KOTUKU FLATS KEMP STREET · KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	CONTRACT NUMBER 2278 SCALE, 1/16" = 1'.0", 40'.0" = 1" SITE AND ANCILIARY PLAN	SHEET No. 1 IN SET OF: 44
WELLINGTON CITY CORPORATION TOWN PLANNING DEPARTMENT ARCHITECTURAL DIVISION K. V. CLARKE, CITY PLANNER	TRACING NO. A.M. 247/1 DESIGNED W. J. BEECH DRAWN M. COLARIC MARCH '68 TRACED P. LENIHAN JUNE '68 CHECKED APPROVED C.M. Muir CITY ARCHITECT	

ELECTRICAL SYMBOLS

- SURFACE MOUNTED LIGHT
- BRACKET LIGHT WITH SWITCH
- PUBLIC LIGHT
- WATER PROOF PUBLIC LIGHT
- WATER PROOF LIGHT
- POWER POINT
- POWER POINT WITH SWITCH
- SWITCH
- TWO WAY TIME SWITCH T.S.
- SUB SWITCHBOARD (IN FLAT)
- MAIN SWITCHBOARD



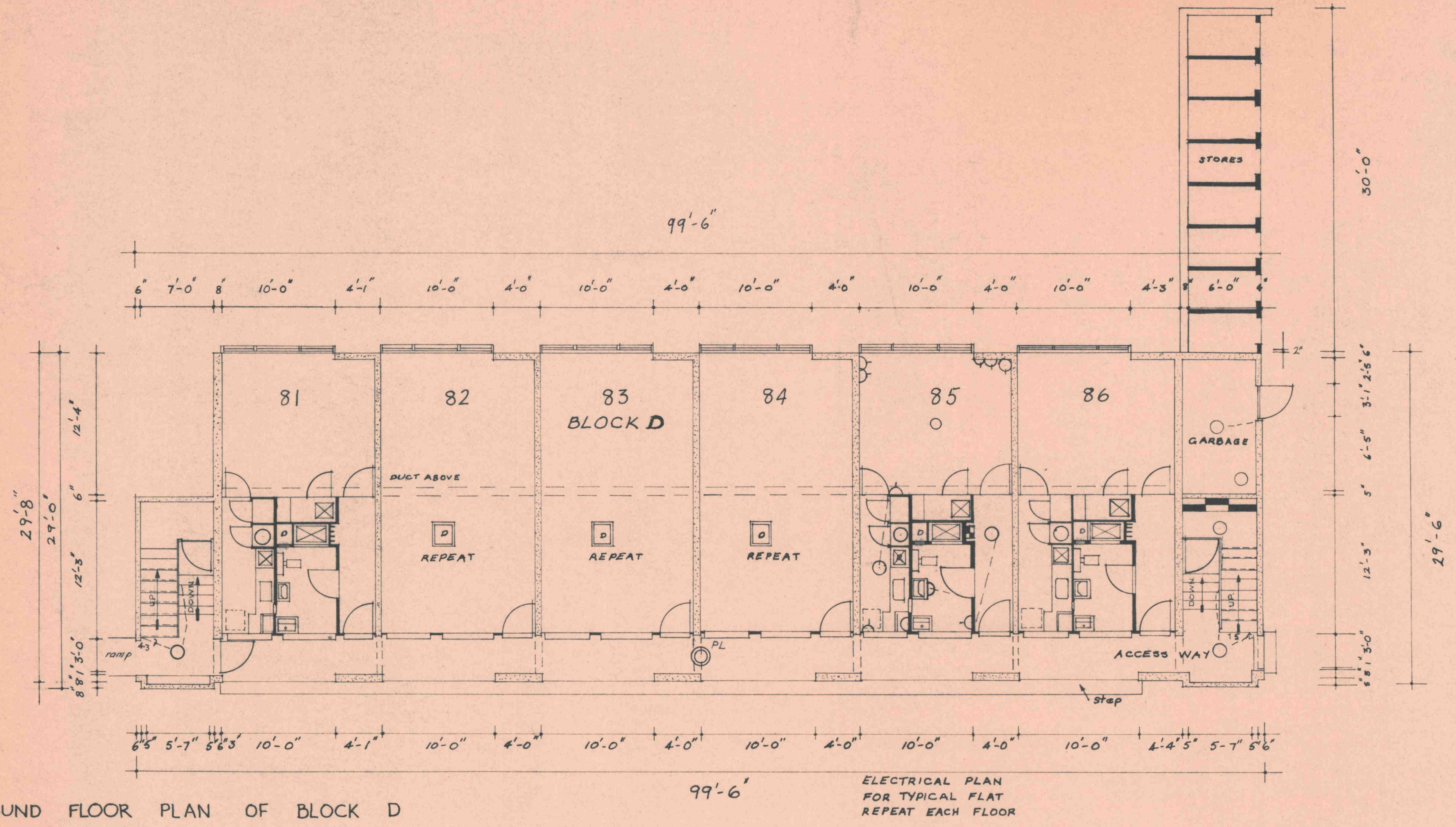
ELECTRICAL PLAN
FOR TYPICAL FLAT
REPEAT EACH FLOOR

NOTE: FOR INTERIOR DIMENSIONS OF EACH FLAT AND DIMENSIONS OF STAIR CASES ETC., SEE 1/2" SCALE DRAWINGS

1/8" SCALE GROUND FLOOR PLAN

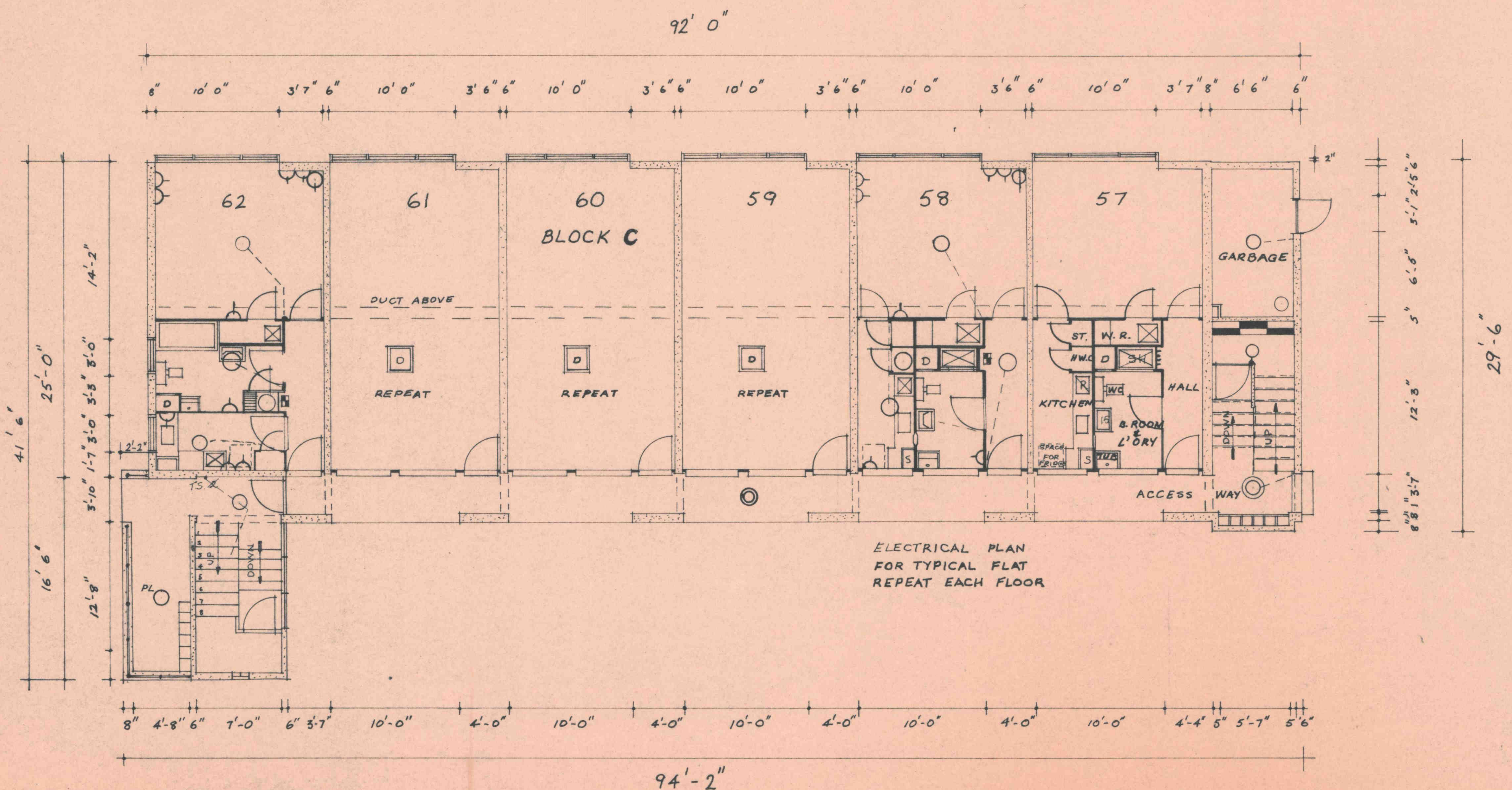
KOTUKU FLATS KEMP STREET - KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	CONTRACT NUMBER 2278 SCALE as shown 1/8" SCALE GROUND FLOOR PLAN OF BLOCK A & B	SHEET No. 2 IN SET OF: 44
WELLINGTON CITY CORPORATION TOWN PLANNING DEPARTMENT ARCHITECTURAL DIVISION K. V. CLARKE, CITY PLANNER	TRACING NO. A.M. 247/2	

DESIGNED	W. J. BEECH	
DRAWN	P. LENIHAN	DEC. '67
TRACED	P. LENIHAN	JUNE '68
CHECKED	[illegible]	
APPROVED	C.M. Muir	CITY ARCHITECT



⅛" SCALE GROUND FLOOR PLAN OF BLOCK D

NOTE: FOR INTERIOR DIMENSIONS OF EACH FLAT AND DIMENSIONS OF STAIR CASES ETC, SEE ¼" SCALE DRAWINGS
FIRST, SECOND AND THIRD FLOORS SIMILAR



NOTE: FOR POSITION OF STORES SEE SITE AND ANCILLARY PLAN, ALSO DRAINAGE PLAN.

⅛" SCALE GROUND FLOOR PLAN OF BLOCK C

ELECTRICAL SYMBOLS

- SURFACE MOUNTED LIGHT
- BRACKET LIGHT WITH SWITCH
- PUBLIC LIGHT — PL
- WATER PROOF PUBLIC LIGHT — PL
- WATER PROOF LIGHT
- POWER POINT
- POWER POINT WITH SWITCH
- SWITCH
- TWO WAY TIME SWITCH — T.S.
- SUB SWITCHBOARD (IN FLAT)
- MAIN SWITCHBOARD

KOTUKU FLATS
KEMP STREET KILBIRNIE
FOR THE WELLINGTON CITY CORPORATION

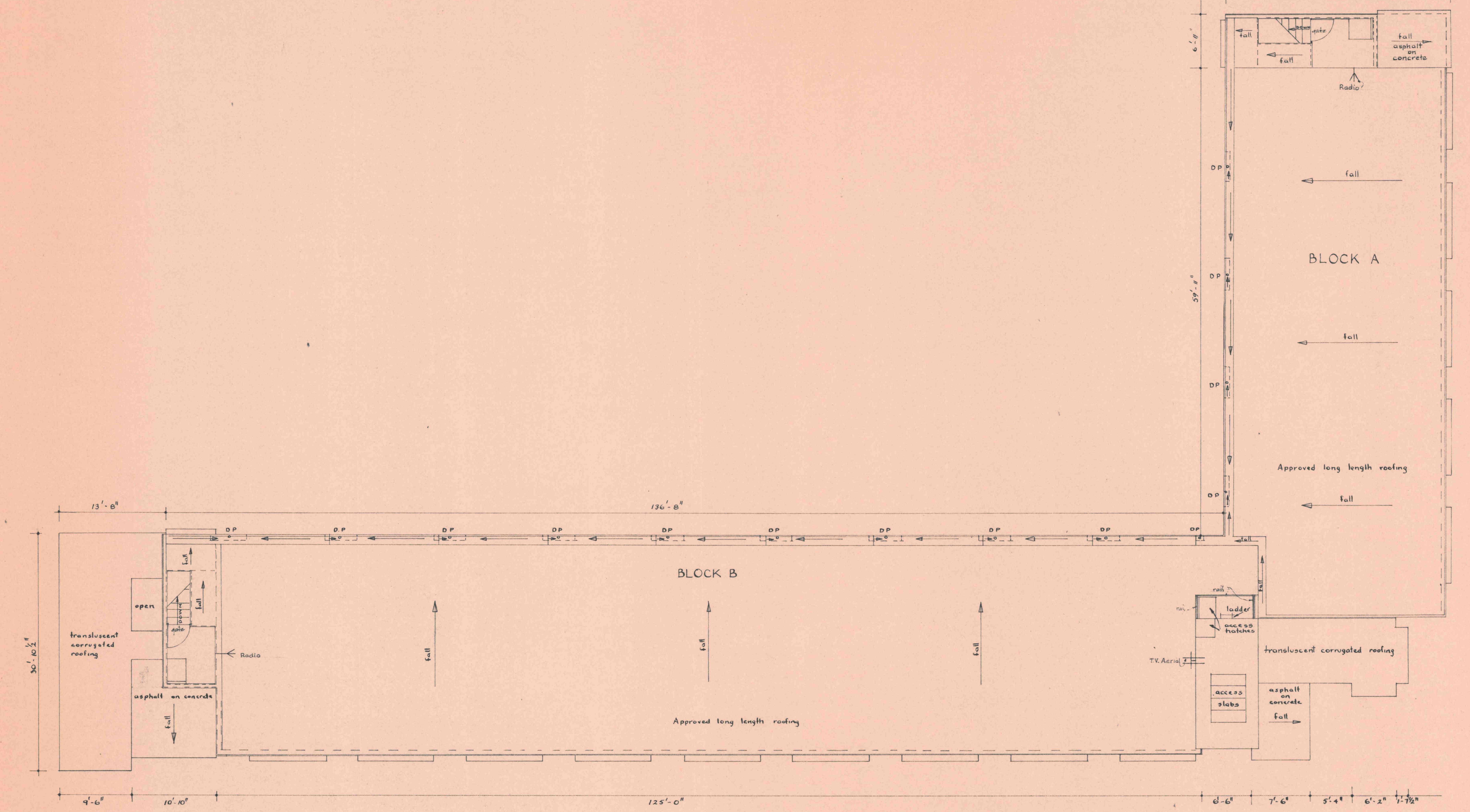
CONTRACT NUMBER 2278
SCALE as shown
⅛" SCALE GROUND FLOOR PLAN OF BLOCK C & D
SHEET No. 3 IN SET OF: 44

WELLINGTON CITY CORPORATION
TOWN PLANNING DEPARTMENT
ARCHITECTURAL DIVISION

K. V. CLARKE, CITY PLANNER

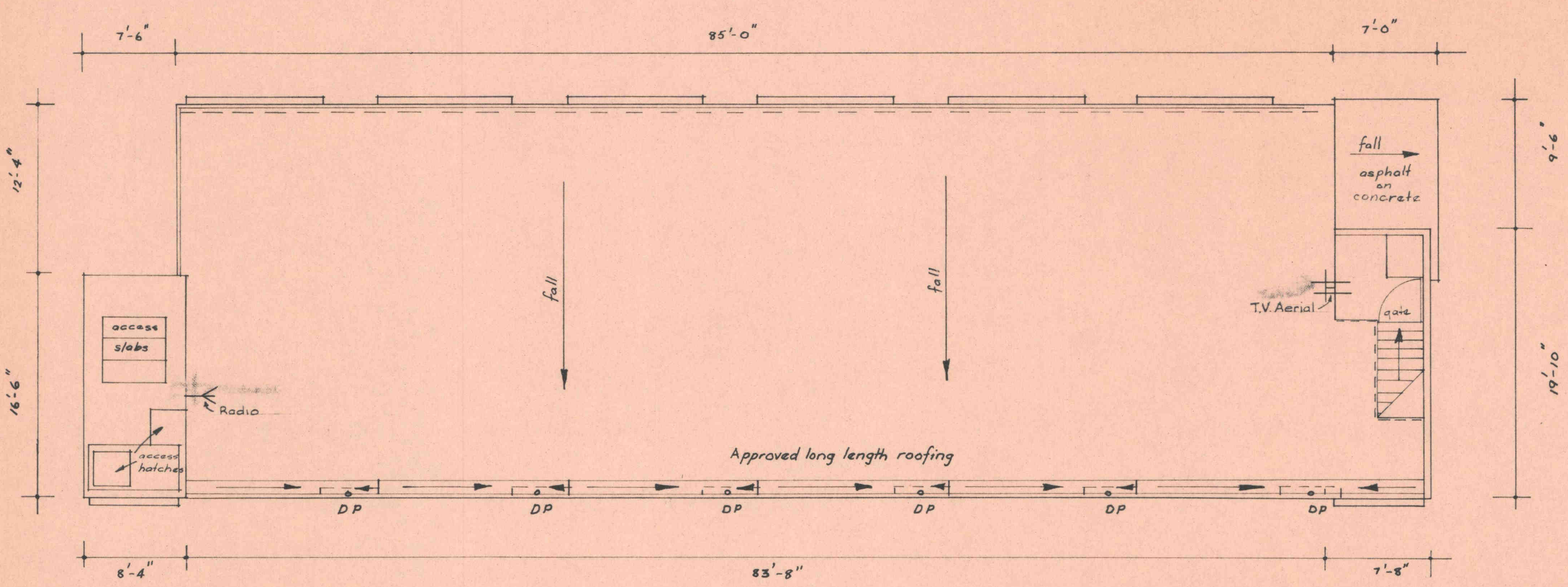
TRACING NO. A.M. 247/3

DESIGNED	W.J. BEECH
DRAWN	P. LENIHAN
TRACED	S. ZARAVINOS
CHECKED	ejb
APPROVED	C.W. Muir CITY ARCHITECT

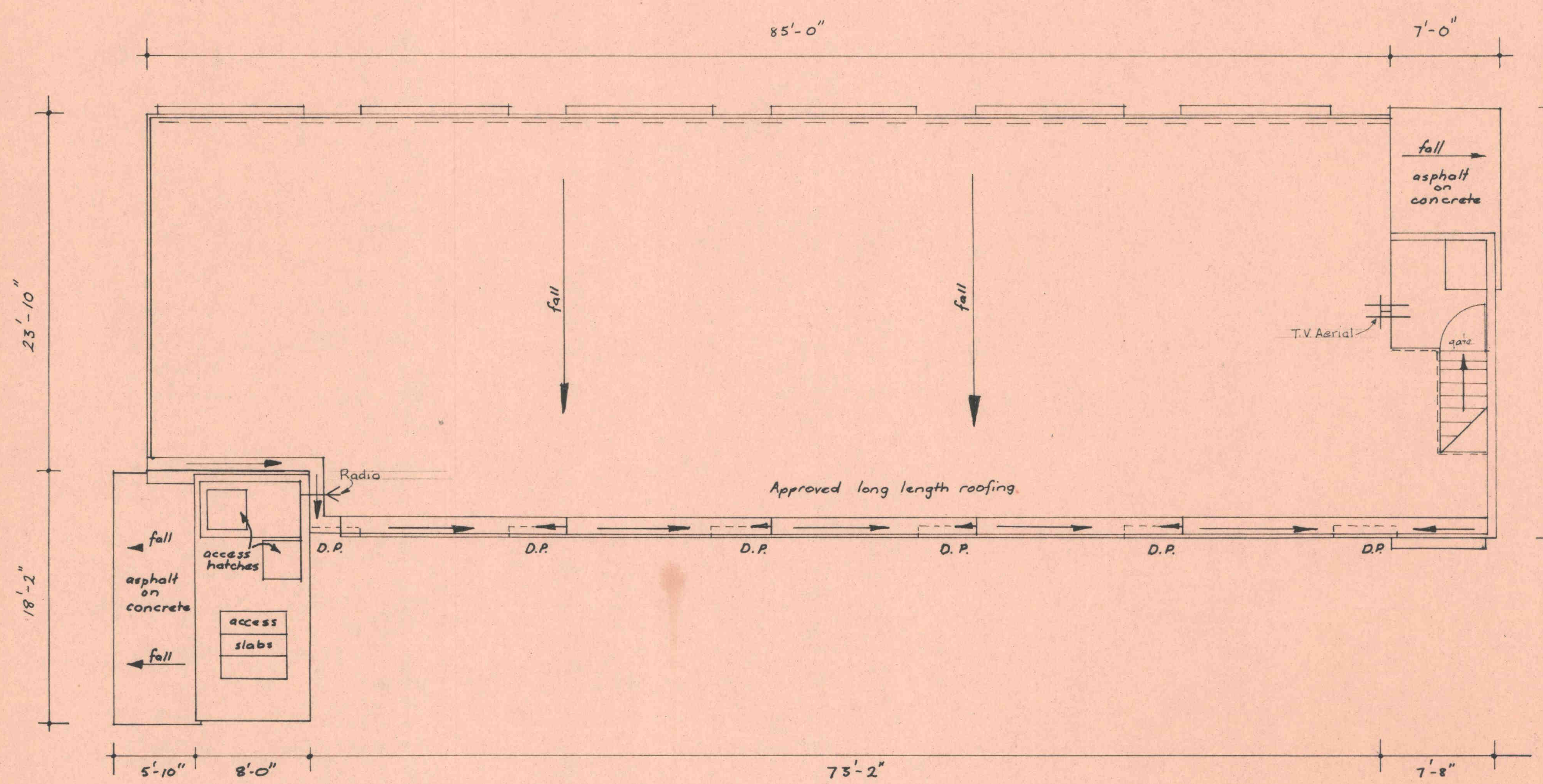


1/8" SCALE ROOF PLAN OF BLOCKS A AND B

KOTUKU FLATS KEMP STREET - KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	CONTRACT NUMBER 2278 SCALE as shown 1/8" SCALE ROOF PLAN BLOCK A & B	SHEET No. 4 IN SET OF: 44
WELLINGTON CITY CORPORATION TOWN PLANNING DEPARTMENT ARCHITECTURAL DIVISION K. V. CLARKE, CITY PLANNER	TRACING NO. A.M. 247/4. DESIGNED W. J. BEECH DRAWN P. LENIHAN - APR. '68 TRACED P. LENIHAN JUNE '68 CHECKED WB APPROVED C.M. Muir CITY ARCHITECT	



1/8" SCALE ROOF PLAN OF BLOCK D



1/8" SCALE ROOF PLAN OF BLOCK C

KOTUKU FLATS
KEMP STREET KILBIRNIE
FOR THE WELLINGTON CITY CORPORATION

CONTRACT NUMBER 2278
as shown
1/8" SCALE ROOF PLAN BLOCKS C & D

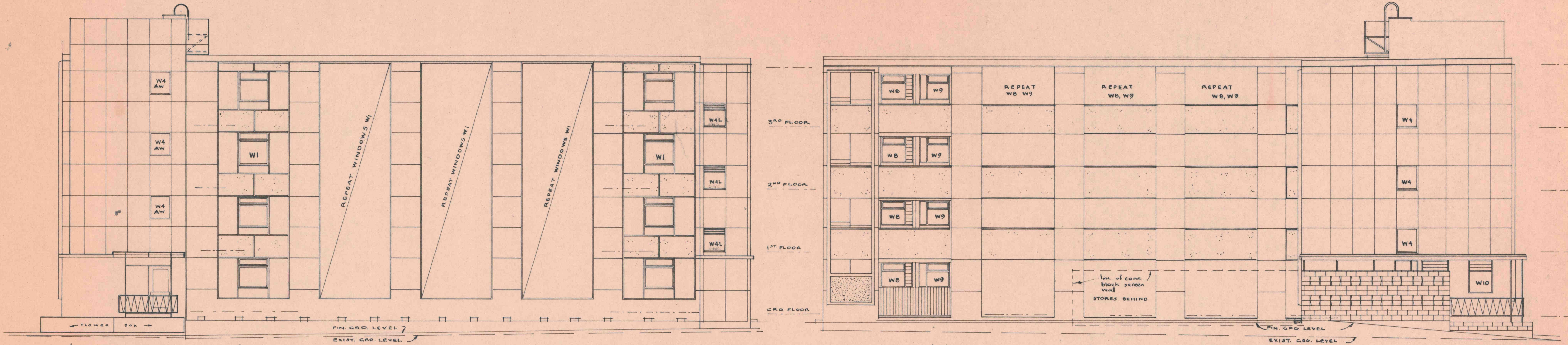
SHEET No. 5 IN SET OF 44

WELLINGTON CITY CORPORATION
TOWN PLANNING DEPARTMENT
ARCHITECTURAL DIVISION

TRACING NO. A.M 247/5

DESIGNED	W.J. BEECH
DRAWN	P. LENIHAN
TRACED	S. ZARAVINOS
CHECKED	
APPROVED	C.M. Muir CITY ARCHITECT

K.V. CLARKE, CITY PLANNER

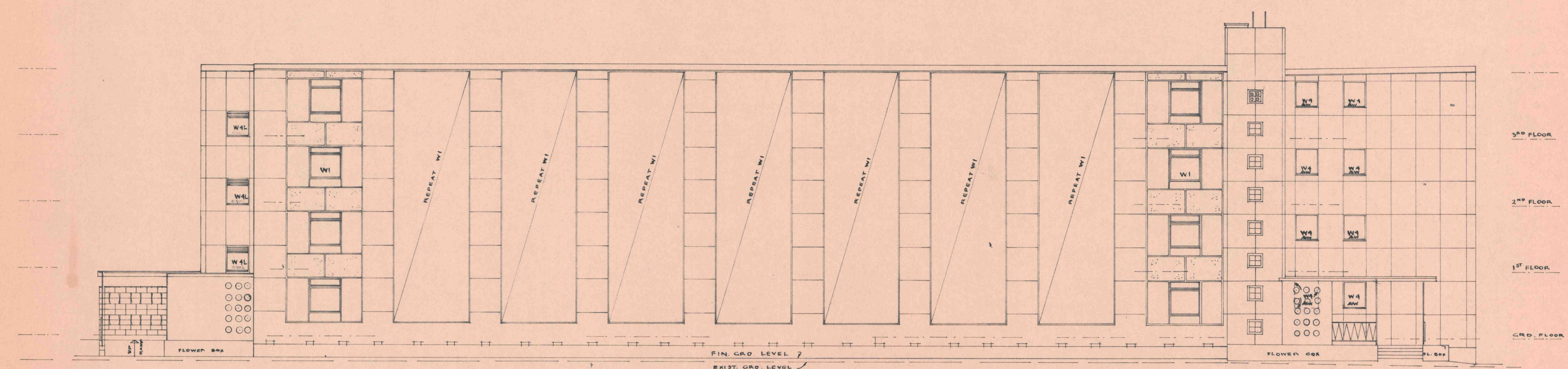


1/8" SCALE NORTH ELEVATION OF BLOCK B

1/8" SCALE NORTH ELEVATION OF BLOCK A

1/8" SCALE SOUTH ELEVATION OF BLOCK A

1/8" SCALE SOUTH ELEVATION OF BLOCK B

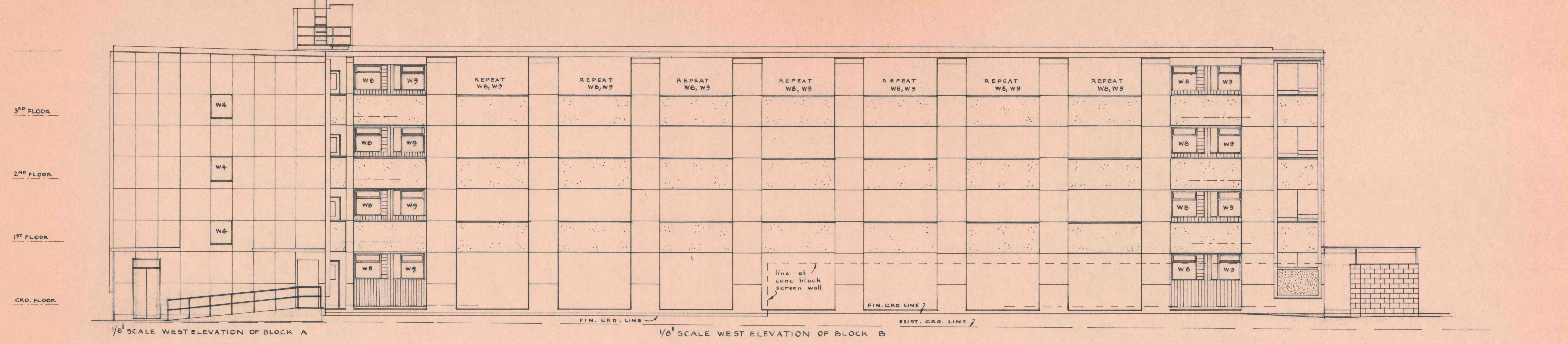


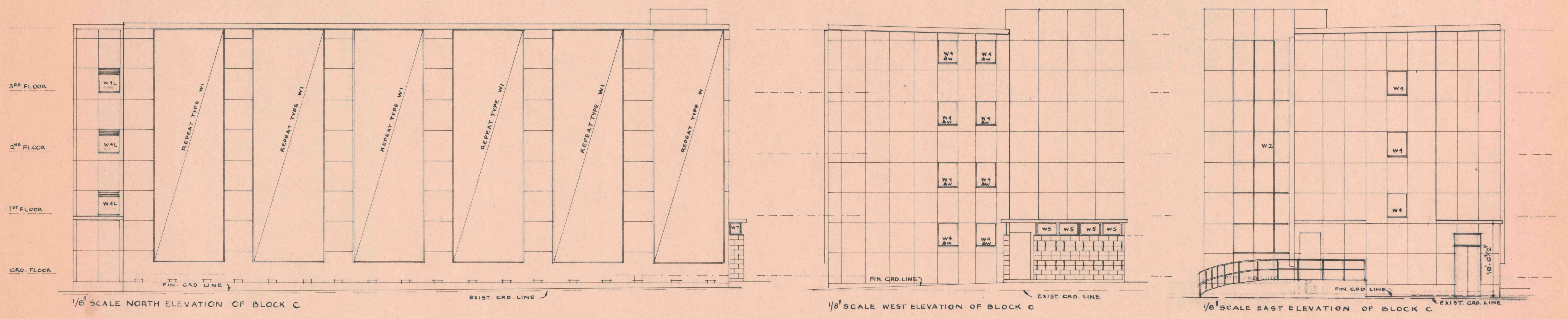
1/8" SCALE EAST ELEVATION OF BLOCK B

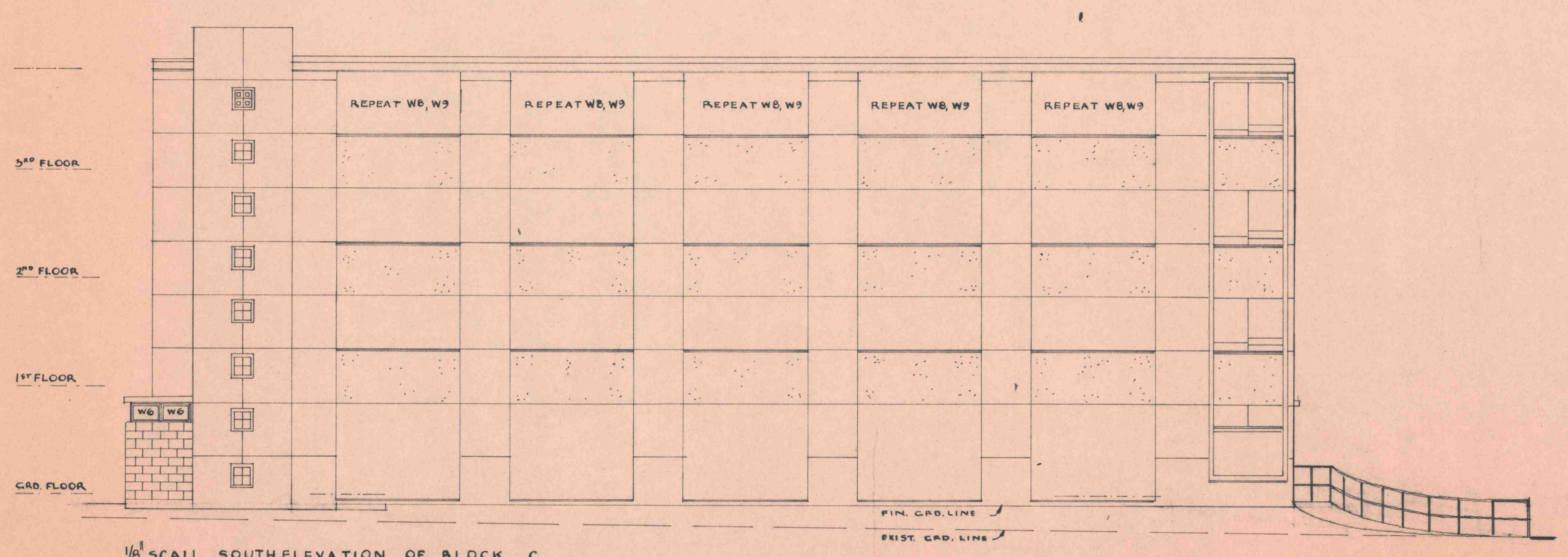
1/8" SCALE ELEVATION OF BLOCK A

KOTUKU FLATS KEMP STREET · KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	CONTRACT NUMBER 2278 SCALE AS SHOWN ELEVATIONS OF BLOCKS A AND B	SHEET No. 6 IN SET OF: 44
WELLINGTON CITY CORPORATION TOWN PLANNING DEPARTMENT ARCHITECTURAL DIVISION K. V. CLARKE, CITY PLANNER	TRACING NO. A. M. 247/6	

DESIGNED	W. J. BEECH	
DRAWN	M. COLARIĆ.	MARCH 68
TRACED	P. LENIHAN	JULY 68
CHECKED		
APPROVED	C.M. Muir	CITY ARCHITECT

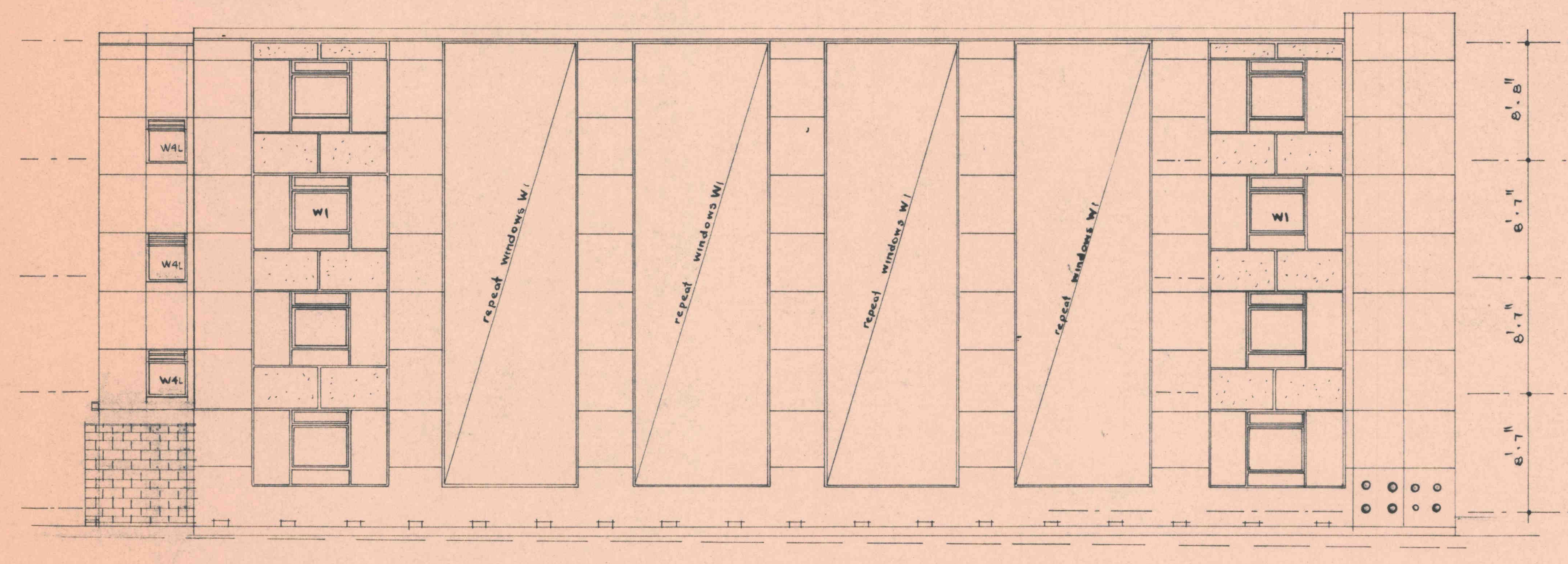




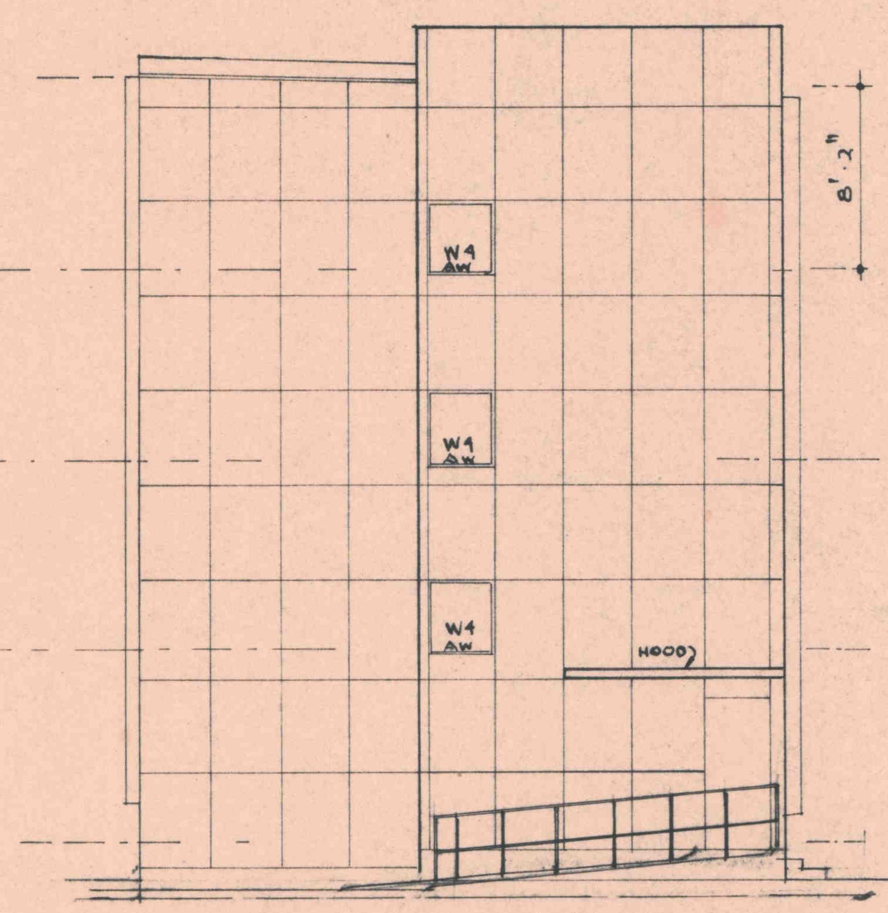


KOTUKU FLATS KEMP STREET · KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	CONTRACT NUMBER 2278 SCALE AS SHOWN WEST ELEVATION OF BLOCK A AND B. ELEVATIONS OF BLOCK C	SHEET No. 7 IN SET OF: 44
WELLINGTON CITY CORPORATION TOWN PLANNING DEPARTMENT ARCHITECTURAL DIVISION K. V. CLARKE, CITY PLANNER	TRACING NO. A. M. 247/7	

DESIGNED	W. J. BEECH	
DRAWN	M. COLARIC	MARCH '68
TRACED	P. LENIHAN	JULY '68
CHECKED	WJB	
APPROVED	C.M. Main	CITY ARCHITECT

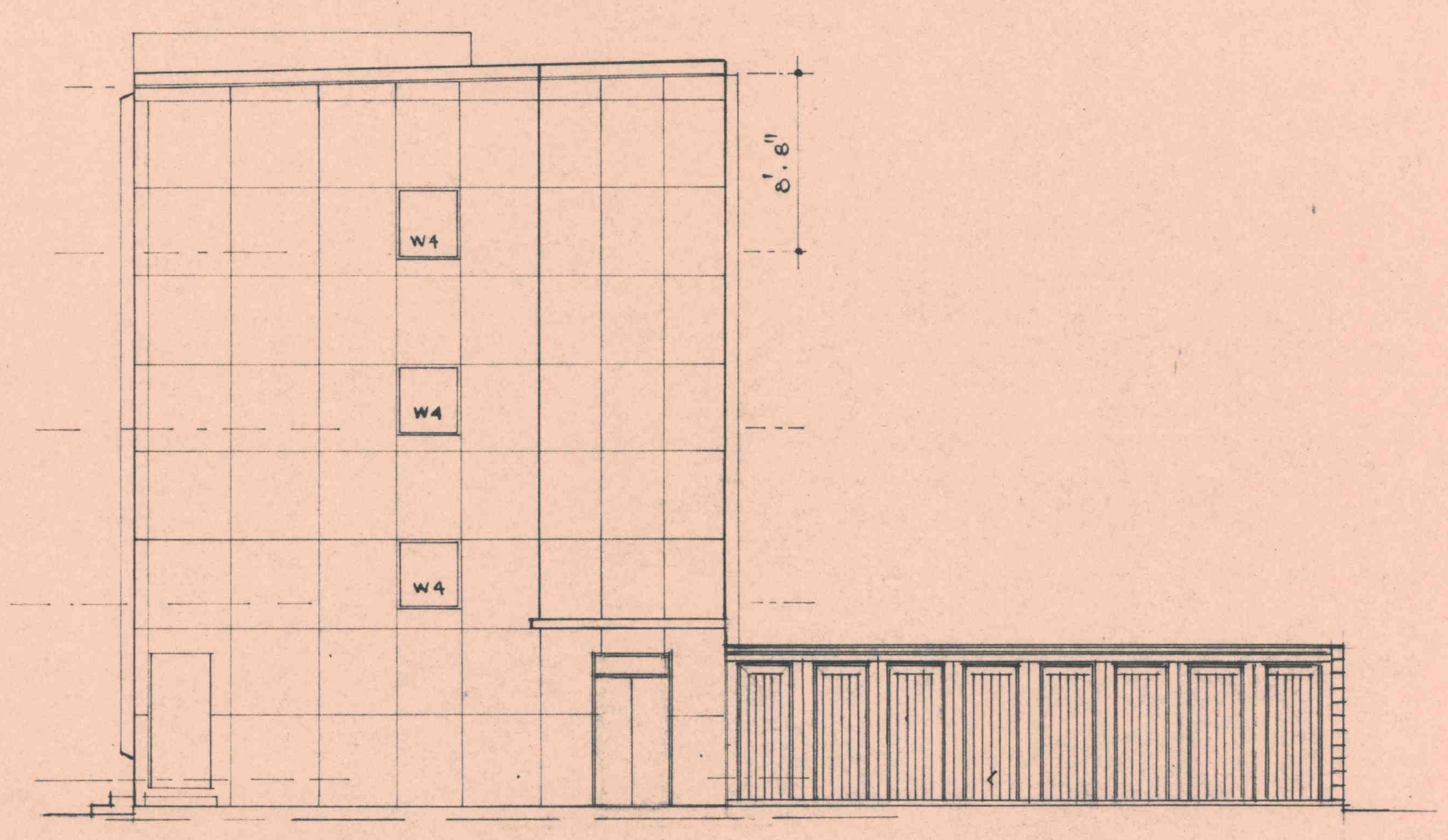


1/8" SCALE NORTH ELEVATION



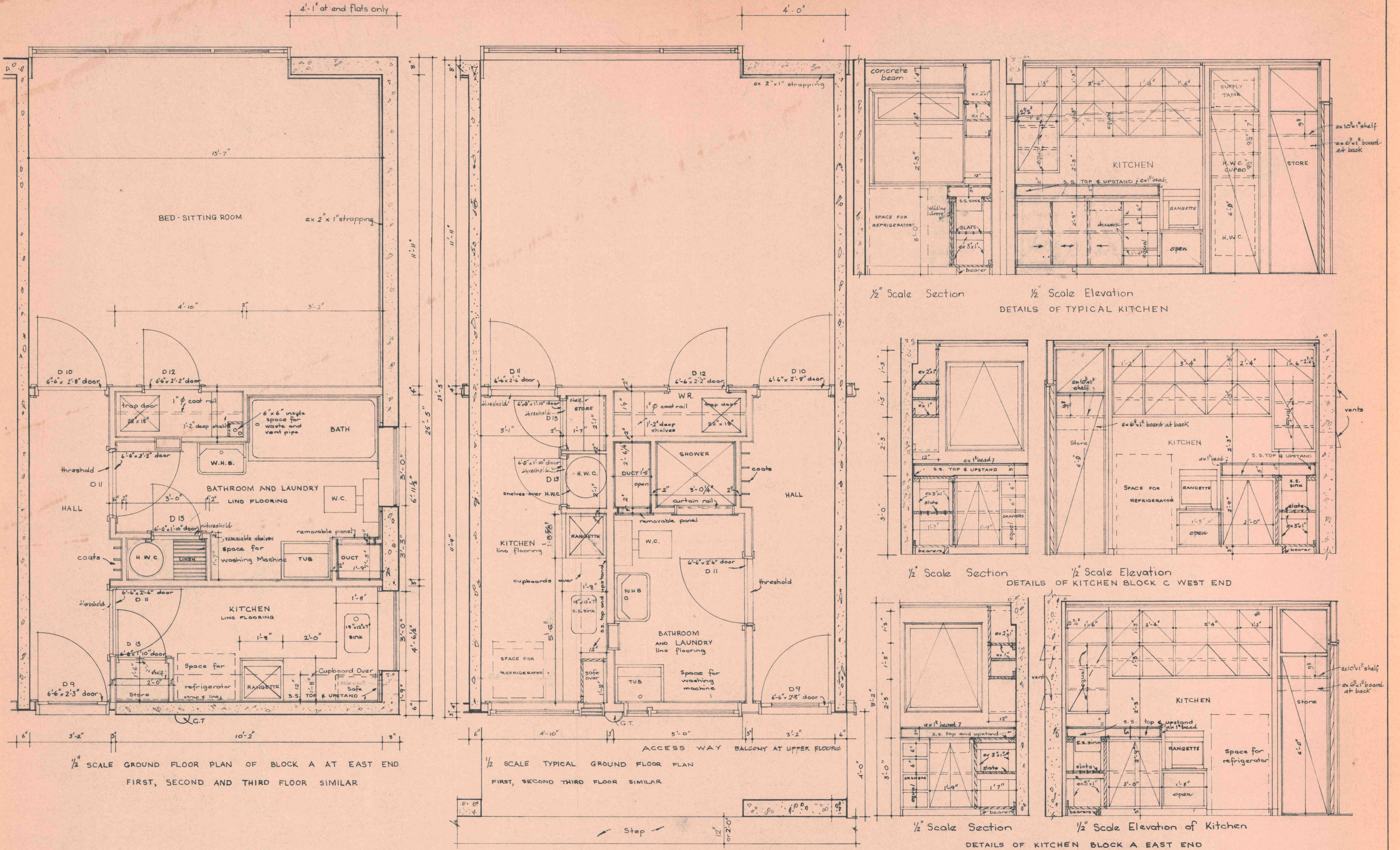
1/8" SCALE WEST ELEVATION

1/8" SCALE SOUTH ELEVATION



1/8" SCALE EAST ELEVATION

KOTUKU FLATS KEMP STREET · KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	CONTRACT NUMBER 2278 SCALE : as shown 1/8" SCALE ELEVATIONS OF BLOCK D		SHEET No. 8 IN SET OF 44
WELLINGTON CITY CORPORATION TOWN PLANNING DEPARTMENT ARCHITECTURAL DIVISION	TRACING NO. A.M. 247/8		
	DESIGNED	W. J. BEECH	
	DRAWN	P. LENIHAN	MARCH '68
	TRACED	P. LENIHAN	JUNE '68
	CHECKED		
K. W. CLARKE, CITY PLANNER	APPROVED		CITY ARCHITECT



1/2" SCALE GROUND FLOOR PLAN OF BLOCK A AT EAST END
FIRST, SECOND AND THIRD FLOOR SIMILAR

1/2 SCALE TYPICAL GROUND FLOOR PLAN
FIRST, SECOND THIRD FLOOR SIMILAR

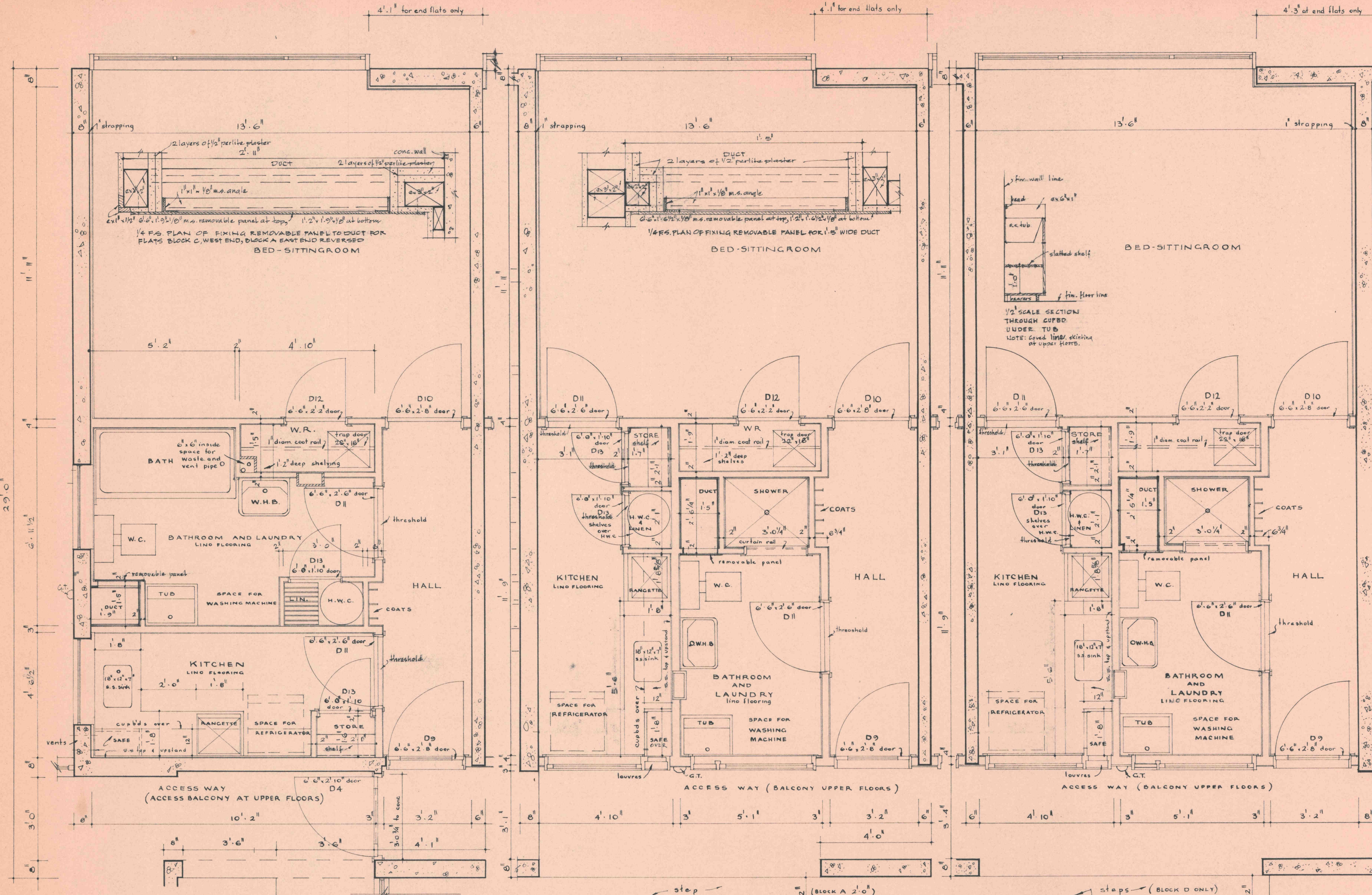
1/2" Scale Section — 1/2 Scale Elevation
DETAILS OF TYPICAL KITCHEN

1/2" Scale Section — 1/2 Scale Elevation
DETAILS OF KITCHEN BLOCK C WEST END

1/2" Scale Section — 1/2" Scale Elevation of Kitchen
DETAILS OF KITCHEN BLOCK A EAST END

NOTE: TRAP DOOR IN WARDROBE AT GROUND FLOOR ONLY

KOTUKU FLATS KEMP STREET - KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	CONTRACT NUMBER 2278 SCALE as shown 1/2" SCALE FLOOR PLANS	SHEET No. 9 IN SET OF: 44
WELLINGTON CITY CORPORATION TOWN PLANNING DEPARTMENT ARCHITECTURAL DIVISION K. V. CLARKE, CITY PLANNER	TRACING NO. A.M. 247/9 DESIGNED W. J. BEECH DRAWN R. D. T. TRACED S.Z. CHECKED APPROVED C.M. Muir CITY ARCHITECT	



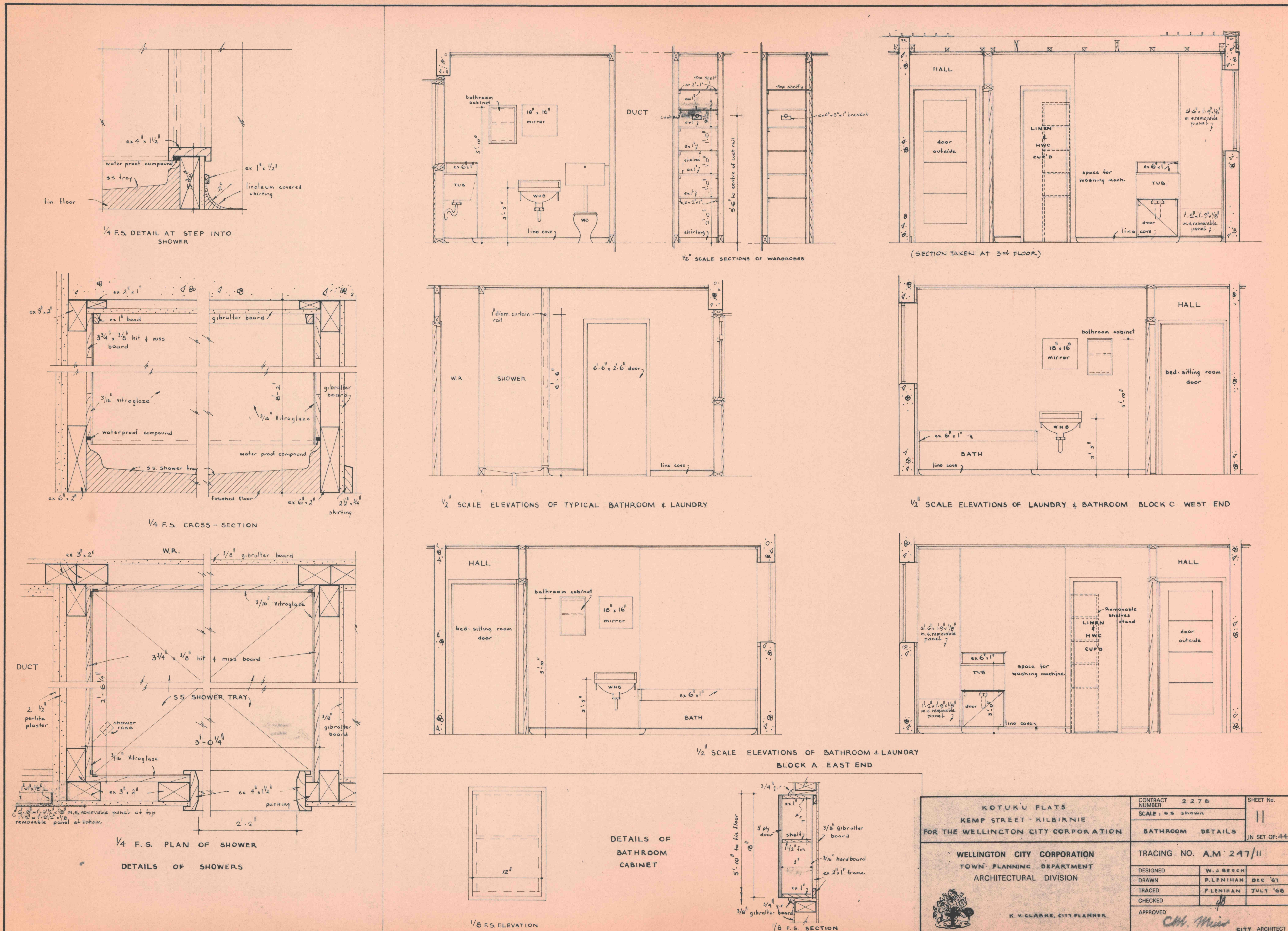
1/2" SCALE GROUND FLOOR PLAN OF BLOCK C AT WEST END
FIRST, SECOND AND THIRD FLOOR SIMILAR

1/2" SCALE GROUND FLOOR PLAN OF BLOCKS A AND D AT WEST END,
BLOCK B NORTH END, FIRST, SECOND AND THIRD FLOOR SIMILAR

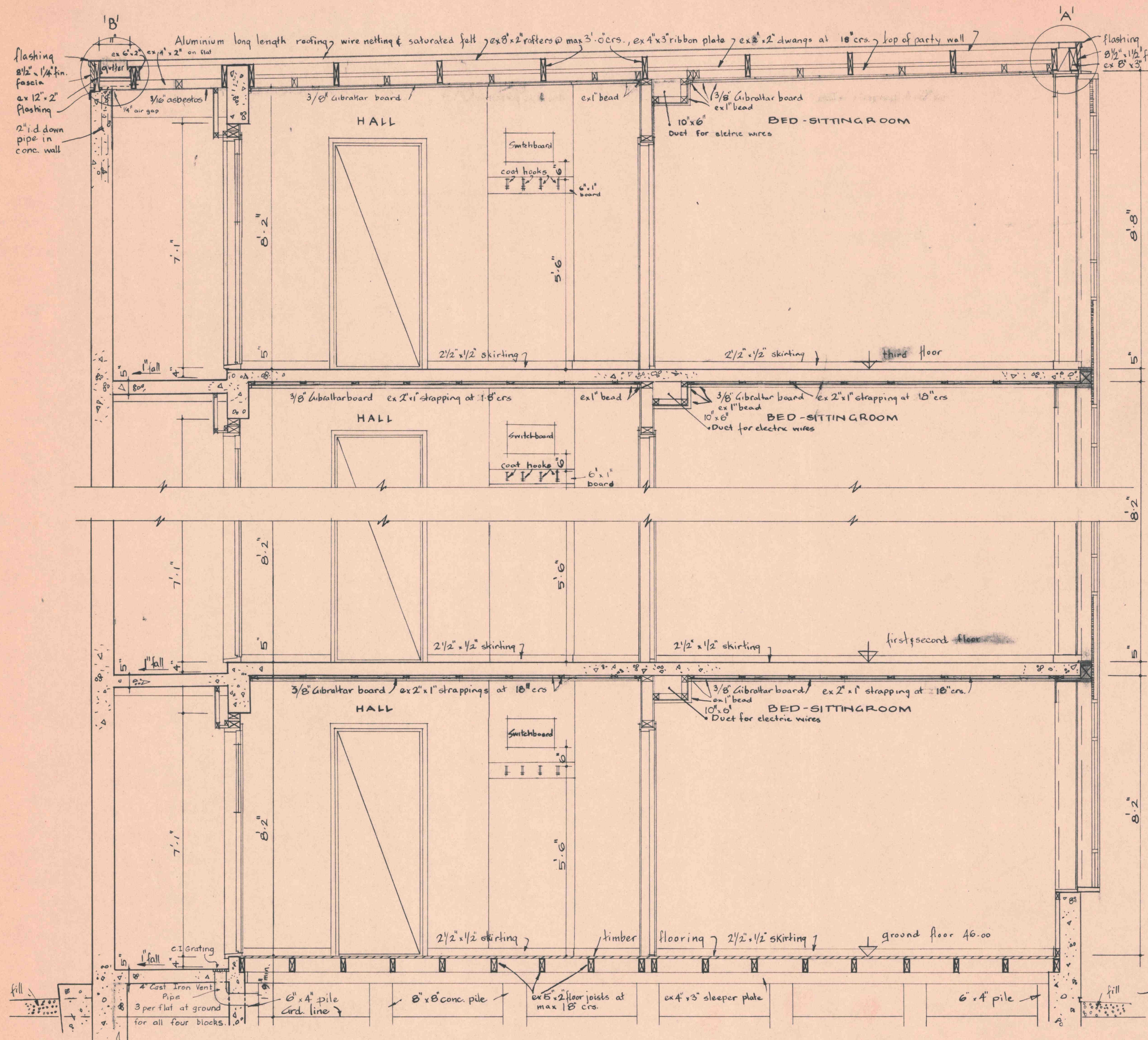
1/2" SCALE GROUND FLOOR PLAN OF BLOCKS C AND D AT EAST END AND
BLOCK B AT SOUTH END, FIRST, SECOND AND THIRD FLOOR SIMILAR

Notes: trap door in wardrobe at ground floor only
GULLY TRAPS AT GRD. FLOOR ONLY

KOTUKU FLATS KEMP STREET - KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	CONTRACT NUMBER 2278 SCALE as shown 1/2" SCALE FLOOR PLANS	SHEET No. 10 IN SET OF: 44
WELLINGTON CITY CORPORATION TOWN PLANNING DEPARTMENT ARCHITECTURAL DIVISION K. V. CLARKE, CITY PLANNER	TRACING NO. A.M. 247/10 DESIGNED W. J. BEECH DRAWN M. COLARIC TRACED P. LENIHAN JULY '68 CHECKED APPROVED CITY ARCHITECT	

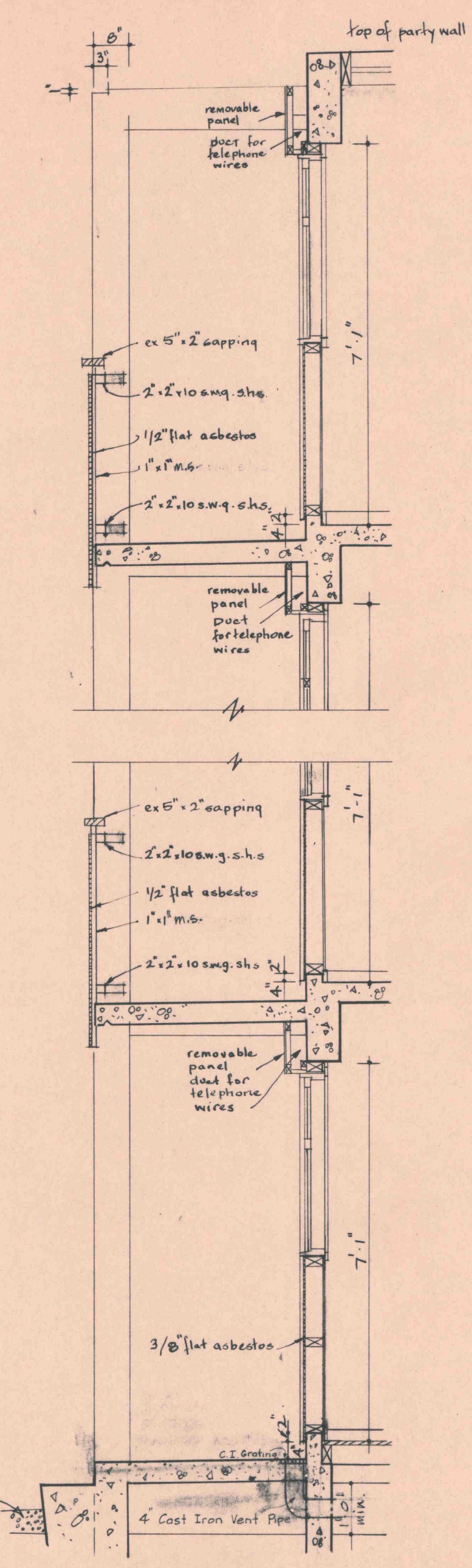


ex 4" x 1 1/2"
water proof compound
ss tray
ex 1" x 1/2"
linoleum covered skirting
fin. floor
1/4 F.S. DETAIL AT STEP INTO SHOWER
ex 3" x 2"
ex 2" x 1"
ex 1" bead
gibralter board
3 3/4" x 3/8" hit & miss board
3/16" vitroglaze
gibralter board
3/16" Vitroglaze
waterproof compound
water proof compound
s.s. shower tray
finished floor
ex 6" x 2"
ex 6" x 2"
2 1/2" x 3/4" skirting
1/4 F.S. CROSS - SECTION
ex 3" x 2"
W.R.
3/8" gibralter board
3/16" Vitroglaze
DUCT
3 3/4" x 3/8" hit & miss board
SS SHOWER TRAY
2 1/2" perlite plaster
shower rose
3/8" gibralter board
3'-0 1/4"
3/16" Vitroglaze
ex 3" x 2"
ex 4" x 1 1/2"
packing
removable panel at bottom
2'-2"
1/4 F.S. PLAN OF SHOWER
DETAILS OF SHOWERS
bathroom cabinet
18" x 16" mirror
DUCT
ex 6" x 1"
TUB
WHB
WC
lino cove
Top shelf
coat rail
ex 3" x 3/4" bracket
5'-6" to centre of coat rail
skirting
1/2" SCALE SECTIONS OF WARDROBES
HALL
door outside
LINEN & HWC CUP'D
space for washing mach.
m.s. removable panel
TUB
door
lino cove
(SECTION TAKEN AT 3rd FLOOR)
1" diam curtain rail
W.R.
SHOWER
6'-6"
6'-6" x 2'-6" door
lino cove
1/2" SCALE ELEVATIONS OF TYPICAL BATHROOM & LAUNDRY
HALL
bathroom cabinet
18" x 16" mirror
bed-sitting room door
ex 6" x 1"
WHB
BATH
lino cove
1/2" SCALE ELEVATIONS OF LAUNDRY & BATHROOM BLOCK C WEST END
HALL
bed-sitting room door
bathroom cabinet
18" x 16" mirror
WHB
ex 6" x 1"
BATH
HALL
m.s. removable panel
LINEN HWC CUP'D
Removable shelves stand
door outside
ex 6" x 1"
TUB
space for washing machine
m.s. removable panel
door
lino cove
1/2" SCALE ELEVATIONS OF BATHROOM & LAUNDRY
BLOCK A EAST END
12"
1/8 F.S. ELEVATION
DETAILS OF BATHROOM CABINET
5 ply door
shelf
3/8" gibralter board
3/16" hard board
ex 2" x 1" frame
5'-10" to fin floor
18"
3/8" gibralter board
1/8 F.S. SECTION
KOTUKU FLATS
KEMP STREET - KILBIRNIE
FOR THE WELLINGTON CITY CORPORATION
WELLINGTON CITY CORPORATION
TOWN PLANNING DEPARTMENT
ARCHITECTURAL DIVISION
K. V. CLARKE, CITY PLANNER
CONTRACT NUMBER 2278
SCALE: as shown
BATHROOM DETAILS
SHEET No. 11
IN SET OF: 44
TRACING NO. A.M 247/11
DESIGNED W. J. BEECH
DRAWN P. LENIHAN DEC '67
TRACED P. LENIHAN JULY '68
CHECKED
APPROVED
CITY ARCHITECT

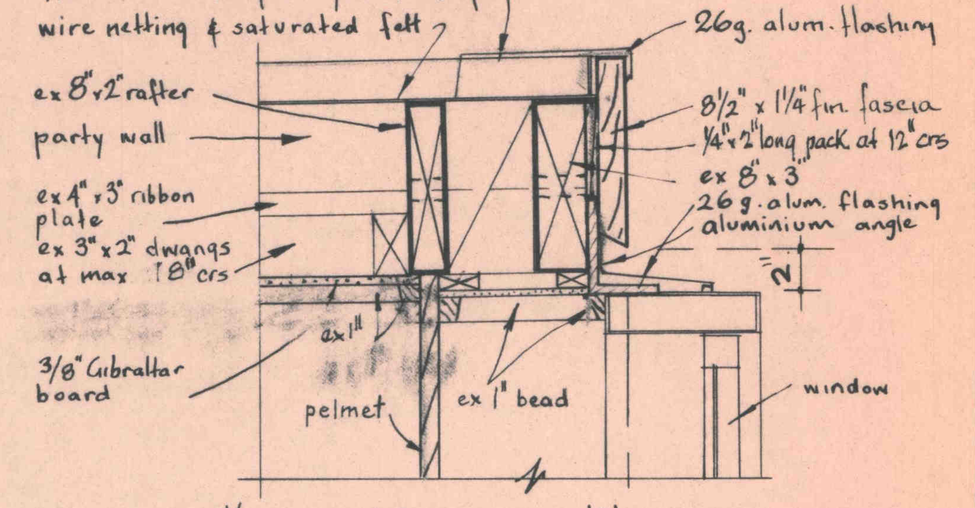


NOTE: FOR FOUNDATIONS SEE STRUCTURAL DRAWINGS

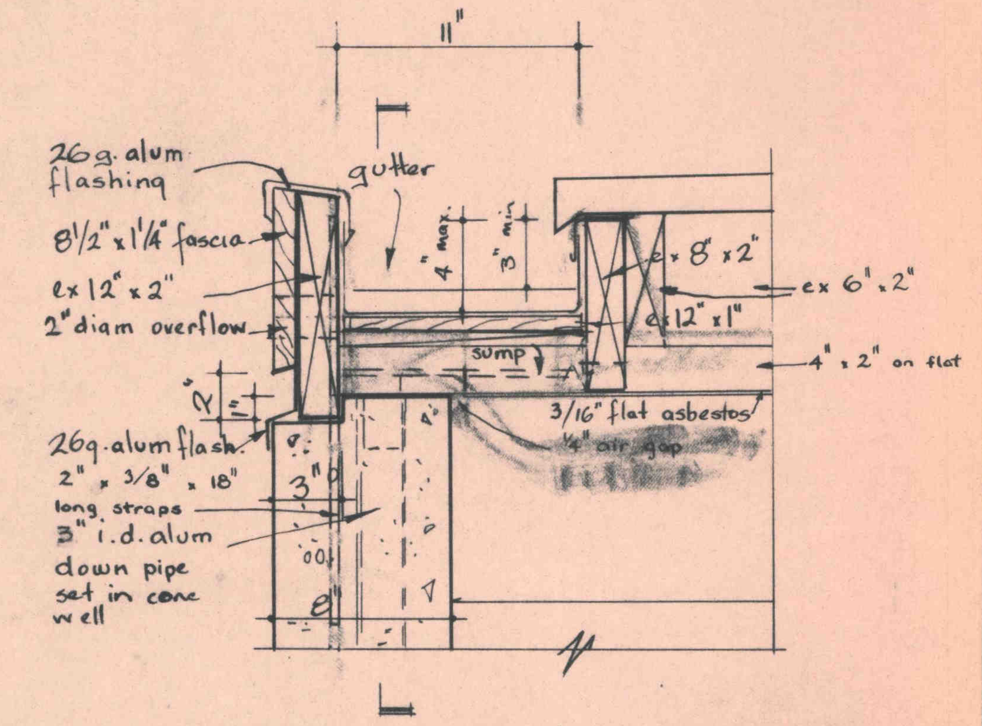
1/2" SCALE TYPICAL SECTION



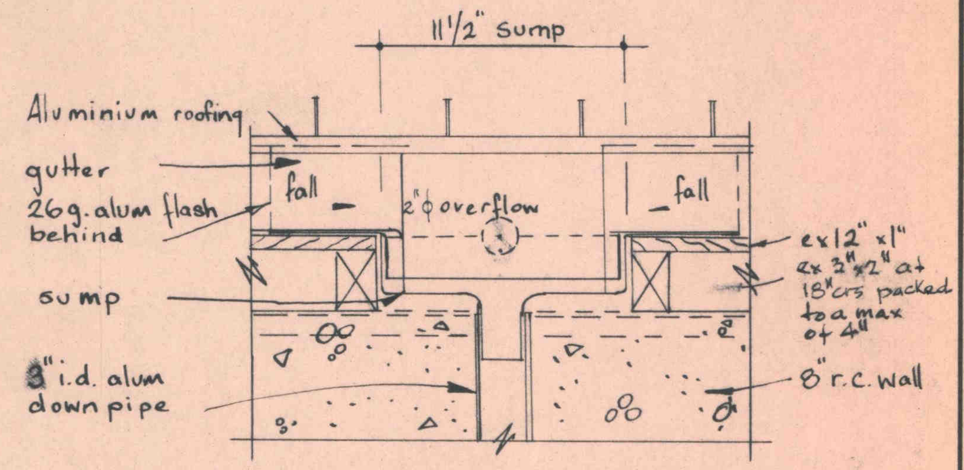
1/2" SCALE SECTION AT BALCONY OPENINGS



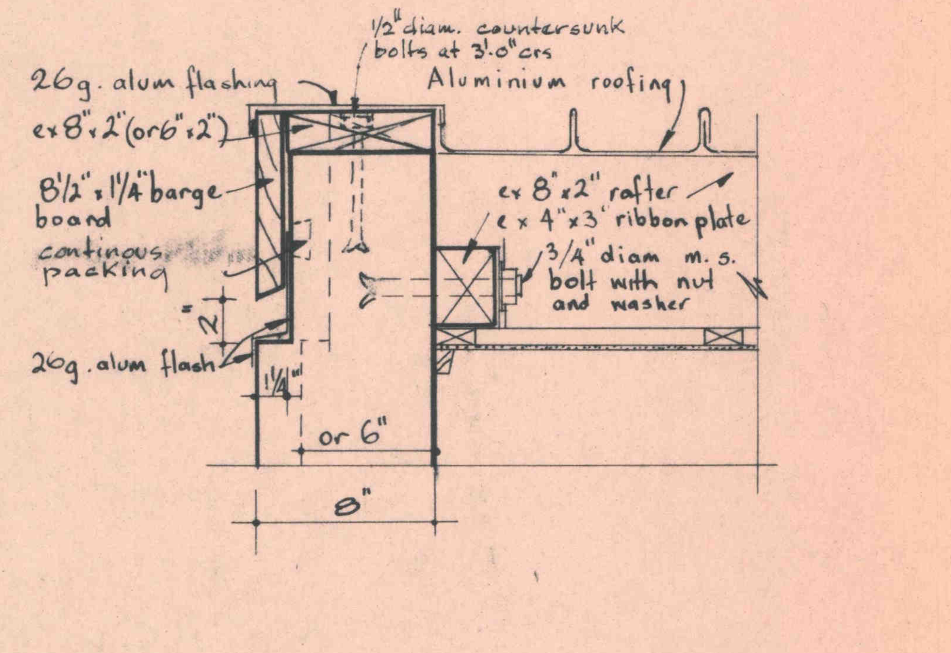
1/8 F.S. DETAIL AT 'A'



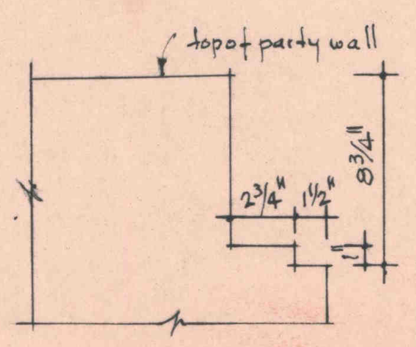
1/8 F.S. DETAIL AT 'B'



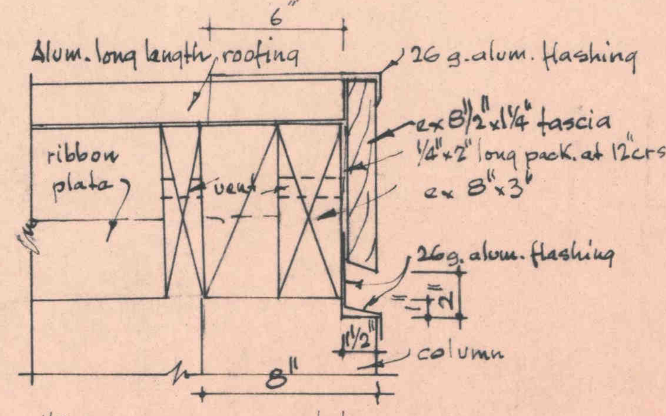
1/8 F.S. SECTION TROUGH SUMP



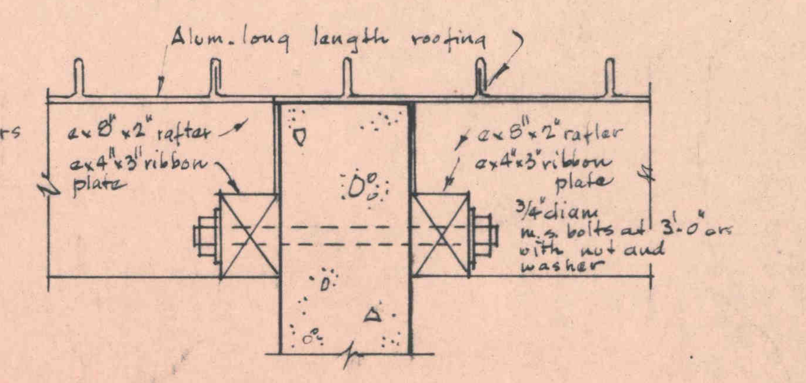
1/8 F.S. TYPICAL DETAIL OF FIXING BARGE BOARD



1/8 F.S. DETAIL OF CUT AT PARTY WALL



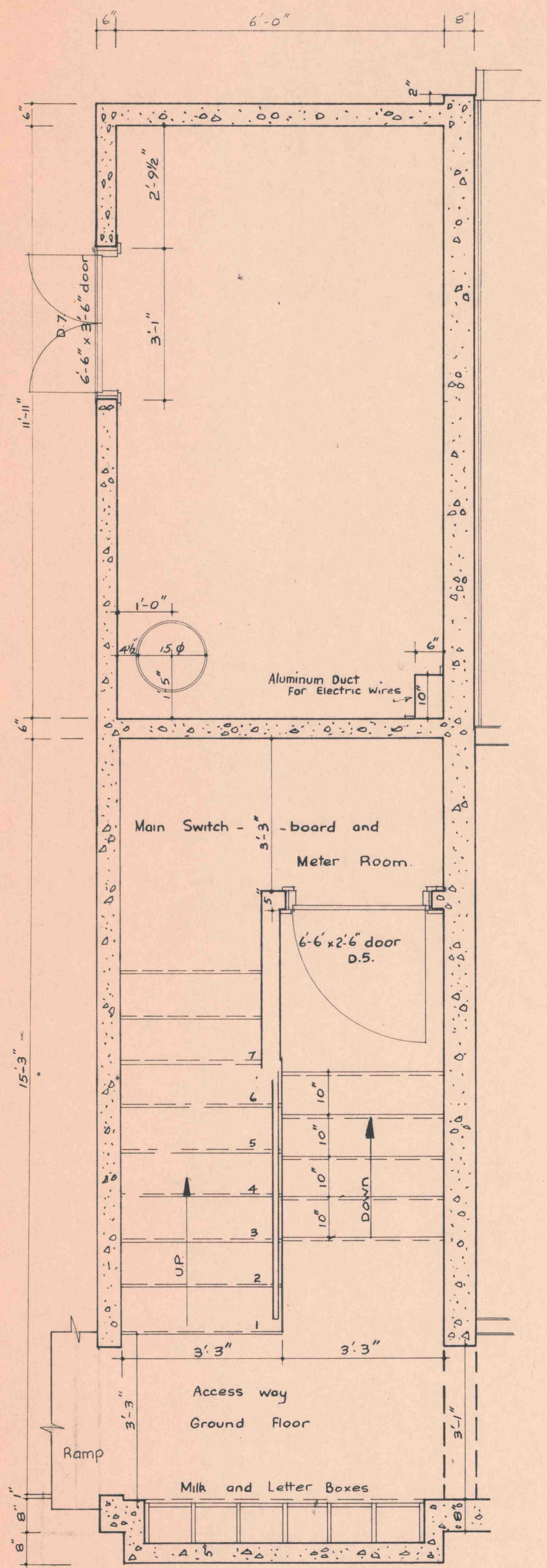
1/8 F.S. DETAIL AT 'A' WHERE COLUMN



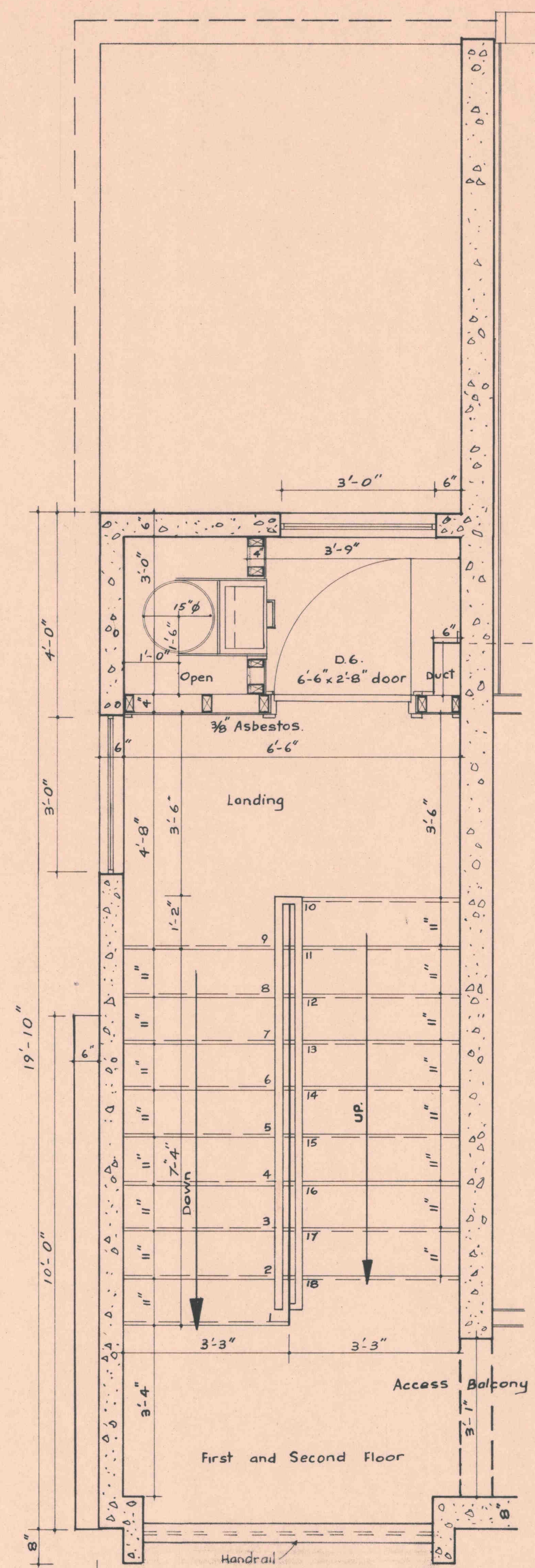
1/8 F.S. DETAIL OF JUNCTION OF ROOF AT PARTY WALL

KOTUKU FLATS KEMP STREET · KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	CONTRACT NUMBER 2278 AS SHOWN 1/2" SCALE TYPICAL CROSS SECTION FOR BLOCKS A,B,C & D	SHEET No. 12 IN SET OF: 44
WELLINGTON CITY CORPORATION TOWN PLANNING DEPARTMENT ARCHITECTURAL DIVISION	TRACING NO. A.M. 247/12	
	DESIGNED	W.J. BEECH
	DRAWN	M. COLARIC
	TRACED	P. LENIHAN
	CHECKED	
K. W. CLARKE, CITY PLANNER	APPROVED	CITY ARCHITECT

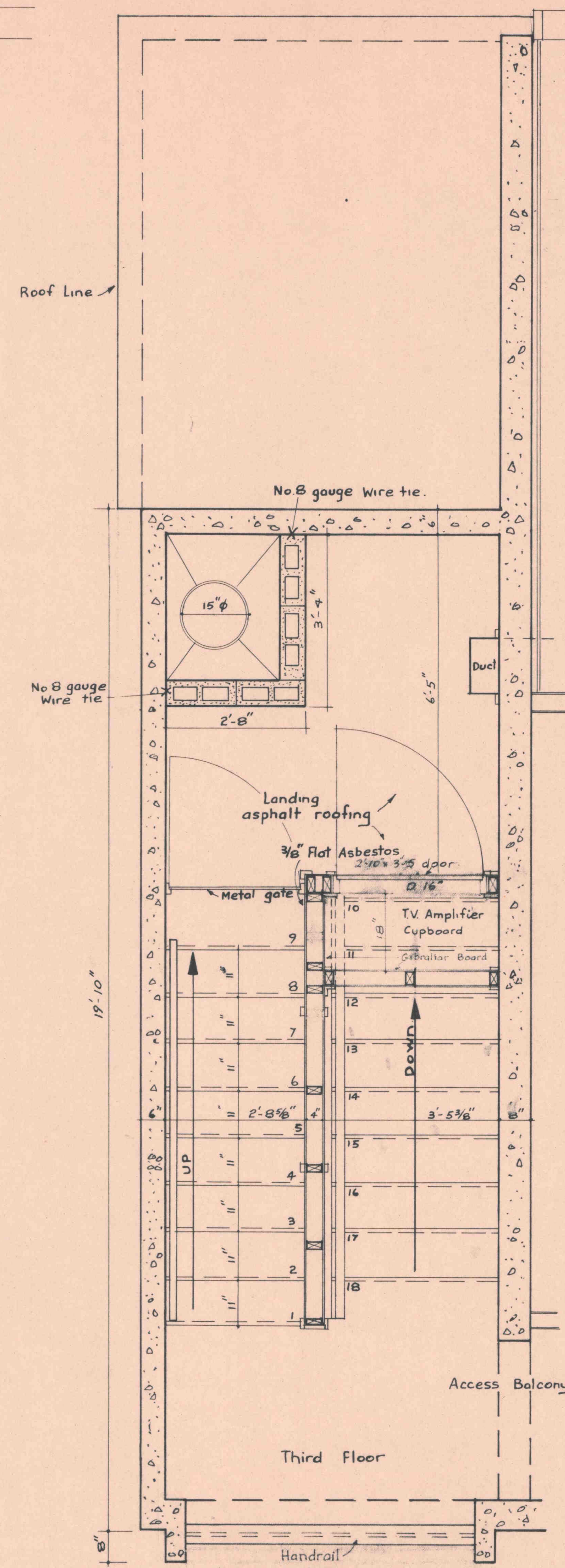
STAIR DETAILS
BLOCK A - C and D
REVERSED



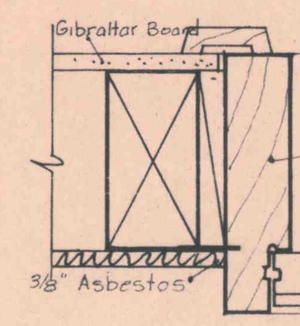
½" Scale Plan of Stair at Ground Floor Block "A" West End, and Blocks "C and D" East End, But Reversed.



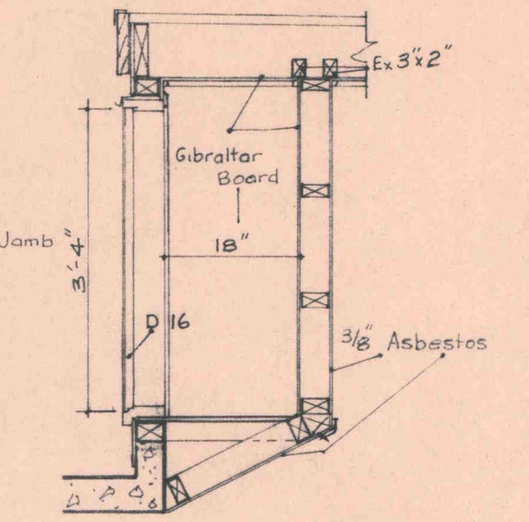
½" Scale Plan of Stair at First and Second Floors Block "A" West End, Blocks "C and D" East End, But Reversed.



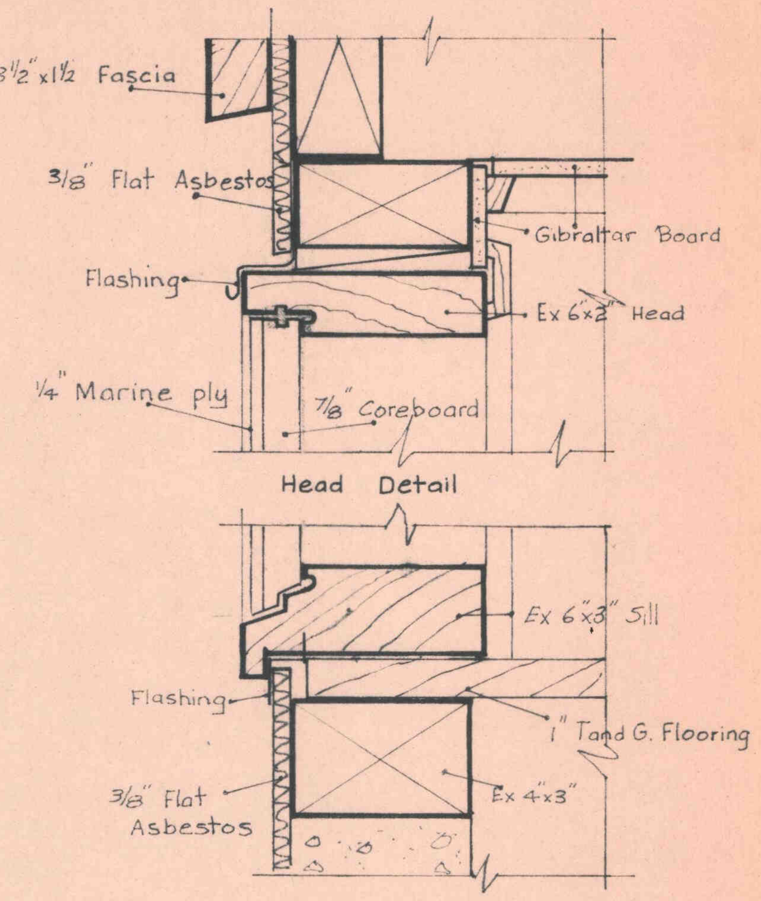
½" Scale Plan of Stair at Roof Level Block "A" West End, and Blocks "C and D" East End, But Reversed.



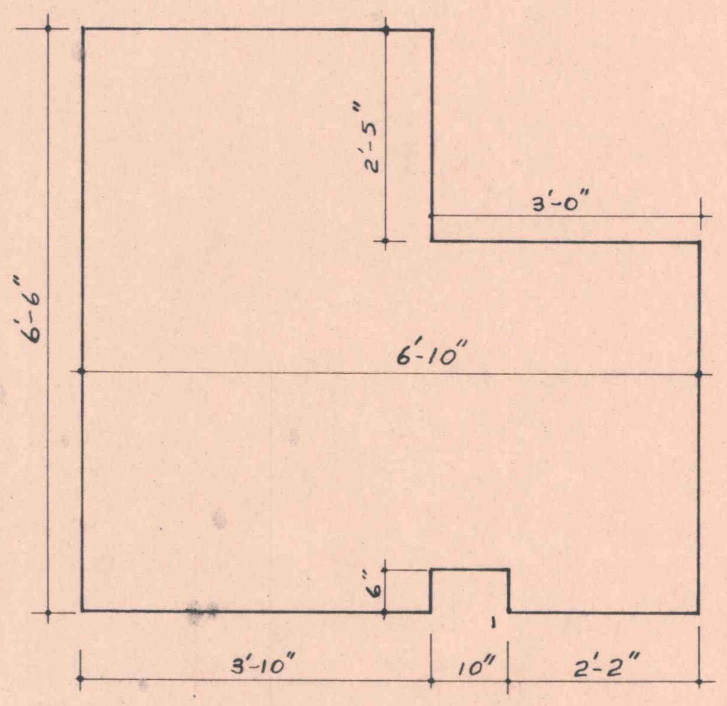
Jamb Detail
¼ F.S.



½" Scale Section through T.V. Amplifier Cupboard

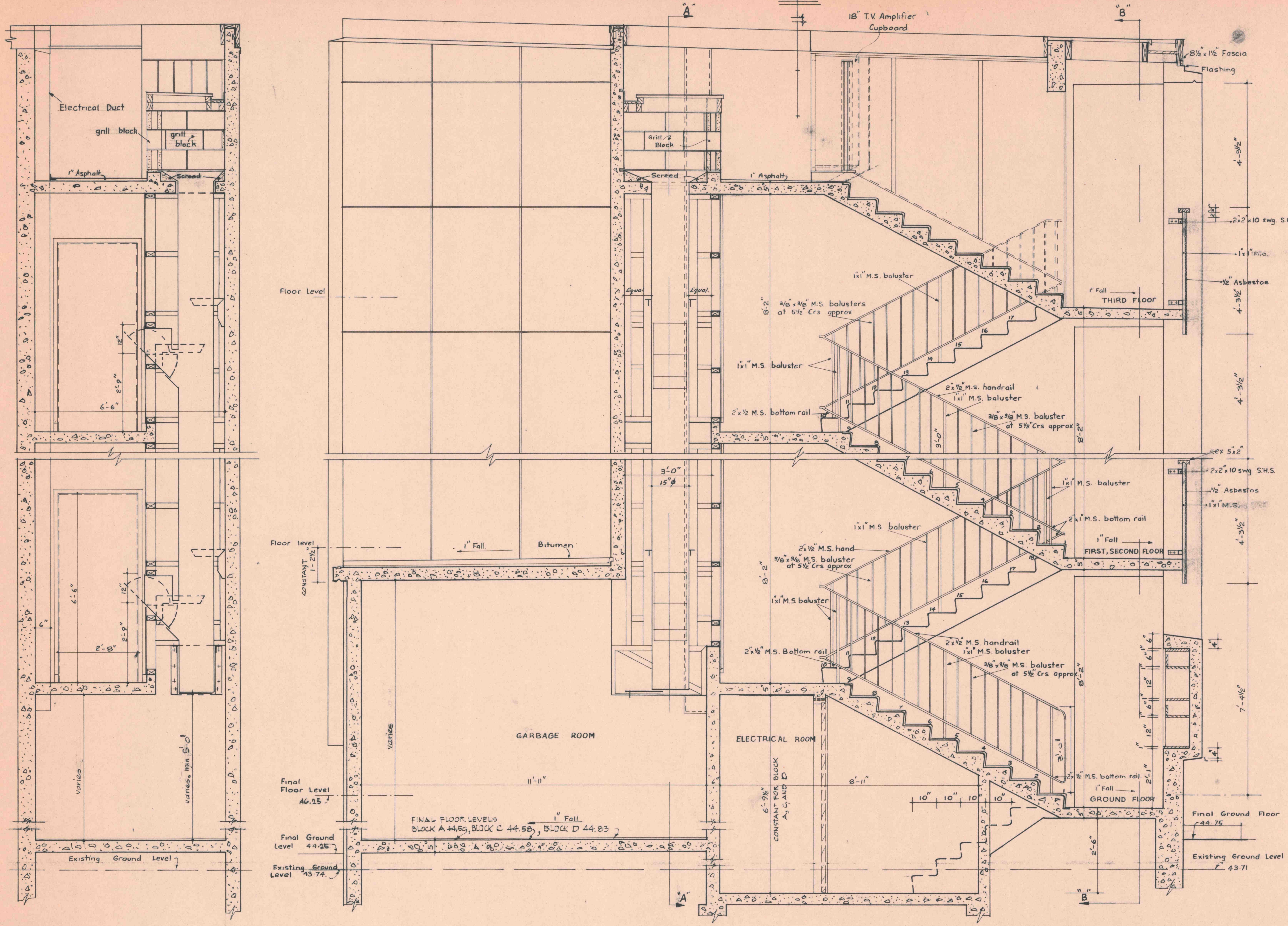


Sill Detail
¼ F.S.



½" Scale Plan of Stair Landing Concrete Slab.

KOTUKU FLATS KEMP STREET, KILBIRNIE FOR THE WELLINGTON CITY CORPORATION.	CONTRACT NUMBER 2278 SCALE: ½" to 1'-0" Plan of Stair. Block A West End, and Blocks C and D East End, But Reversed	SHEET No. 13 IN SET OF: 44
WELLINGTON CITY CORPORATION TOWN PLANNING DEPARTMENT ARCHITECTURAL DIVISION K.V. CLARKE, CITY PLANNER	TRACING NO. A.M. 247/13 DESIGNED W.J. Beech. DRAWN R.D. Tapp. TRACED R.D. Tapp. CHECKED APPROVED C.M. Muir CITY ARCHITECT	Aug. 1968



½" Scale Cross Section "A.A"

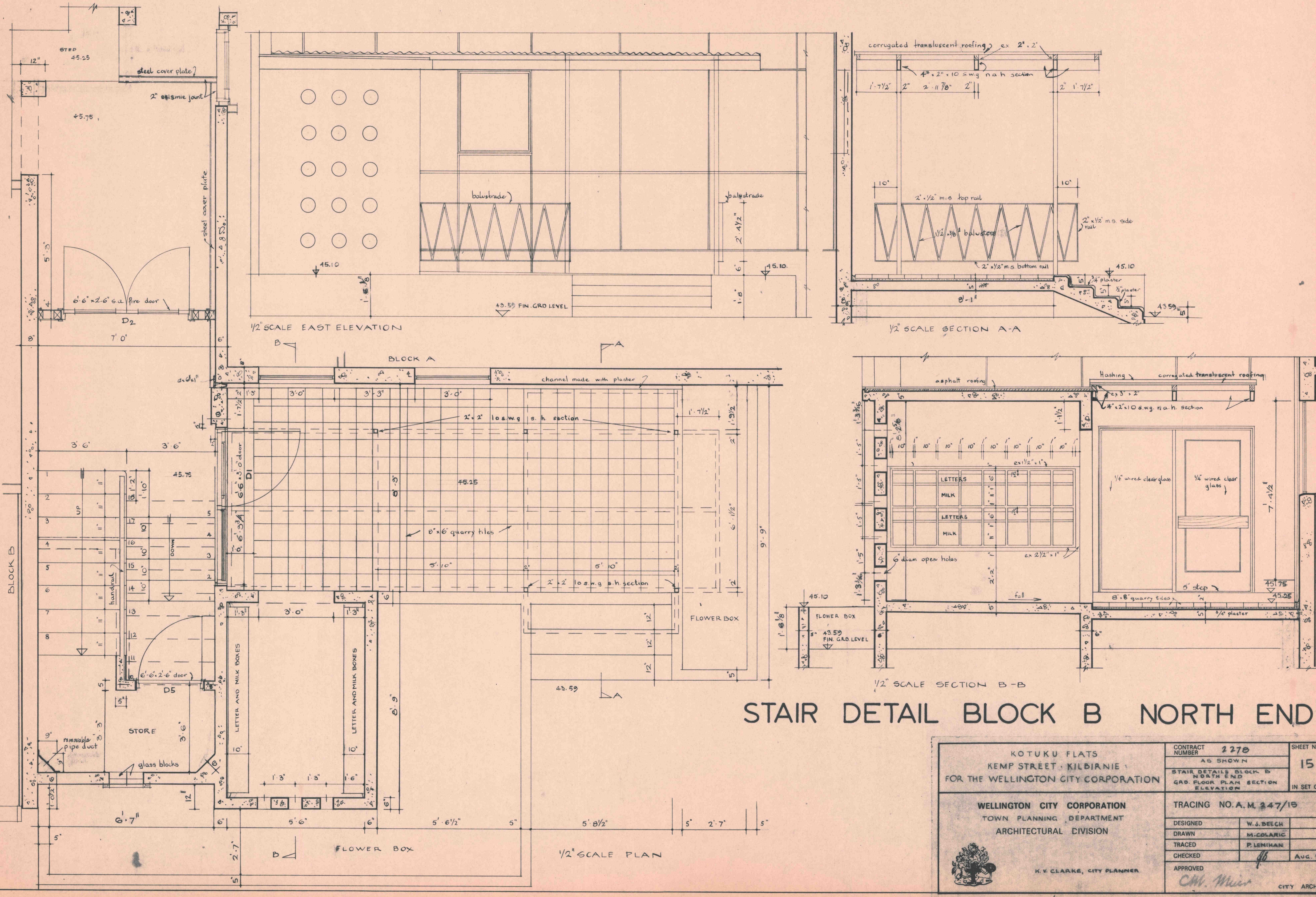
½" Scale Longitudinal Section through Stair at Blocks A West End, C and D East End, But Reversed

½" Scale Cross Section "B-B"

Note: For Foundations see Structural Drawings.

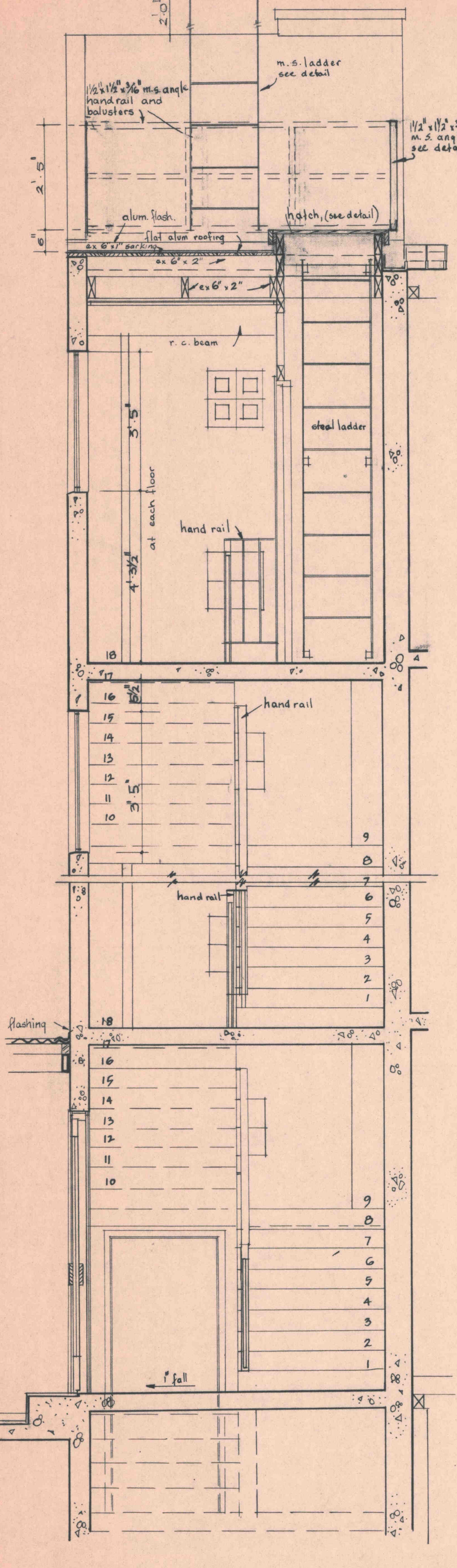
STAIR DETAILS
BLOCK A, C and D REVERSED

KOTUKU FLATS KEMP STREET KILBIRNIE FOR THE WELLINGTON CITY CORPORATION.	CONTRACT NUMBER 2278 SCALE AS SHOWN STAIR DETAILS BLOCKS A WEST END, AND BLOCKS C AND D EAST END, BUT REVERSED.	SHEET No. 14 IN SET OF 44
WELLINGTON CITY CORPORATION TOWN PLANNING DEPARTMENT ARCHITECTURAL DIVISION	TRACING NO. A.M. 247/14.	
	DESIGNED W.J. BEECH	
	DRAWN R.D TAPP	NOV 1967
	TRACED R.D TAPP	
	CHECKED	AUG 1968
K.V. CLARKE CITY PLANNER.	APPROVED C.M. Muir	CITY ARCHITECT



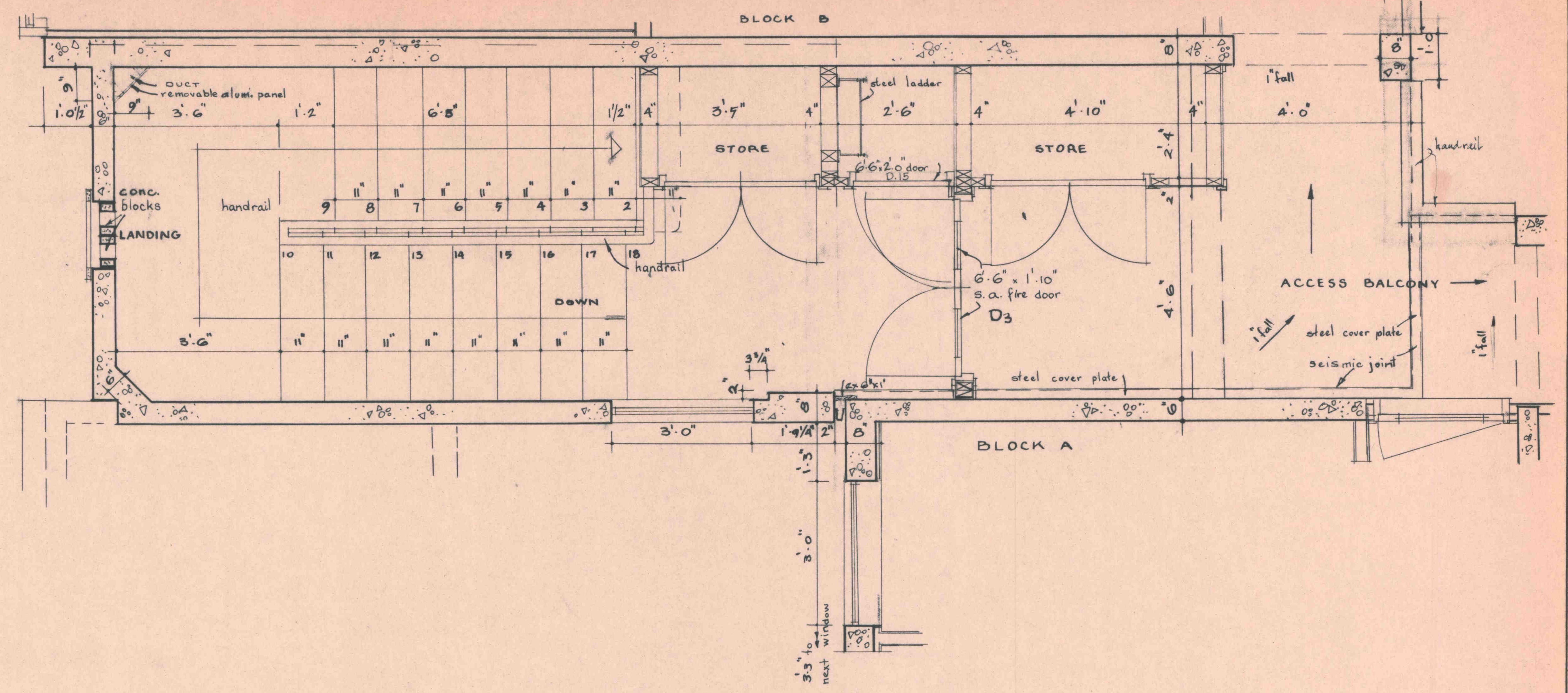
STAIR DETAIL BLOCK B NORTH END

KOTUKU FLATS KEMP STREET · KILBIRNIE · FOR THE WELLINGTON CITY CORPORATION	CONTRACT NUMBER 2278 AS SHOWN STAIR DETAILS BLOCK B NORTH END GRD. FLOOR PLAN SECTION ELEVATION	SHEET No. 15 IN SET OF: 44
WELLINGTON CITY CORPORATION TOWN PLANNING DEPARTMENT ARCHITECTURAL DIVISION K. V. CLARKE, CITY PLANNER	TRACING NO. A.M. 247/15 DESIGNED W. J. BEECH DRAWN M. COLARIC TRACED P. LENIHAN CHECKED APPROVED C.M. Muir CITY ARCHITECT	AUG. 1968

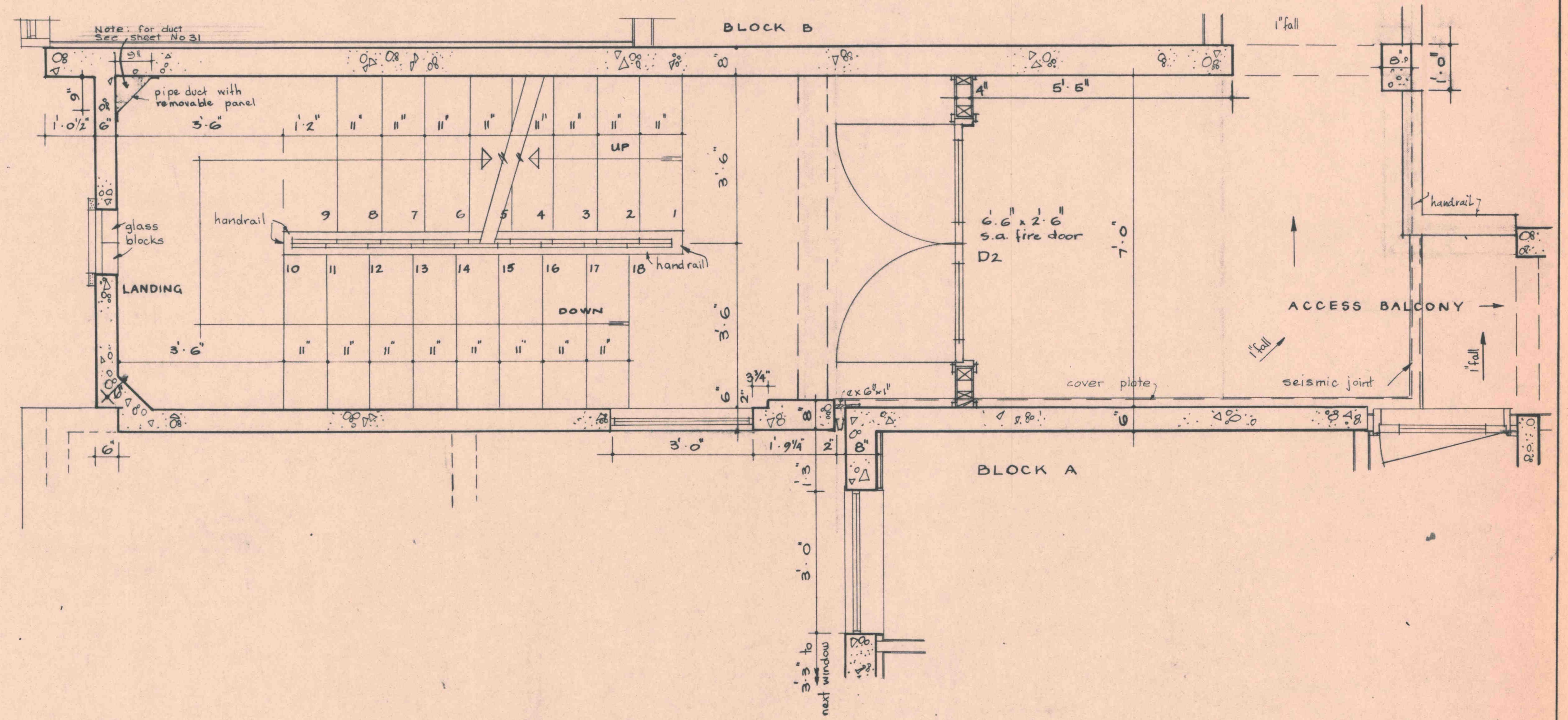


1/2" SCALE CROSS SECTION

NOTE: FOR FOUNDATIONS SEE STRUCTURAL DRGS..



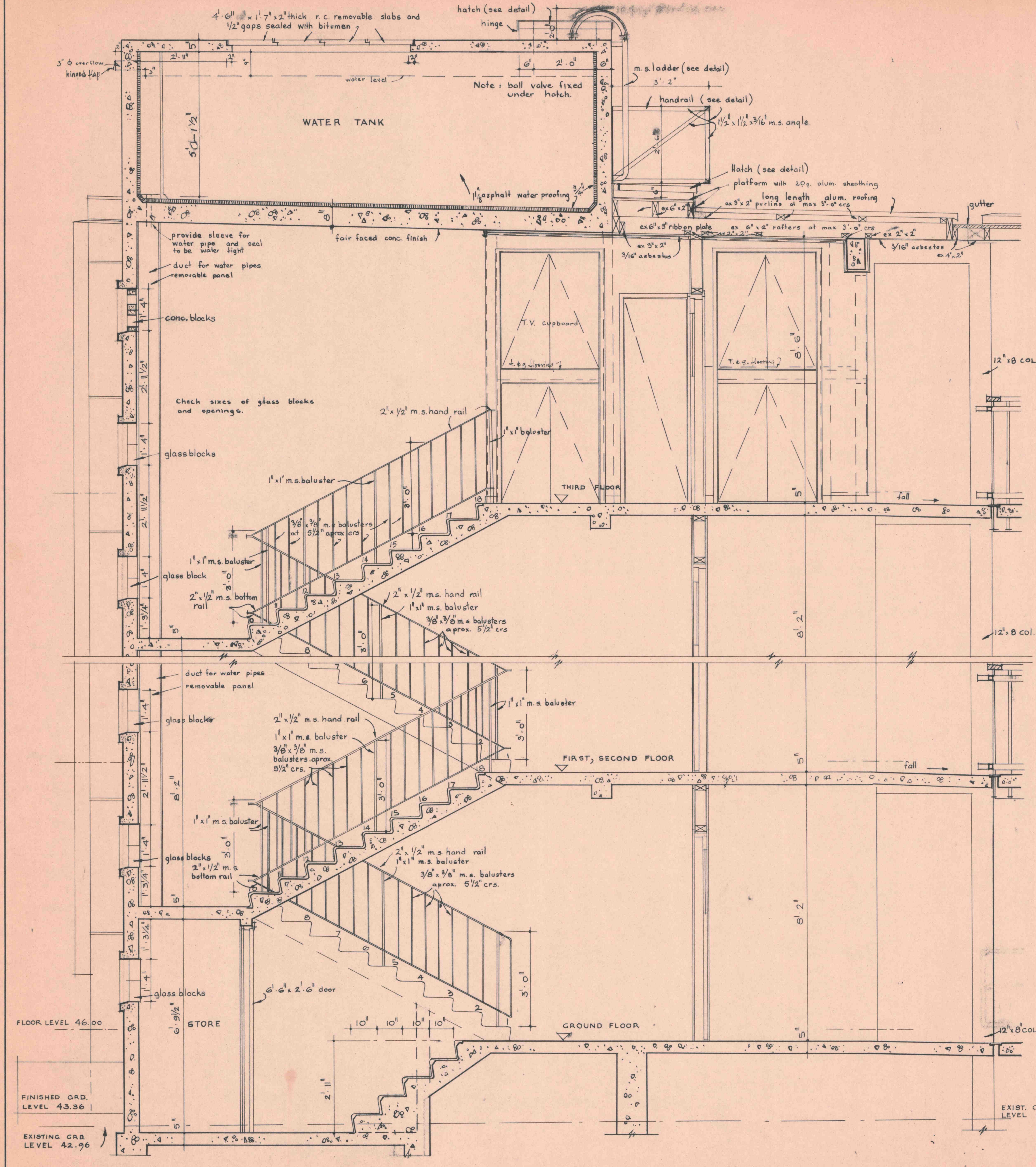
1/2" SCALE PLAN AT THIRD FLOOR LEVEL



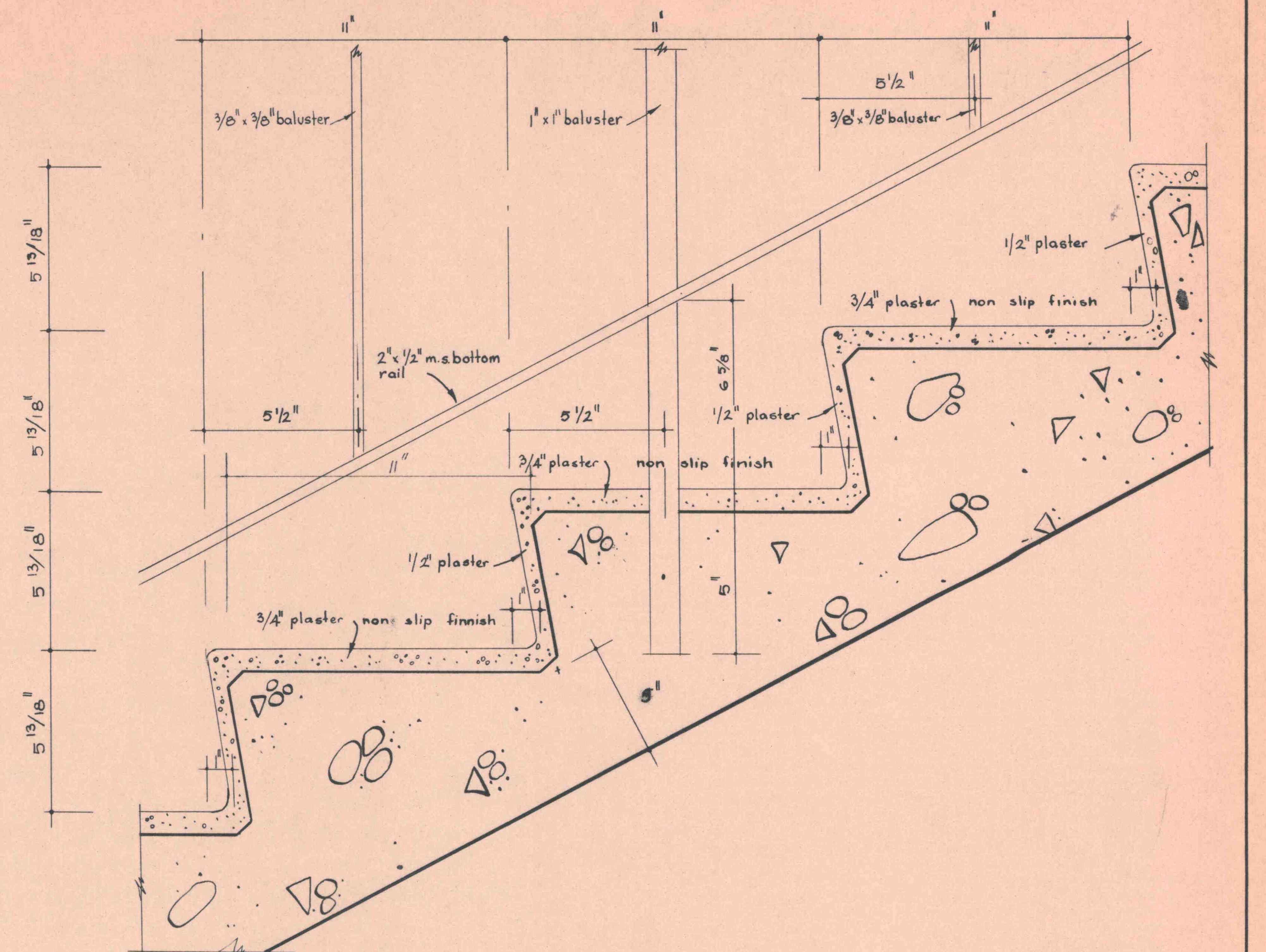
1/2" SCALE PLAN AT FIRST AND SECOND FLOOR LEVEL

STAIR DETAILS BLOCK B
NORTH END

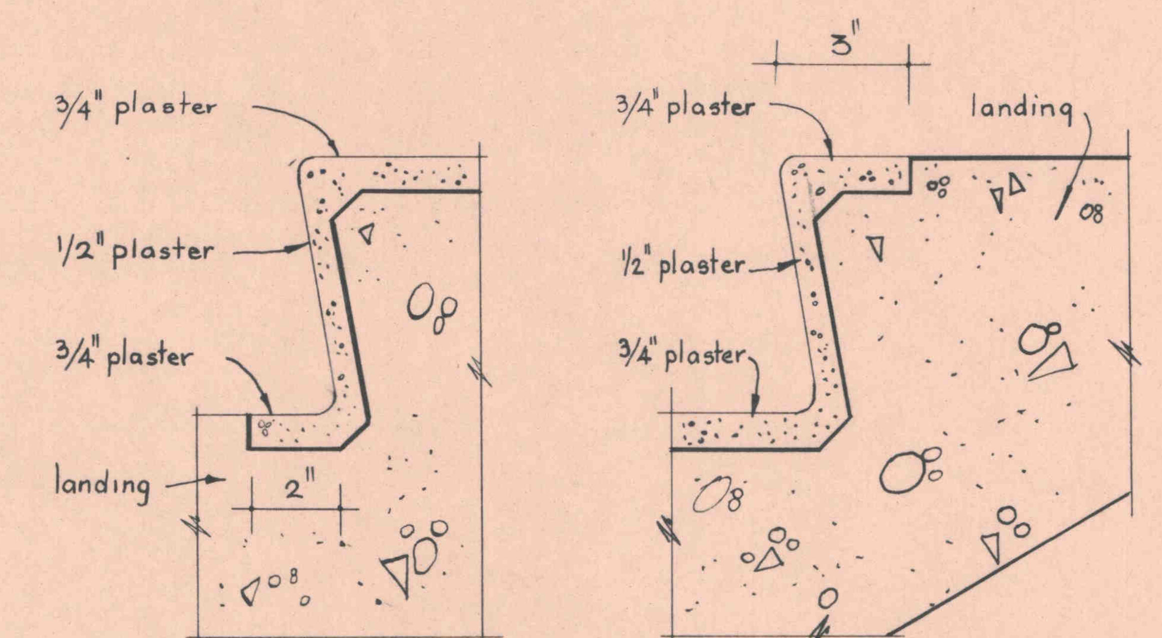
KOTUKU FLATS KEMP STREET KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	CONTRACT NUMBER 2278 SCALE: AS SHOWN STAIR DETAILS, BLOCK B NORTH END PLANS AND CROSS SECTION	SHEET No. 16 IN SET OF: 44
WELLINGTON CITY CORPORATION TOWN PLANNING DEPARTMENT ARCHITECTURAL DIVISION H.V. CLARKE, CITY PLANNER	TRACING NO. A.M. 247/16	
	DESIGNED	W.J. BEECH	
	DRAWN	A. COLARIĆ	NOV. 67
	TRACED	P. LENIHAN	FEB 68
	CHECKED	[illegible]	Aug. 68
	APPROVED	[illegible] CITY ARCHITECT	



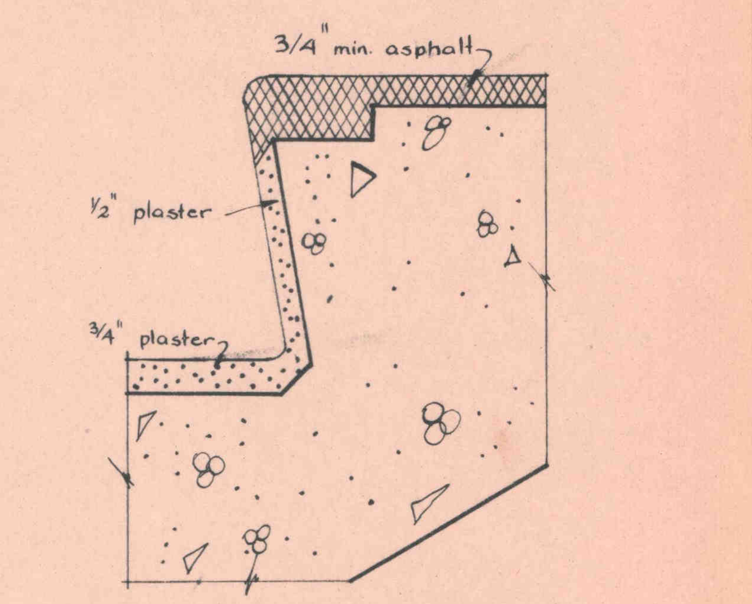
1/2" SCALE LONGITUDINAL SECTION THROUGH STAIR AT NORTH END OF BLOCK B
NOTE: FOR FOUNDATIONS SEE STRUCTURAL DRGS.



1/4 F.S. TYPICAL DETAIL OF TREADS AND RISERS



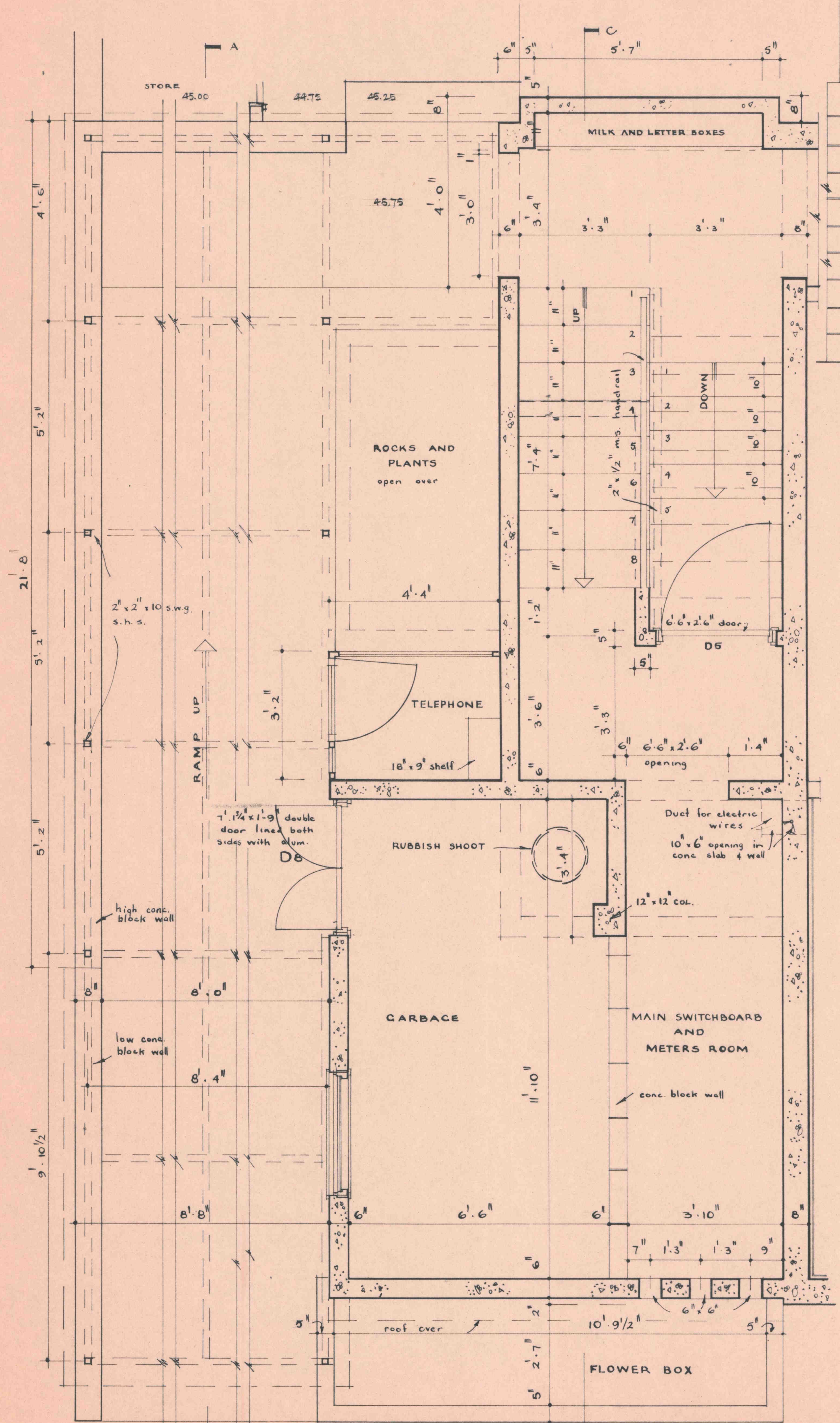
1/4 F.S. DETAILS OF PLASTER FINISH AT LANDINGS.



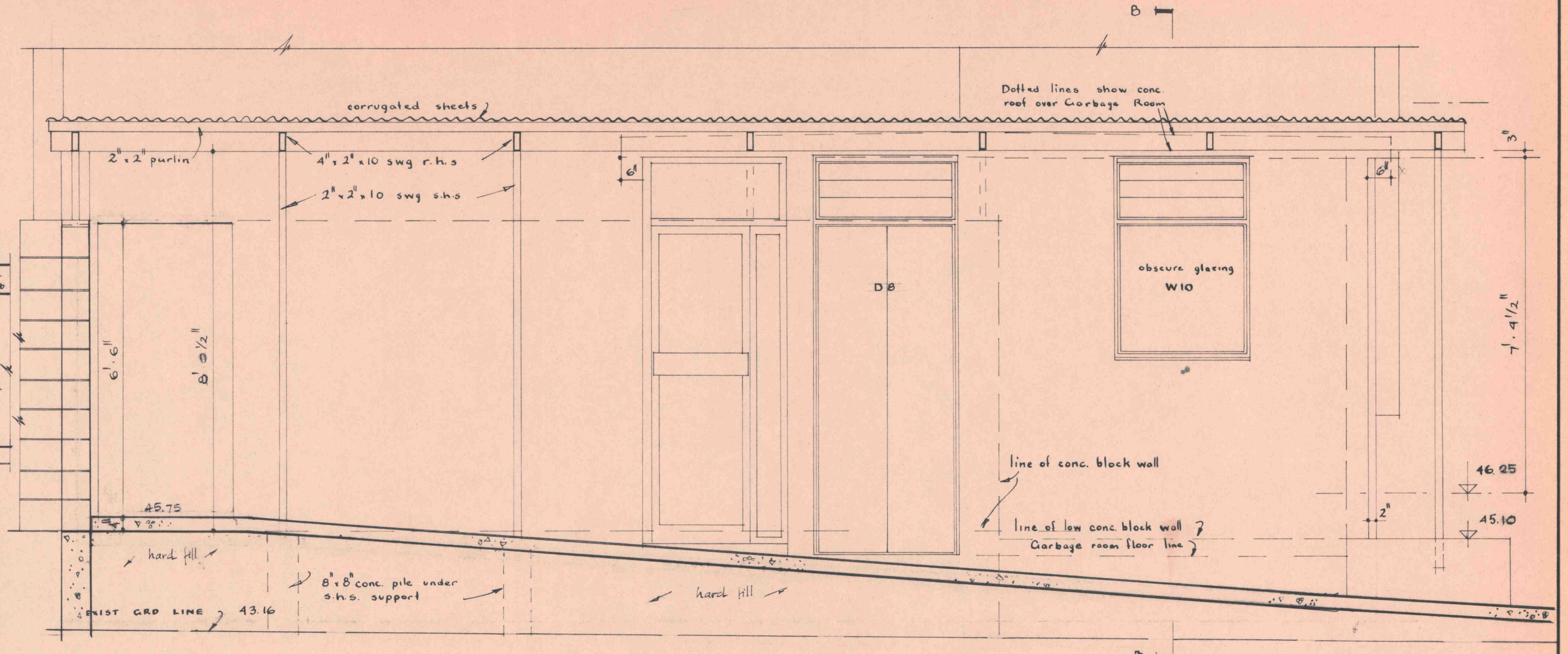
1/4 F.S. DETAIL OF ASPHALT FINISH AT TOP OF OPEN STAIRS

STAIR DETAILS BLOCK B NORTH END

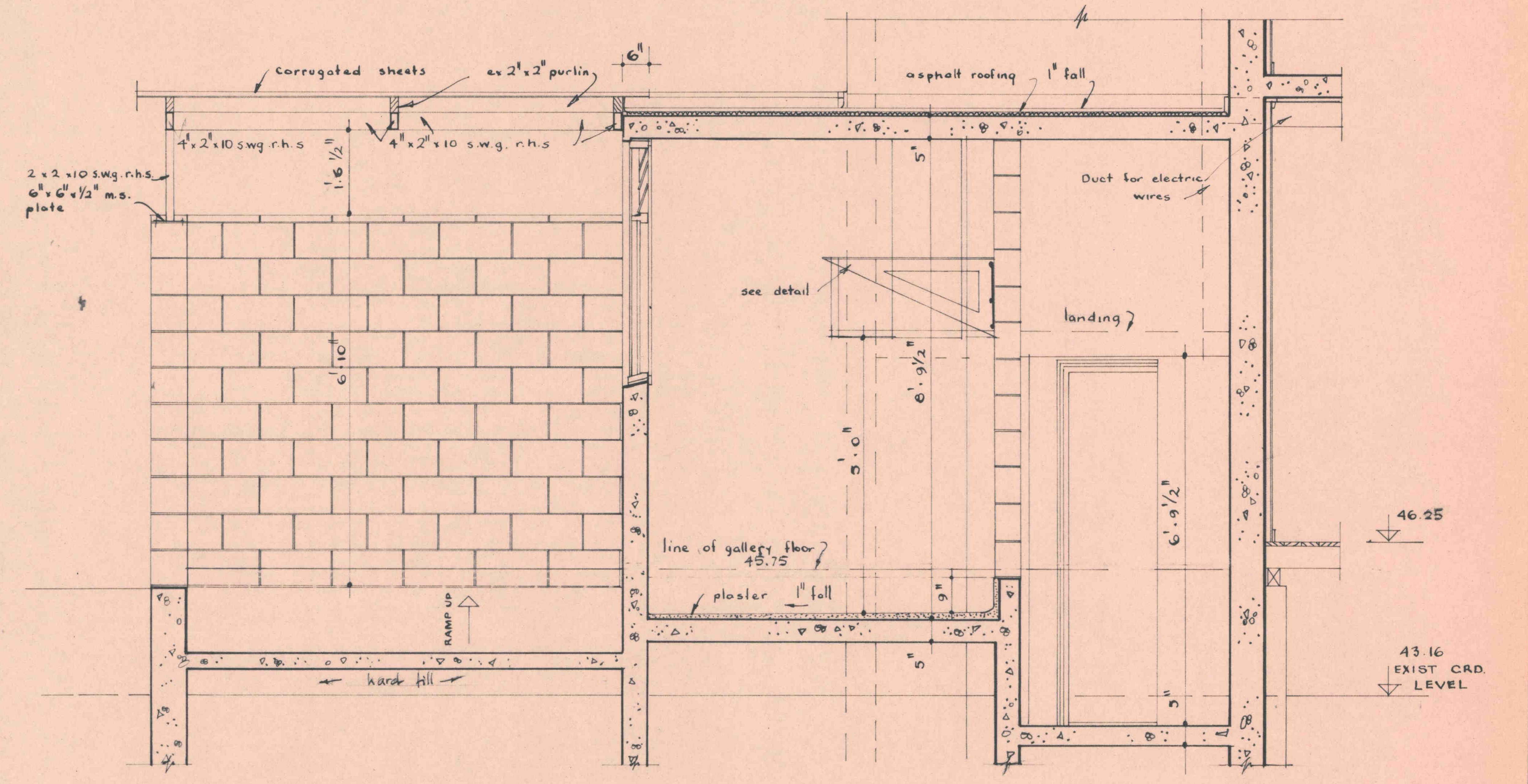
KOTUKU FLATS KEMP STREET KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	CONTRACT NUMBER 2278 AS SHOWN STAIR DETAILS BLOCK B NORTH END LONGITUDINAL SECTIONS ETC.	SHEET No. 17 IN SET OF: 44
WELLINGTON CITY CORPORATION TOWN PLANNING DEPARTMENT ARCHITECTURAL DIVISION	TRACING NO. A.M. 247/17	
	DESIGNED W. J. BEECH	
	DRAWN M. COLARIC	NOV. 67
	TRACED P. LENIHAN	FEB 68
	CHECKED	Aug. 68
H. V. CLARKE, CITY PLANNER	APPROVED C.M. Muir	CITY ARCHITECT



1/2" SCALE PLAN AT GRD. FLOOR



1/2" SCALE SECTION A-A



1/2" SCALE SECTION B-B

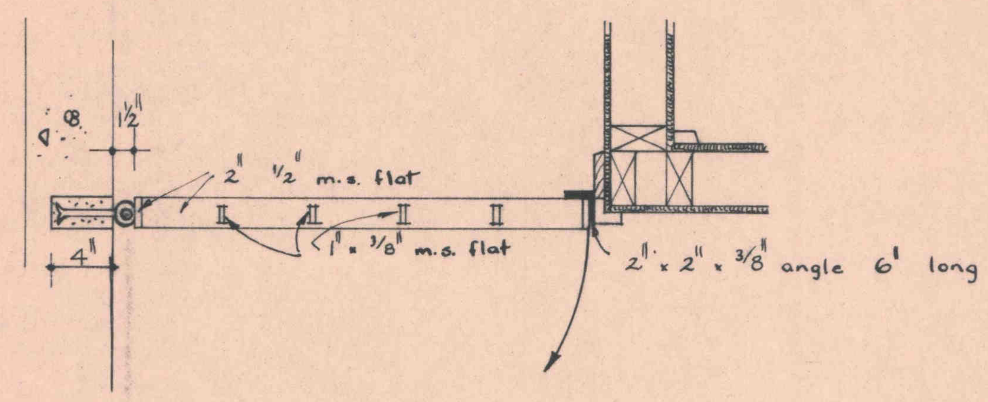
STAIR DETAILS BLOCK B SOUTH END

KOTUKU FLATS
KEMP STREET · KILBIRNIE
FOR THE WELLINGTON CITY CORPORATION

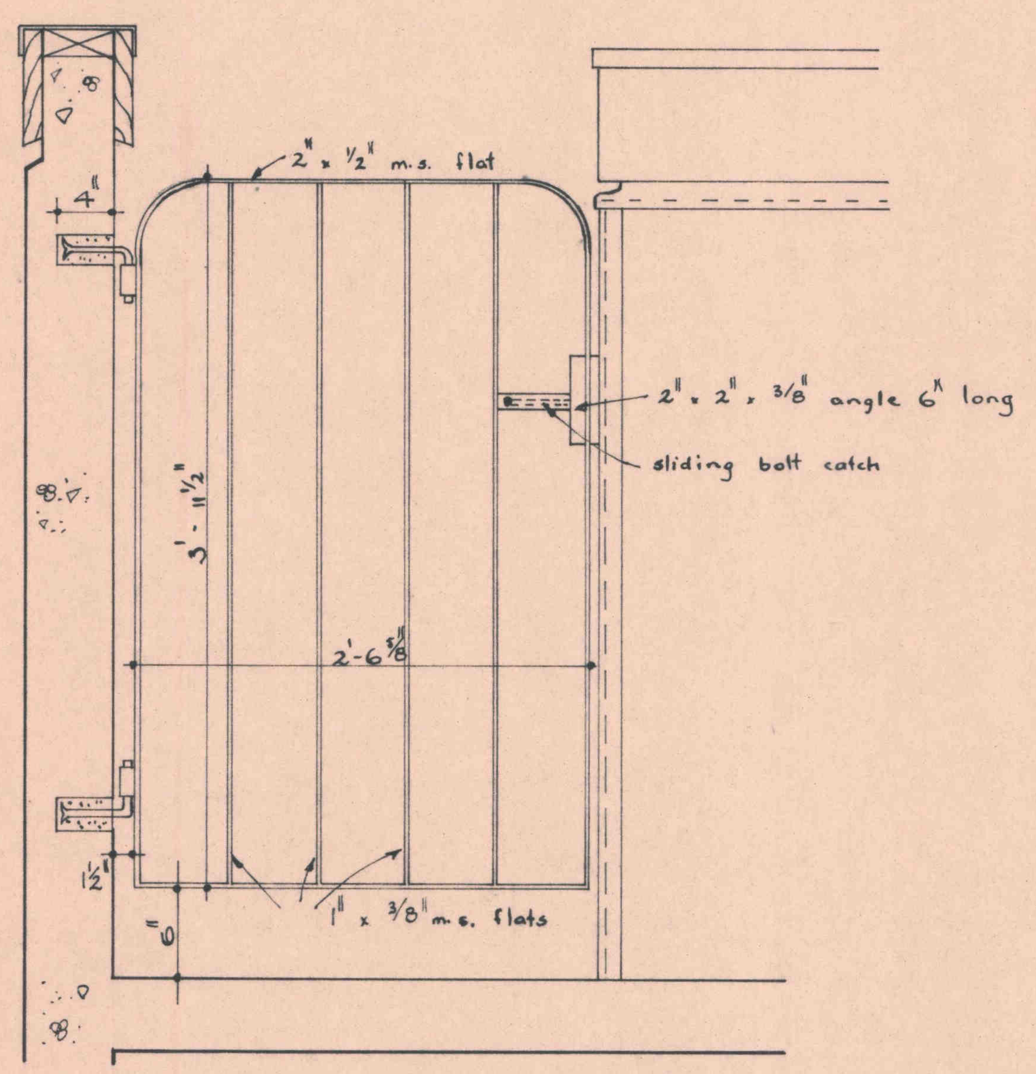
WELLINGTON CITY CORPORATION
TOWN PLANNING DEPARTMENT
ARCHITECTURAL DIVISION

K. V. CLARKE, CITY PLANNER

CONTRACT NUMBER	2278		SHEET No. 18
SCALE: as shown			
STAIR DETAILS BLOCK B SOUTH END GROUND FLOOR PLAN AND SECTIONS			IN SET OF: 44
TRACING NO. A.M. 247/18			
DESIGNED	W. J. BEECH		
DRAWN	M. COLARIC	DEC '67	
TRACED	P. LENIHAN	JULY '68	
CHECKED		AUG. 68	
APPROVED	C.H. Muir	CITY ARCHITECT	

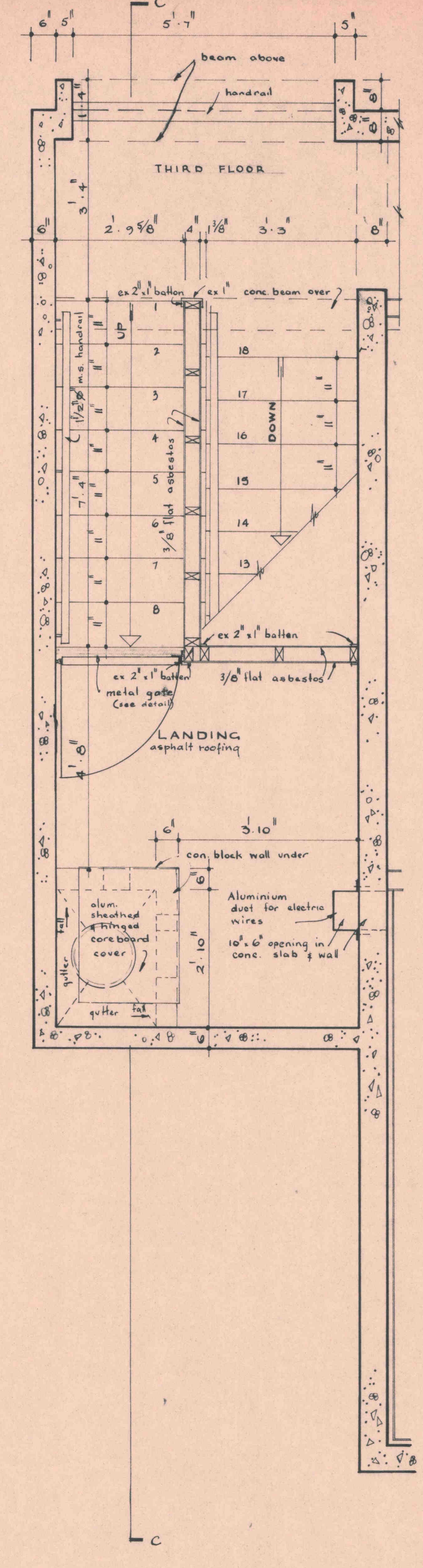


1" SCALE PLAN

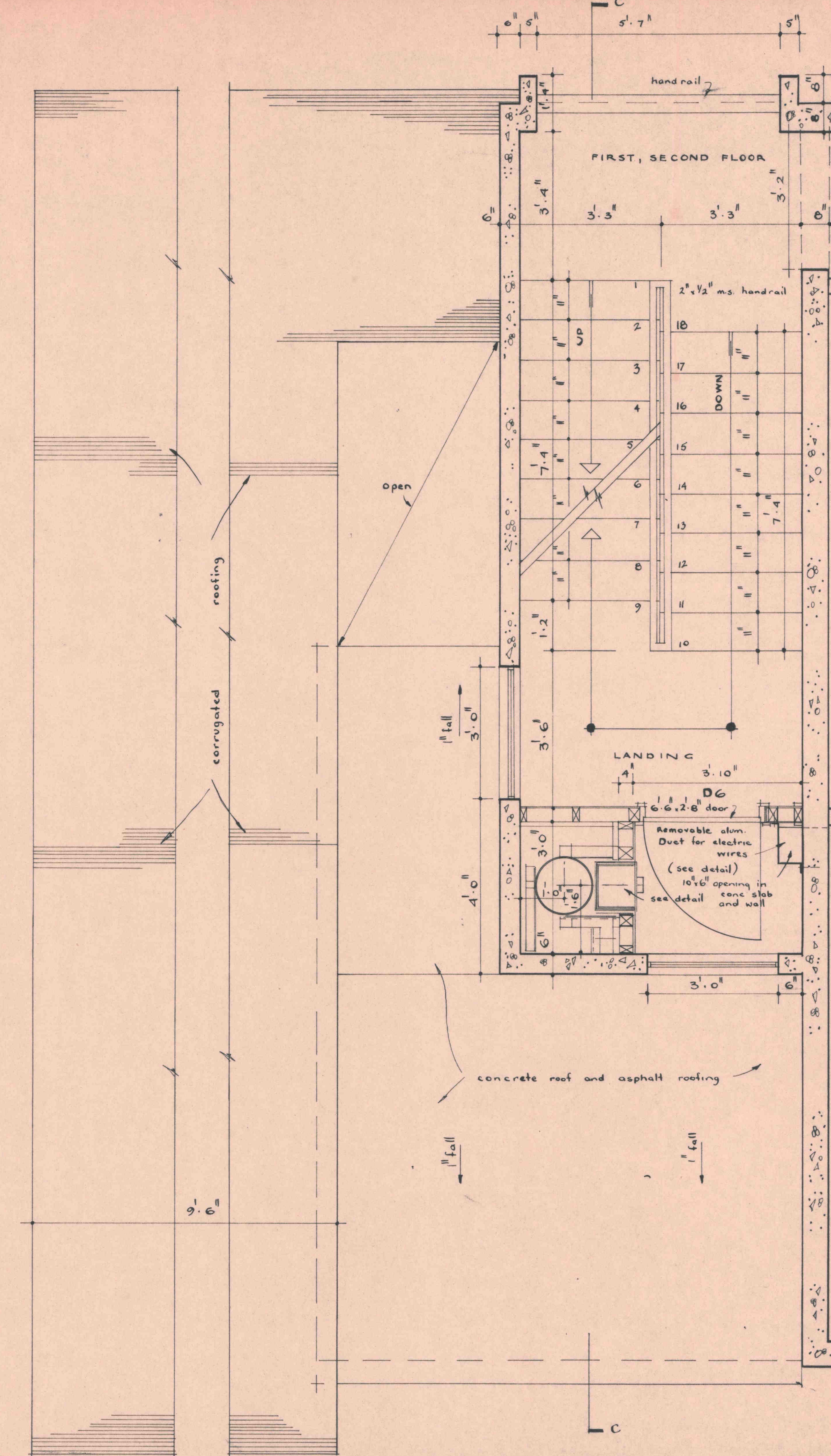


1" SCALE ELEVATION

1" SCALE DETAIL OF GATE



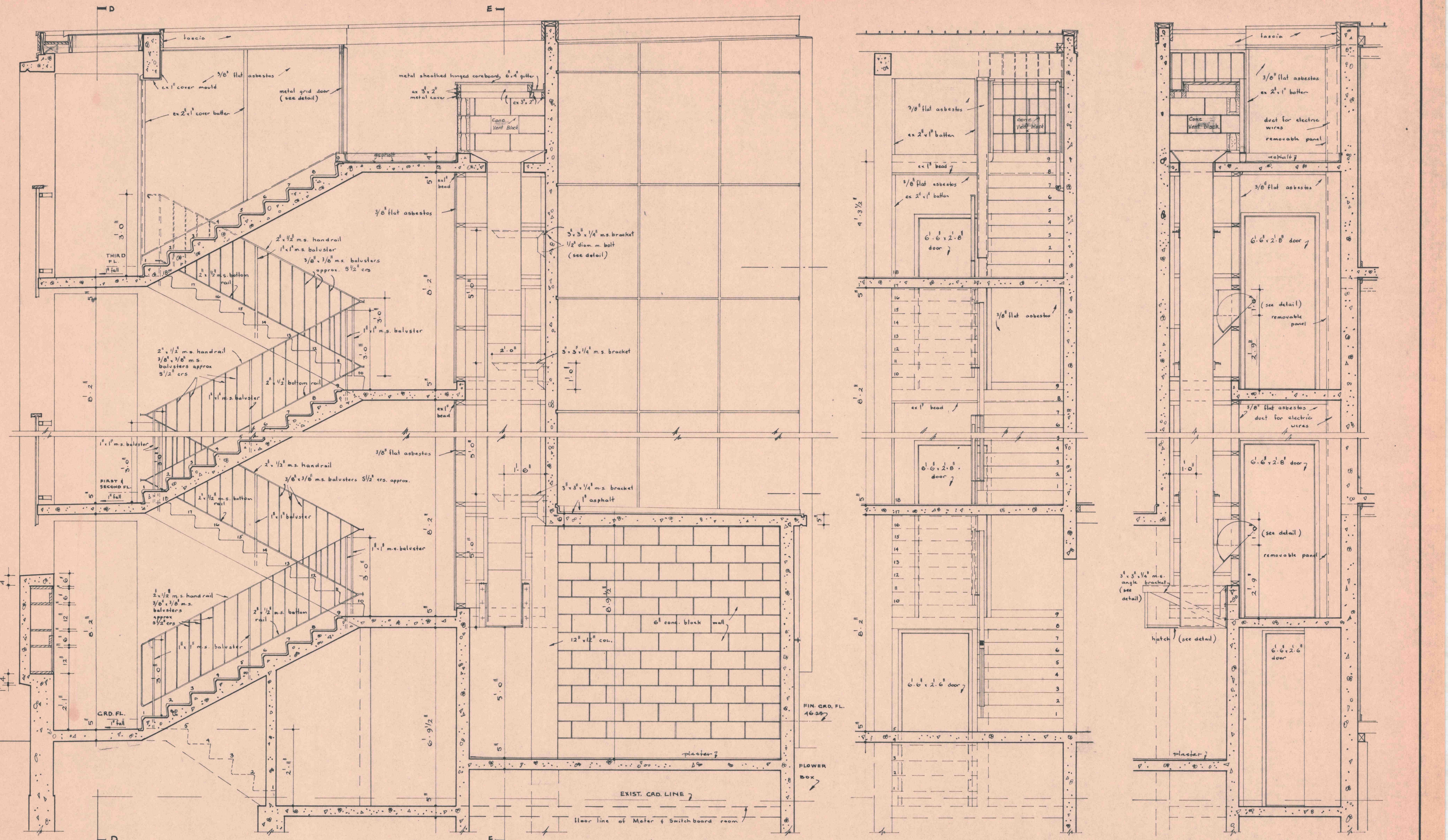
1/2" SCALE THIRD FLOOR PLAN



1/2" SCALE TYPICAL PLAN

STAIR DETAILS BLOCK B
SOUTH END

KOTUKU FLATS KEMP STREET · KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	CONTRACT NUMBER 2278 SCALE: AS SHOWN STAIR DETAILS BLOCK B SOUTH END TYPICAL FLOOR PLAN AND THIRD FLOOR PLAN	SHEET No. 19 IN SET OF: 44
WELLINGTON CITY CORPORATION TOWN PLANNING DEPARTMENT ARCHITECTURAL DIVISION K. V. CLARKE, CITY PLANNER	TRACING NO. A. M. 247/19 DESIGNED W. J. BEECH DRAWN M. COLARIĆ TRACED P. LENIHAN JULY '68 CHECKED AUG. 68 APPROVED C.M. Muir CITY ARCHITECT	



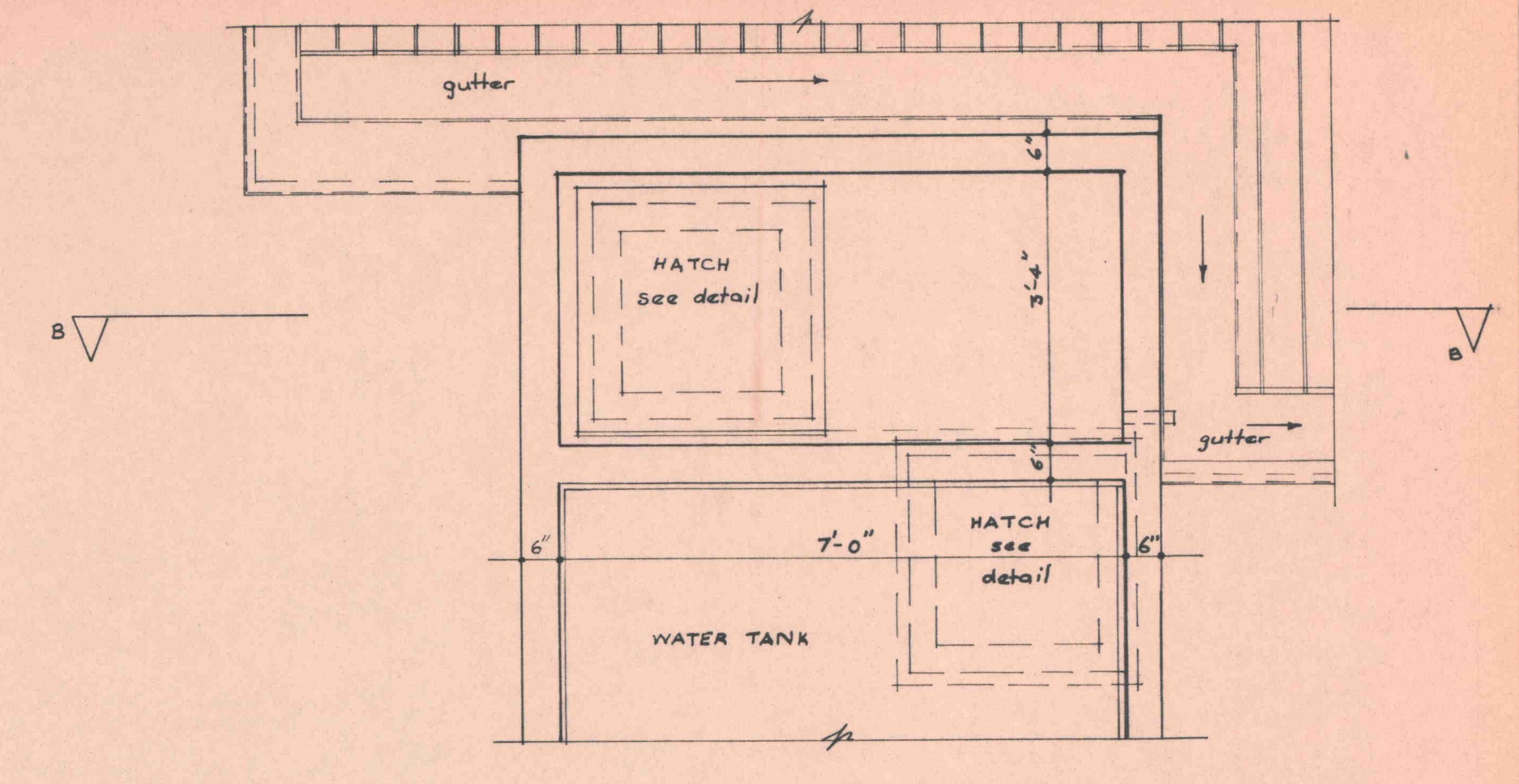
1/2 SCALE SECTION C-C

1/2" SCALE SECTION D-D

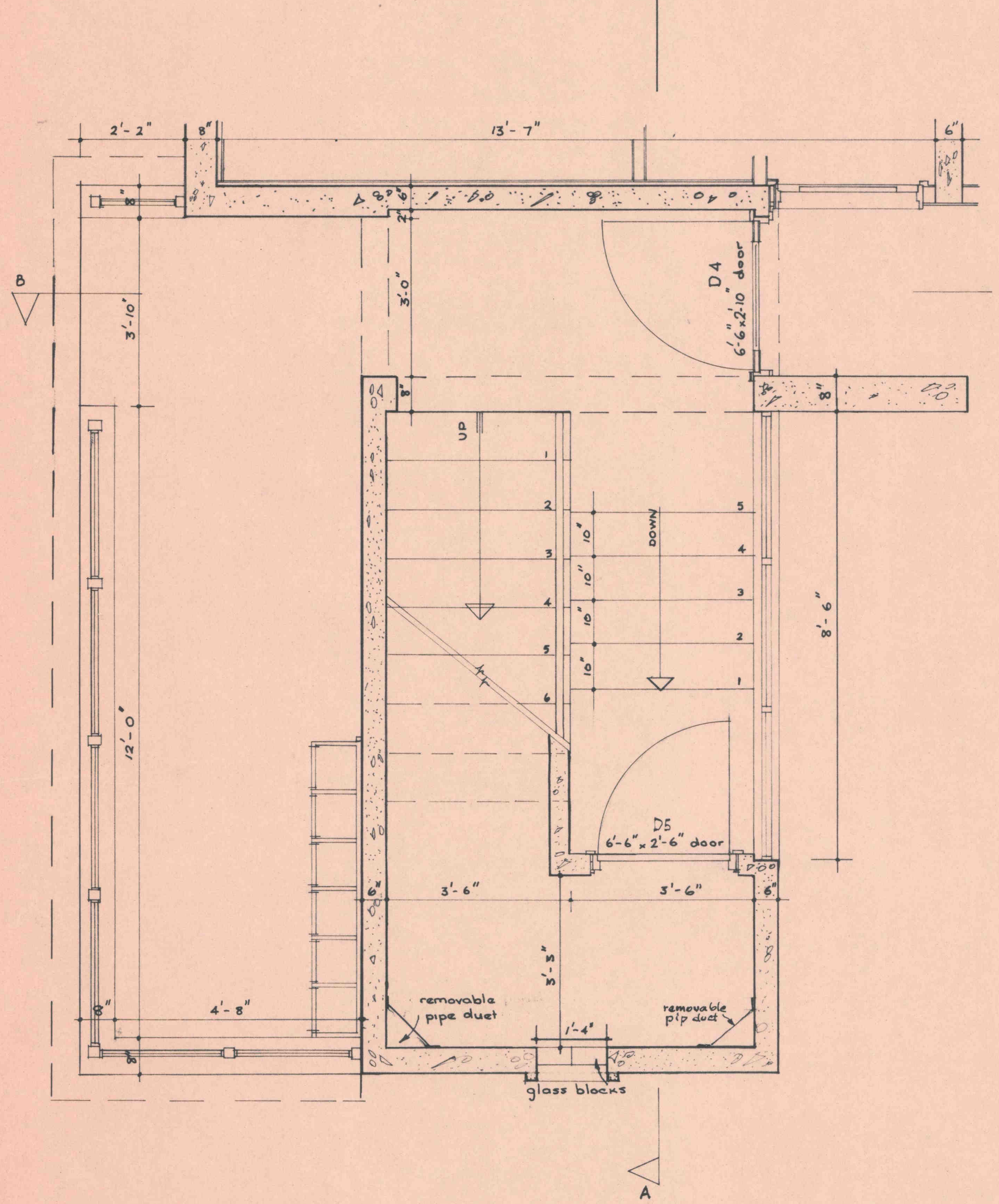
1/2" SCALE SECTION E-E

STAIR DETAILS SOUTH END BLOCK B

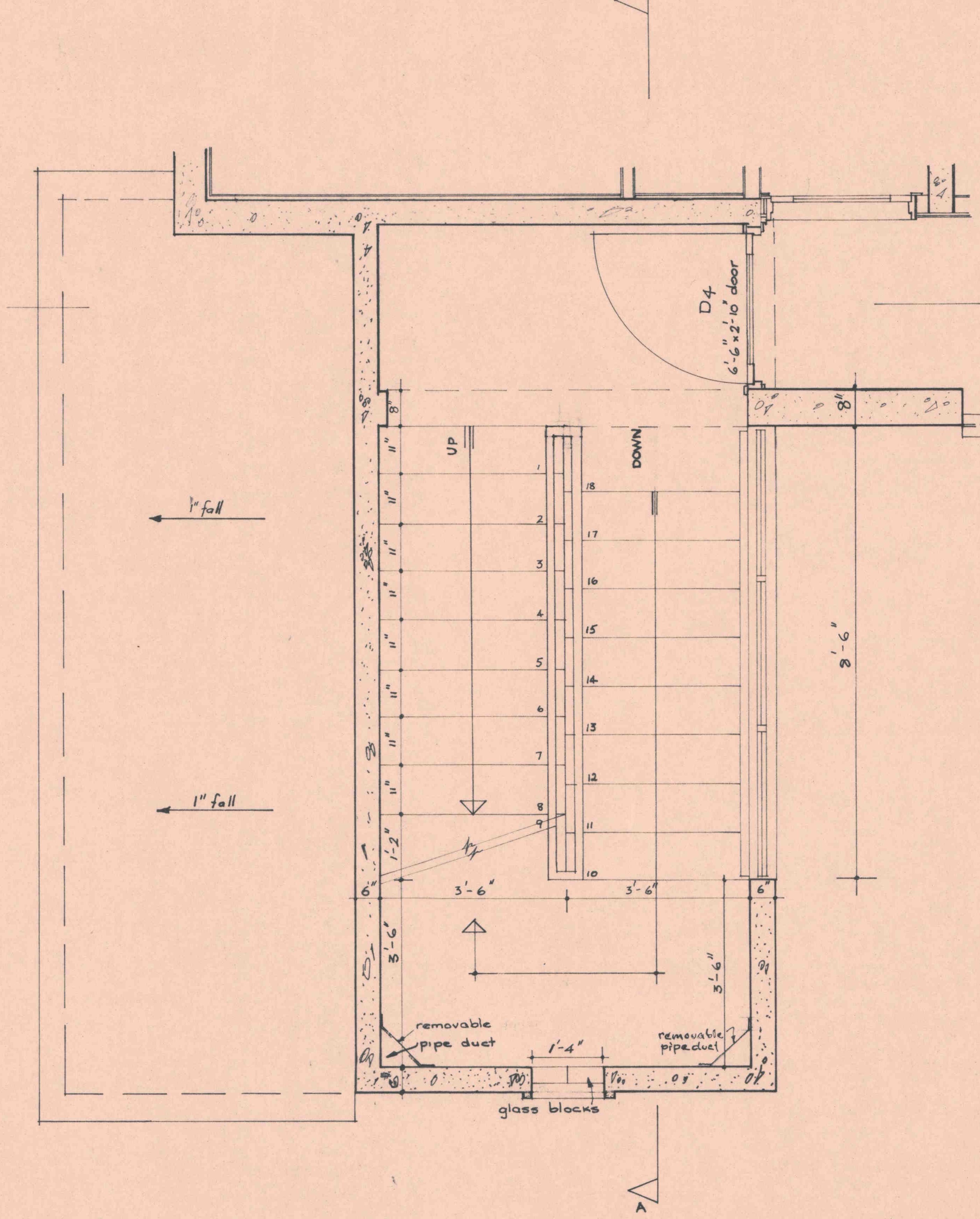
KOTUKU FLATS KEMP STREET . KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	CONTRACT NUMBER 2278 SCALE : AS SHOWN STAIR DETAILS, BLOCK B SOUTH END SECTIONS : C-C, D-D, & E-E.	SHEET No. 20 IN SET OF: 44
WELLINGTON CITY CORPORATION TOWN PLANNING DEPARTMENT ARCHITECTURAL . DIVISION K.V. CLARKE, CITY PLANNER	TRACING NO. A.M. 247/20 DESIGNED W.J. BEECH DRAWN M. COLARIC FEB '68 TRACED P. LENIHAN JULY '68 CHECKED AUG. 68 APPROVED C.M. Muir CITY ARCHITECT	



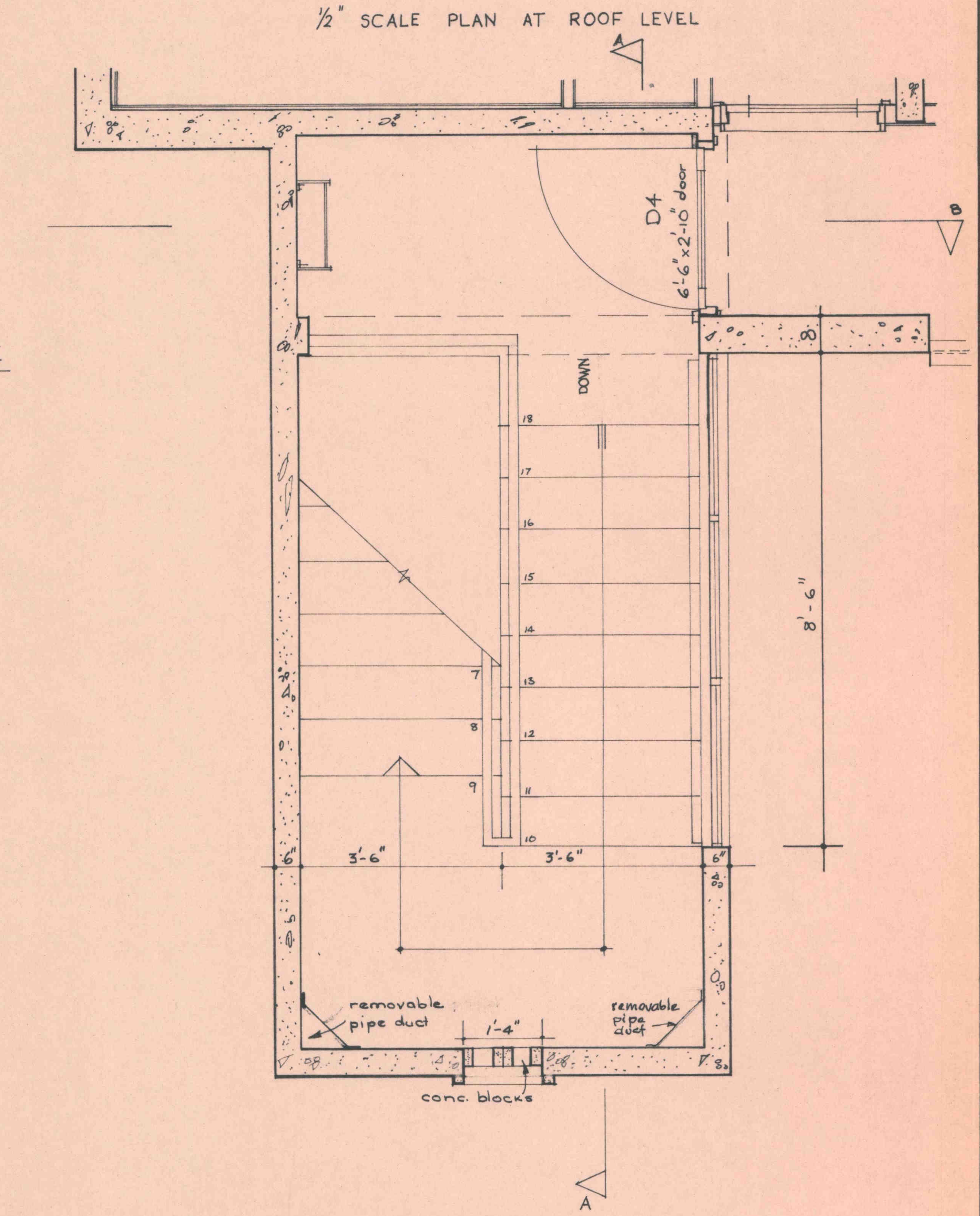
1/2" SCALE PLAN AT ROOF LEVEL



1/2" SCALE PLAN AT GROUND LEVEL



1/2" SCALE PLAN AT FIRST AND SECOND FLOOR LEVEL
TYPICAL PLAN.



1/2" SCALE PLAN AT THIRD FLOOR LEVEL

STAIR DETAILS BLOCK C
WEST END

KOTUKU FLATS
KEMP STREET KILBIRNIE
FOR THE WELLINGTON CITY CORPORATION

CONTRACT NUMBER 2278
SCALE AS SHOWN
STAIR PLANS BLOCK C WEST END
SHEET No. 21 IN SET OF: 44

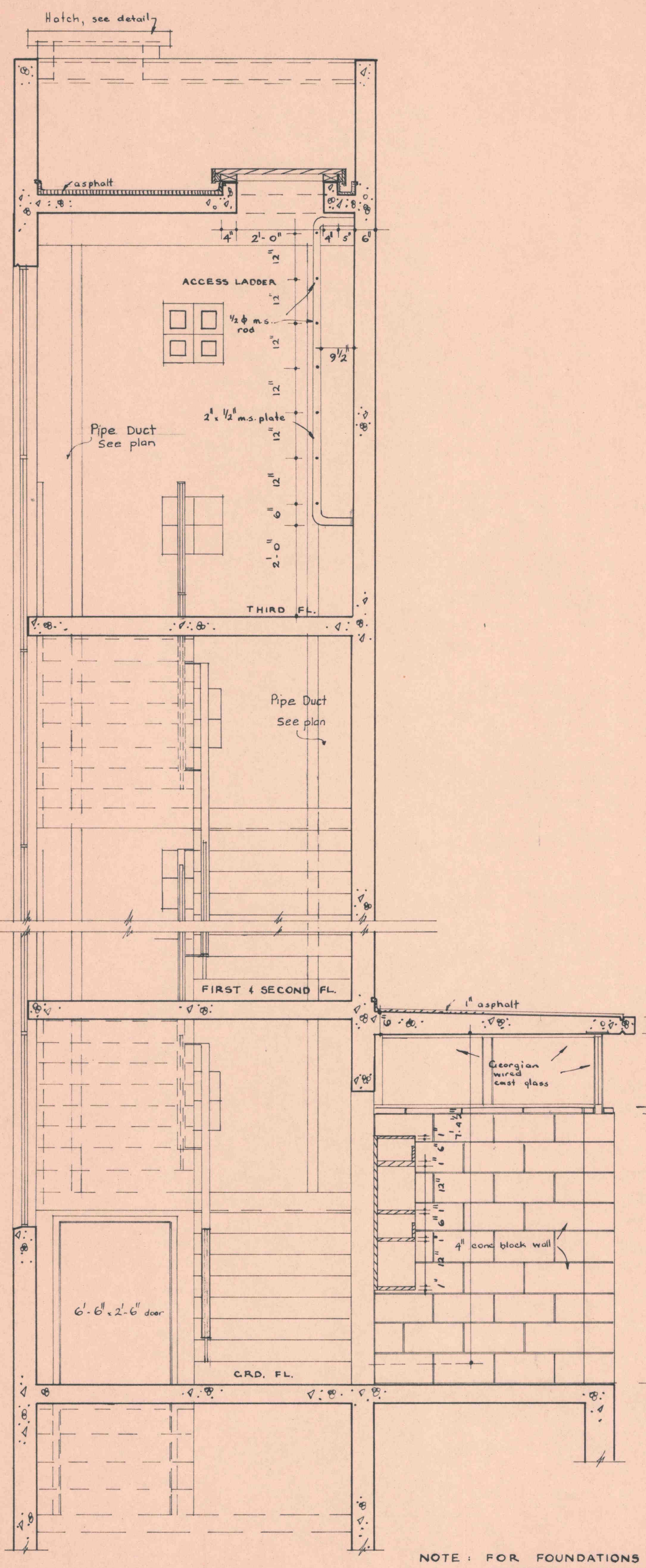
WELLINGTON CITY CORPORATION
TOWN PLANNING DEPARTMENT
ARCHITECTURAL DIVISION

TRACING NO. A.M. 247/21

DESIGNED	W.J. BEECH
DRAWN	P. LENIHAN
TRACED	S. ZARAVINOS
CHECKED	AUG 68
APPROVED	

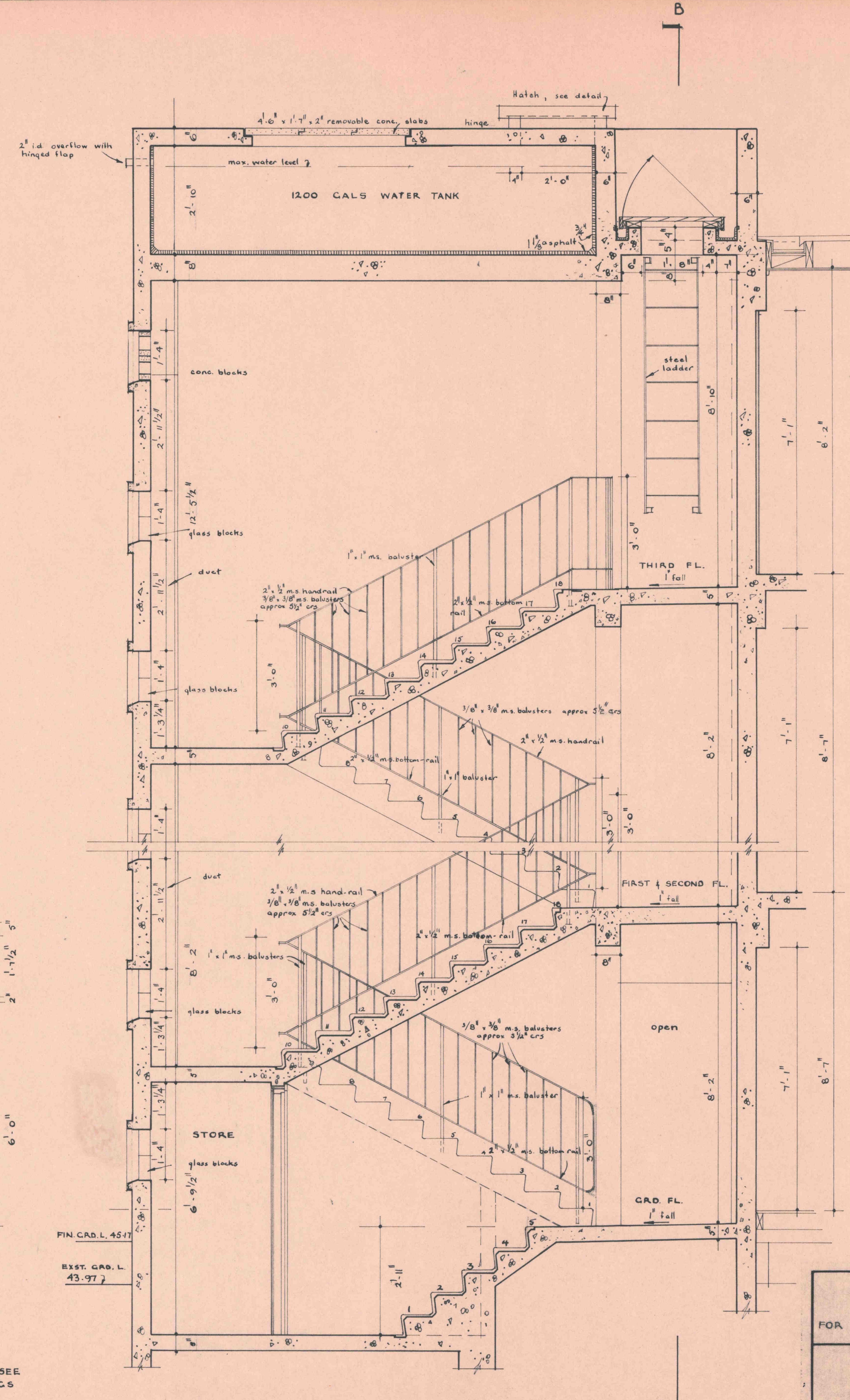
K.V. CLARKE, CITY PLANNER

CITY ARCHITECT



NOTE: FOR FOUNDATIONS SEE STRUCTURAL DRAWINGS

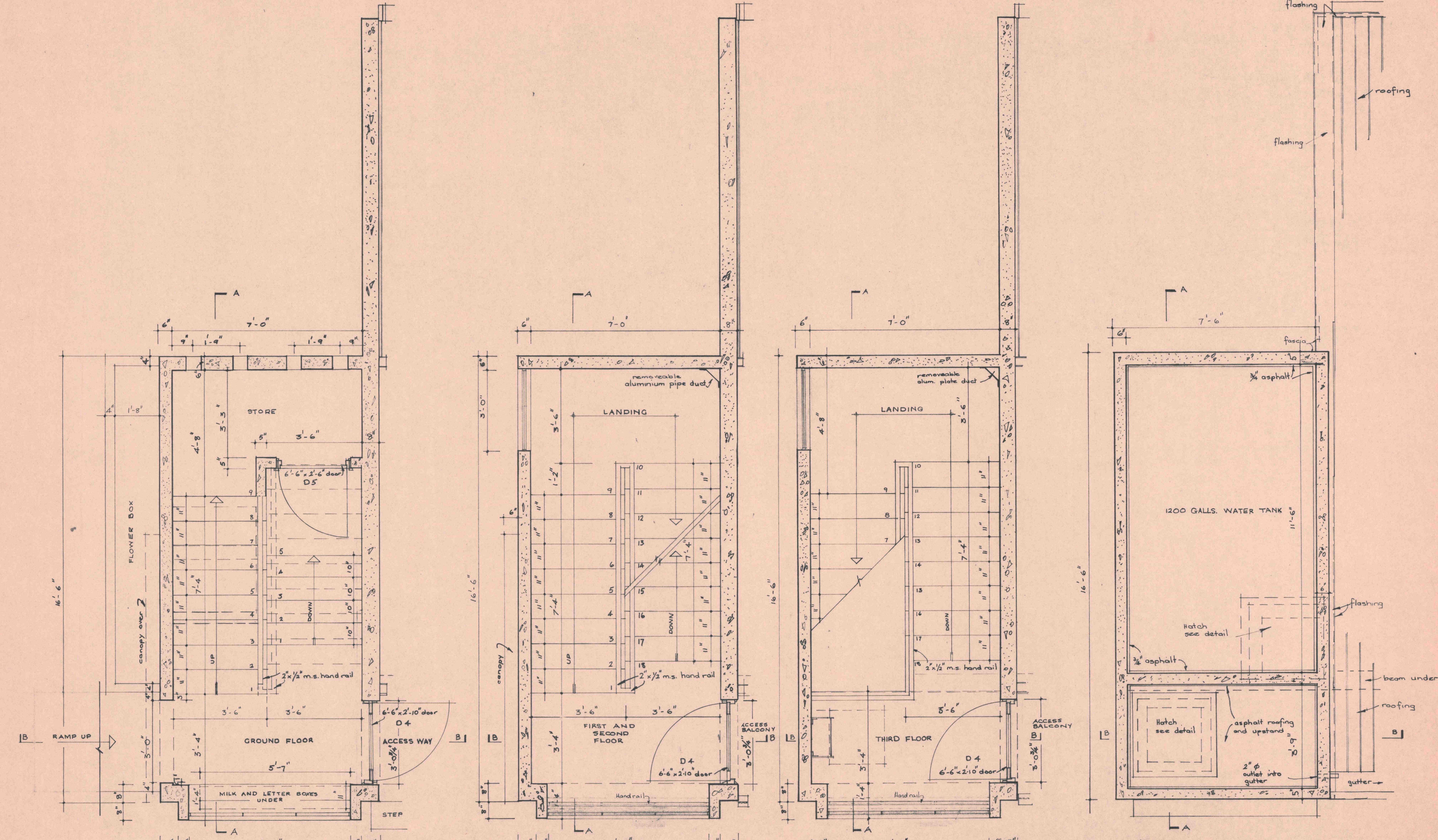
1/2" SCALE SECTION B - B



1/2" SCALE SECTION A - A

STAIR DETAILS
BLOCK C
WEST END

KOTUKU FLATS KEMP STREET, KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	CONTRACT NUMBER 2278		SHEET No. 22
	SCALE as shown		
	STAIR DETAILS BLOCK C WEST END SECTIONS		IN SET OF: 44
WELLINGTON CITY CORPORATION TOWN PLANNING DEPARTMENT ARCHITECTURAL DIVISION K. V. CLARKE, CITY PLANNER	TRACING NO. A.M. 247/22		
	DESIGNED	W. J. BEECH	
	DRAWN	P. LENIHAN	MAR '68
	TRACED	P. LENIHAN	JULY '68
	CHECKED	[illegible]	AUG 68
	APPROVED	CITY ARCHITECT	



½" SCALE PLAN AT GROUND FLOOR

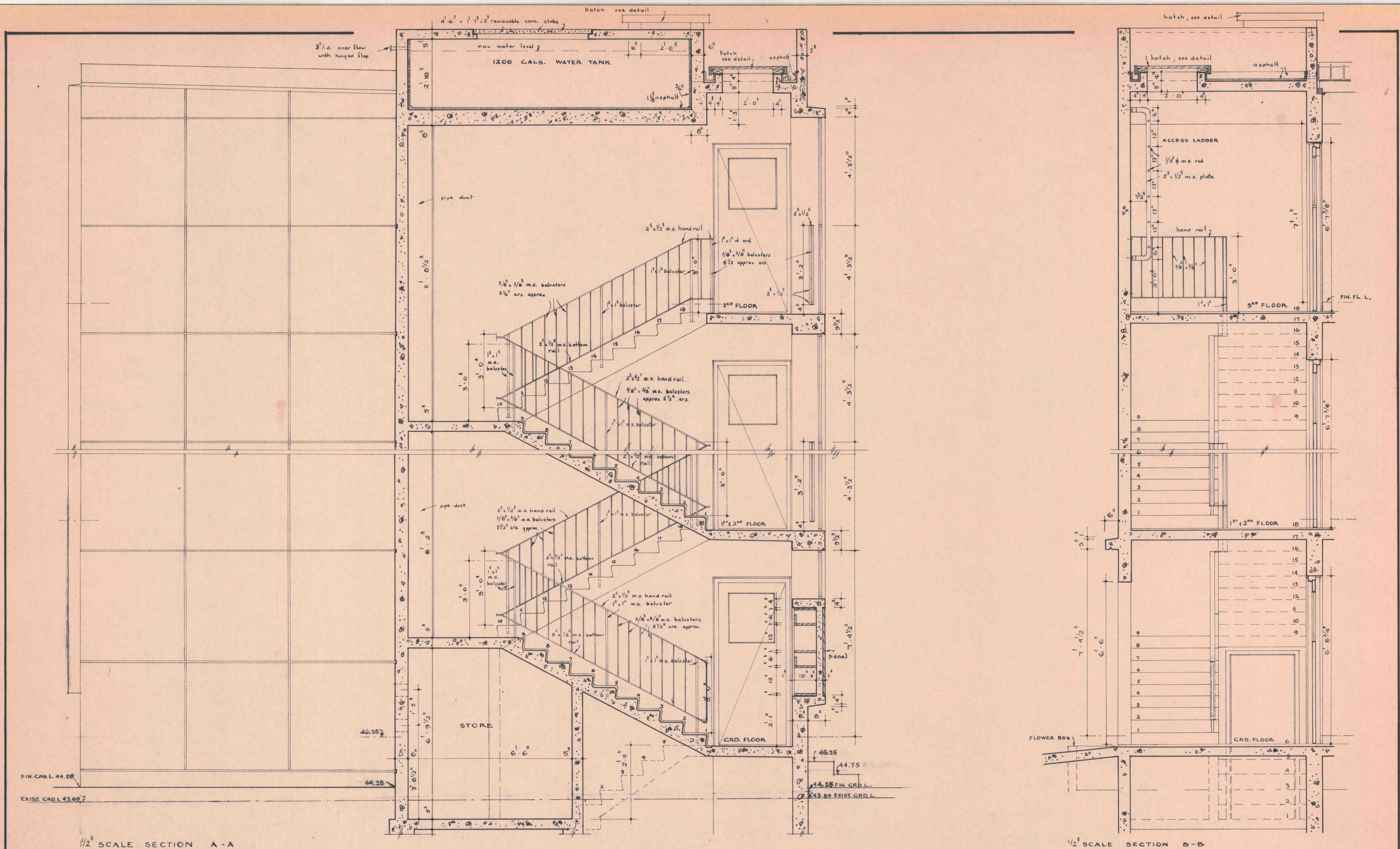
½" SCALE PLAN AT FIRST & SECOND FLOOR

½" SCALE PLAN AT THIRD FLOOR

½" SCALE PLAN AT ROOF LEVEL

STAIR DETAILS BLOCK D
WEST END

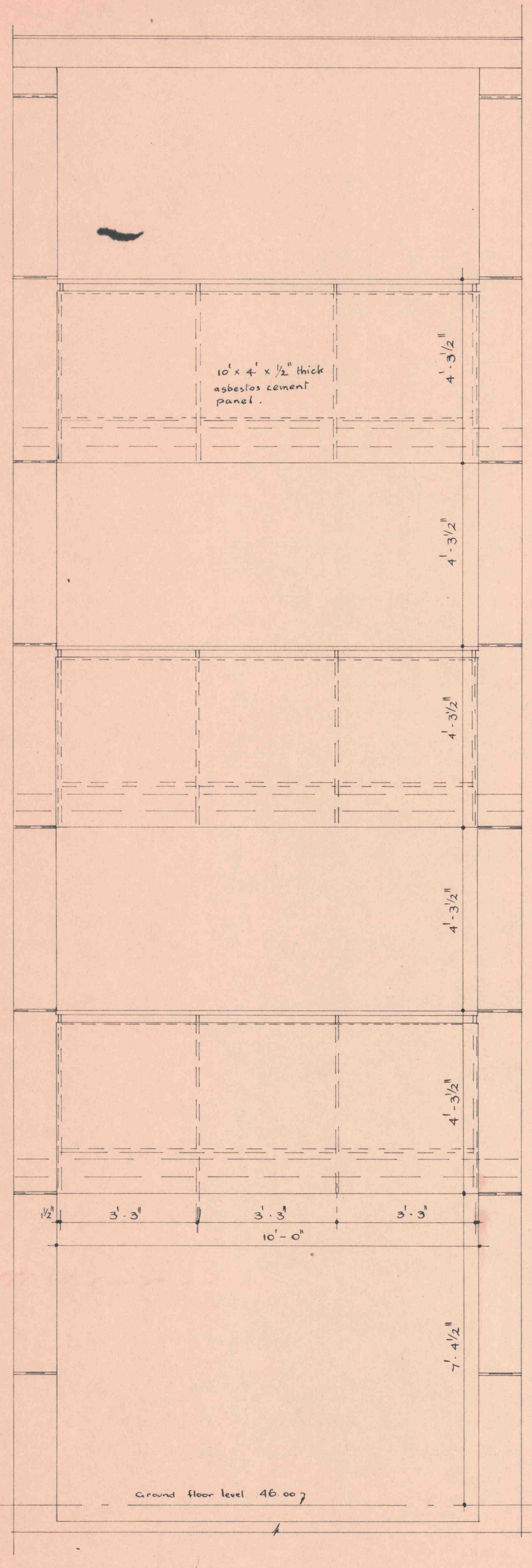
KOTUKU FLATS KEMP STREET, KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	CONTRACT NUMBER 2278 SCALE as shown STAIR DETAILS BLOCK D WEST END FLOOR PLANS	SHEET No. 23 IN SET OF: 44
WELLINGTON CITY CORPORATION TOWN PLANNING DEPARTMENT ARCHITECTURAL DIVISION K.V. CLARKE, CITY PLANNER	TRACING NO. A.M. 247/23	
	DESIGNED W. J. BEECH	
	DRAWN M. COLARIC	FEB. 68
	TRACED S. ZARAVINOS	
	CHECKED	AUG. 68
	APPROVED C.M. Muir CITY ARCHITECT	



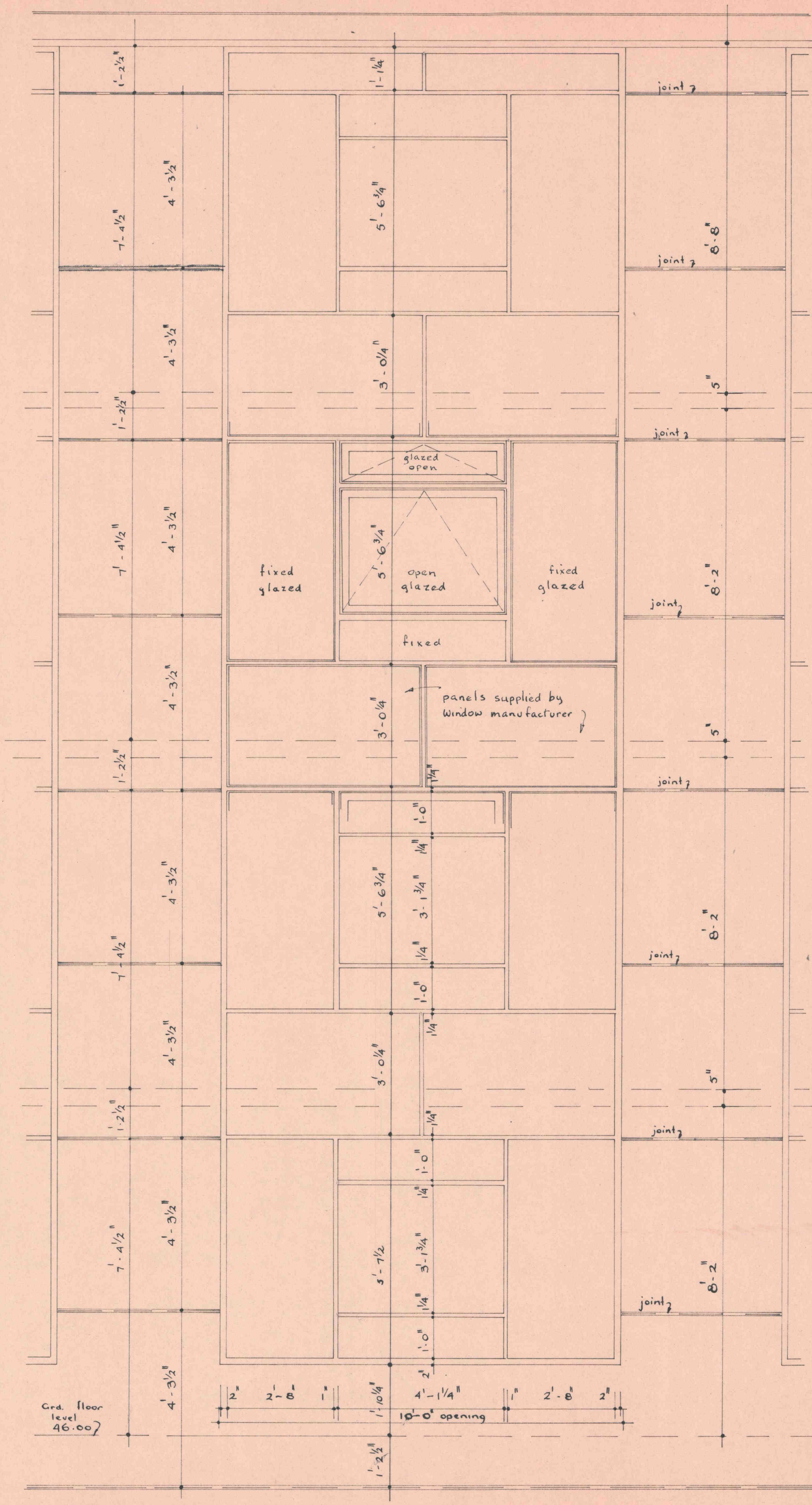
NOTE: FOR FOUNDATIONS SEE STRUCTURAL DRAWINGS

STAIR DETAILS BLOCK D
WEST END

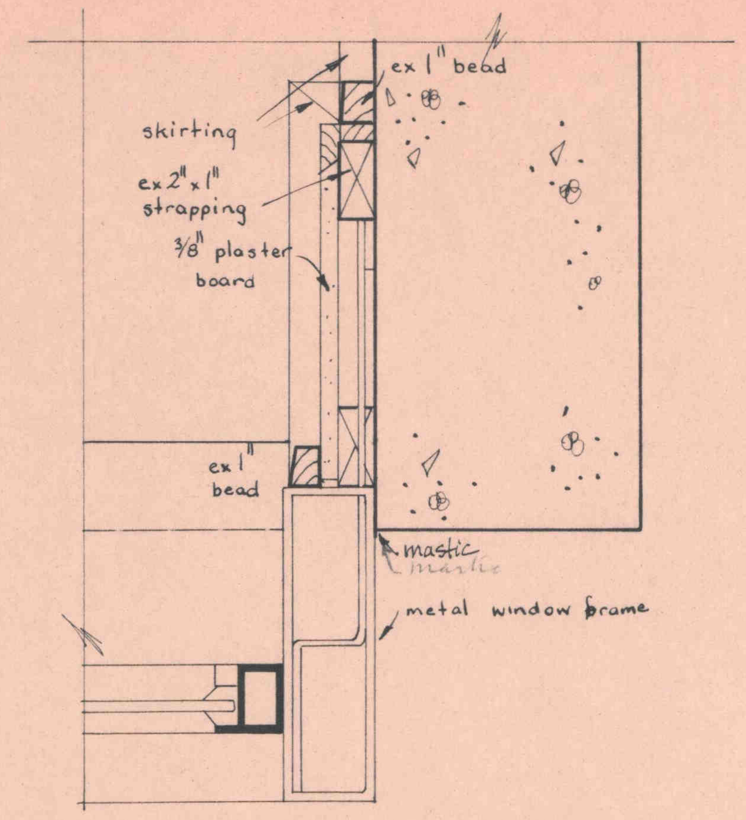
KOTUKU FLATS KEMP STREET, KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	CONTRACT NUMBER 2278 SCALE as shown STAIR DETAILS BLOCK D WEST END SECTIONS.	SHEET No. 24 IN SET OF: 44
WELLINGTON CITY CORPORATION TOWN PLANNING DEPARTMENT ARCHITECTURAL DIVISION K.V. CLARKE, CITY PLANNER	TRACING NO. A.M. 247/24	
	DESIGNED W.J. BEECH	
	DRAWN M. COLARIC FEB 68	
	TRACED P. LENIHAN JULY 68	
	CHECKED AUG. 68	
	APPROVED C.M. Muir CITY ARCHITECT	



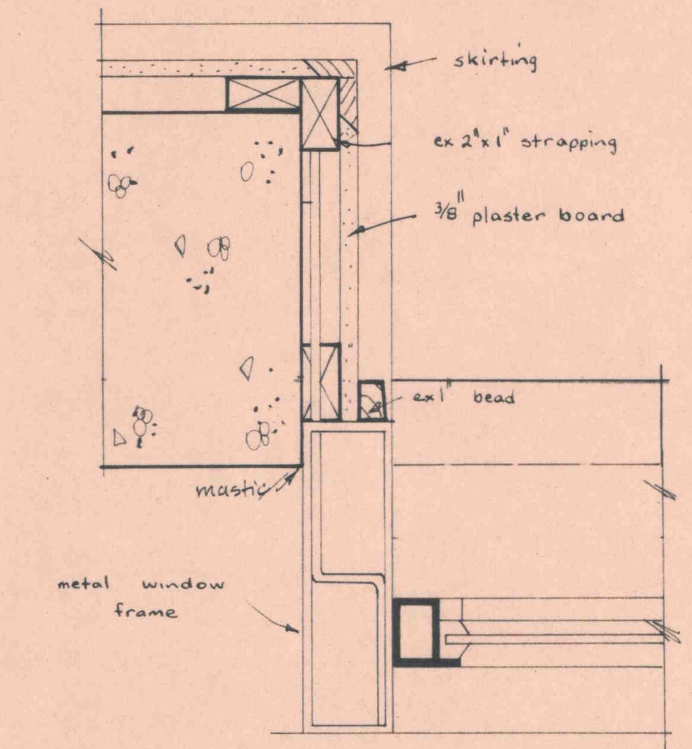
1/2" SCALE TYPICAL ELEVATION OF BALUSTRADE FOR ACCESS BALCONIES



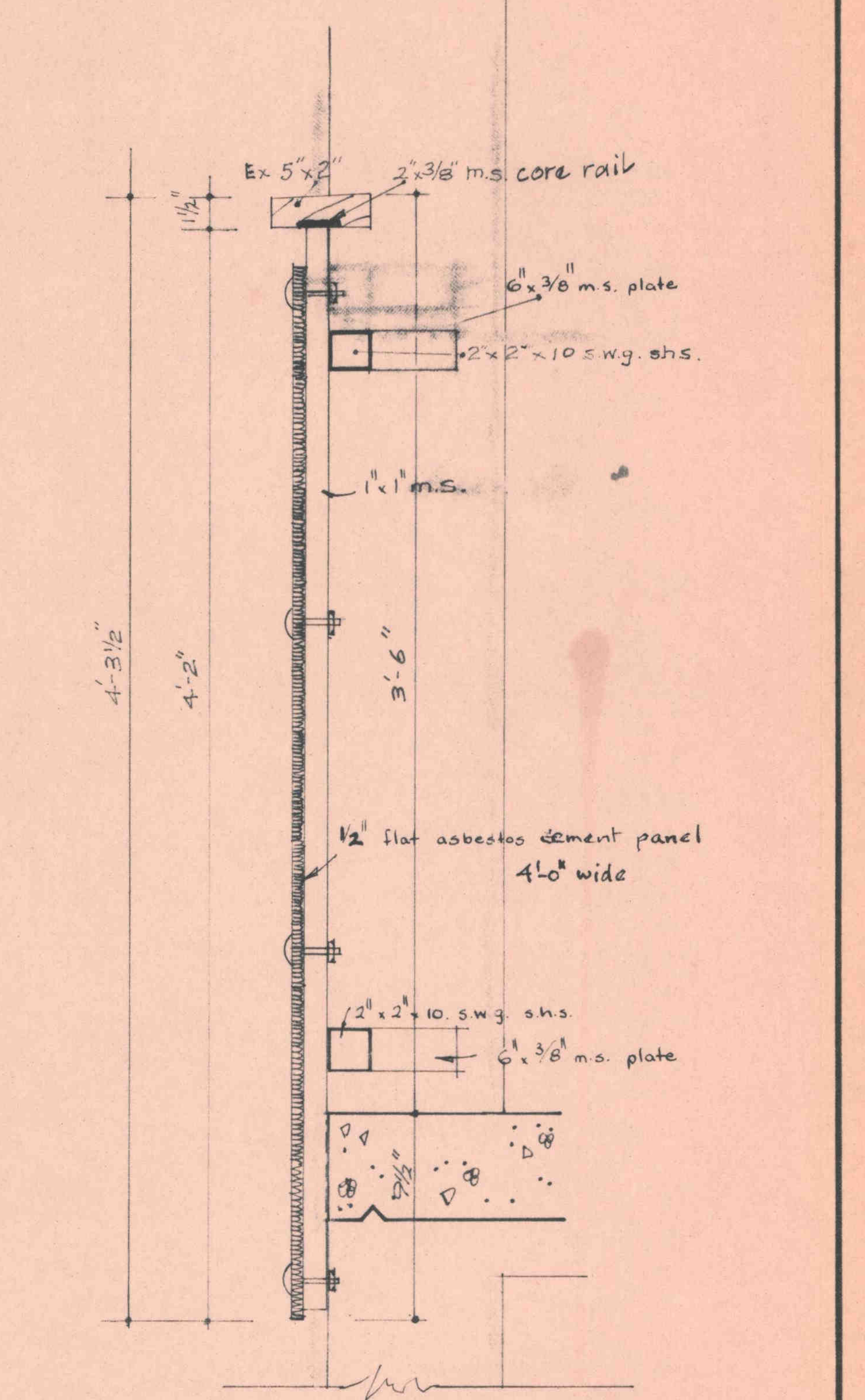
1/2" SCALE TYPICAL ELEVATION OF CURTAIN WALL WINDOWS

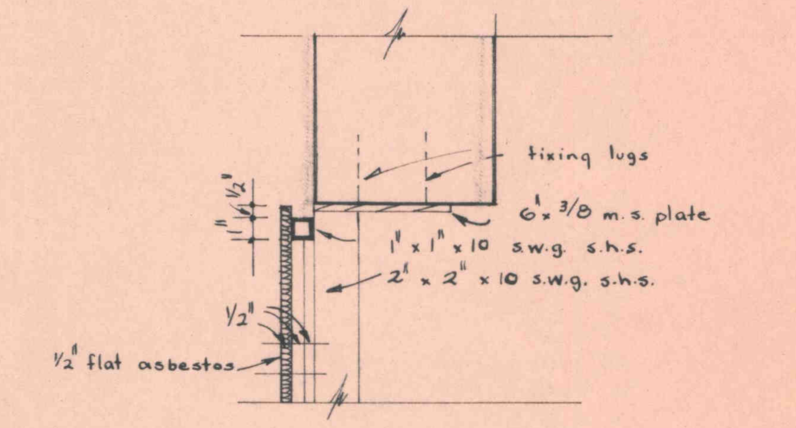


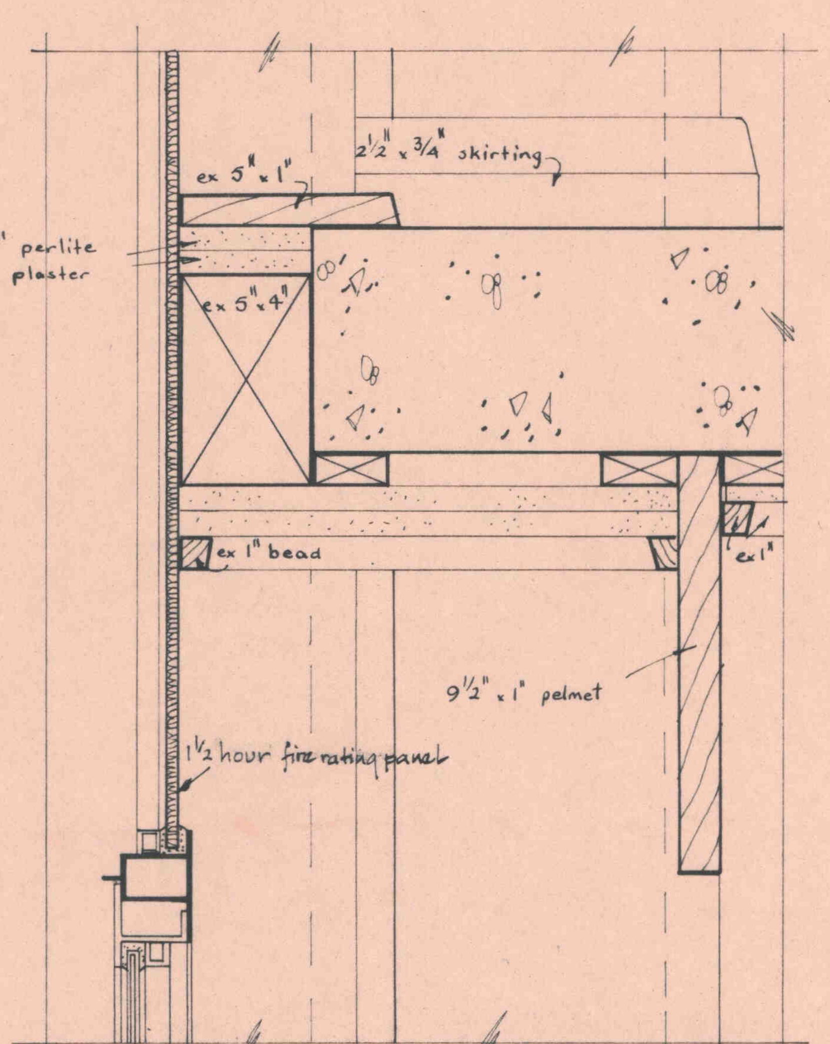
1/4 F.S DETAIL AT PARTY WALL



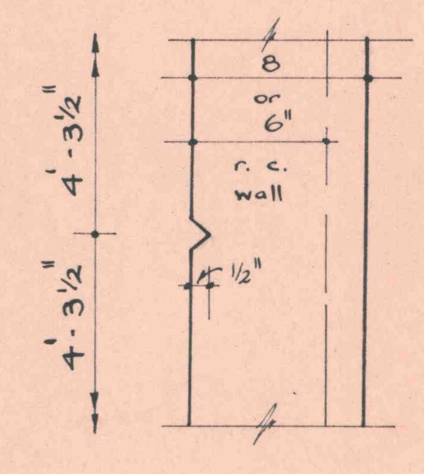
1/4" F.S. DETAIL AT 4'-0" COLOUMN





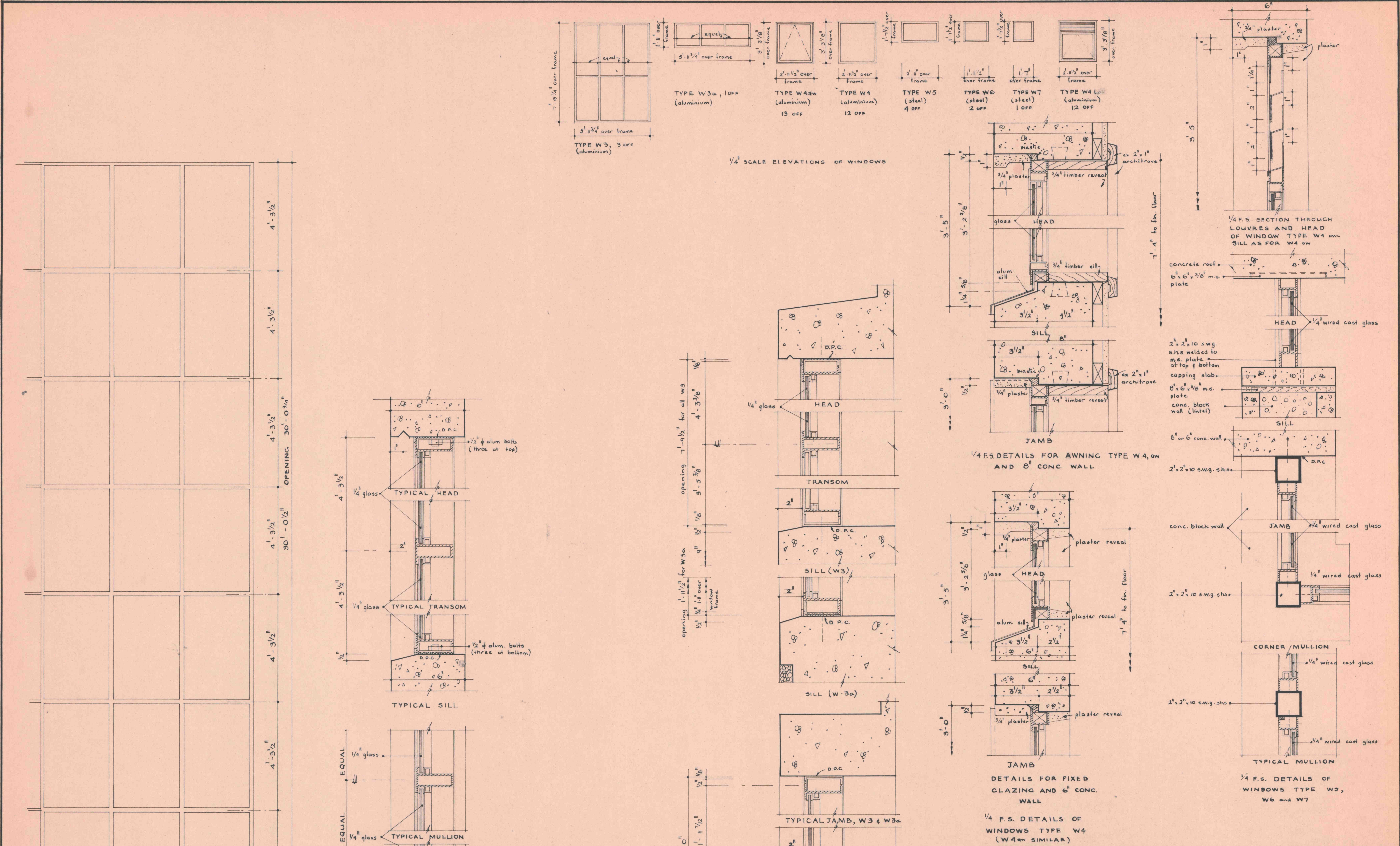


1/4 F.S. DETAIL OF FINISH AT SPANDREL



1/8 F.S. DETAIL OF HORIZONTAL JOINT

KOTUKU FLATS KEMP STREET · KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	CONTRACT NUMBER 2278 SCALE: as shown CURTAIN WALL DETAILS (WINDOWS TYPE W1)	SHEET No. 25 IN SET OF: 44
WELLINGTON CITY CORPORATION TOWN PLANNING DEPARTMENT ARCHITECTURAL DIVISION K. V. CLARKE, CITY PLANNER	TRACING NO. A.M. 247/25	
	DESIGNED	W. J. BEECH
	DRAWN	M. COLARIC
	TRACED	P. LENIHAN JULY '68
	CHECKED	AUG. 68
	APPROVED C.M. Muir	CITY ARCHITECT



KOTUKU FLATS
KEMP STREET · KILBIRNIE
FOR THE WELLINGTON CITY CORPORATION

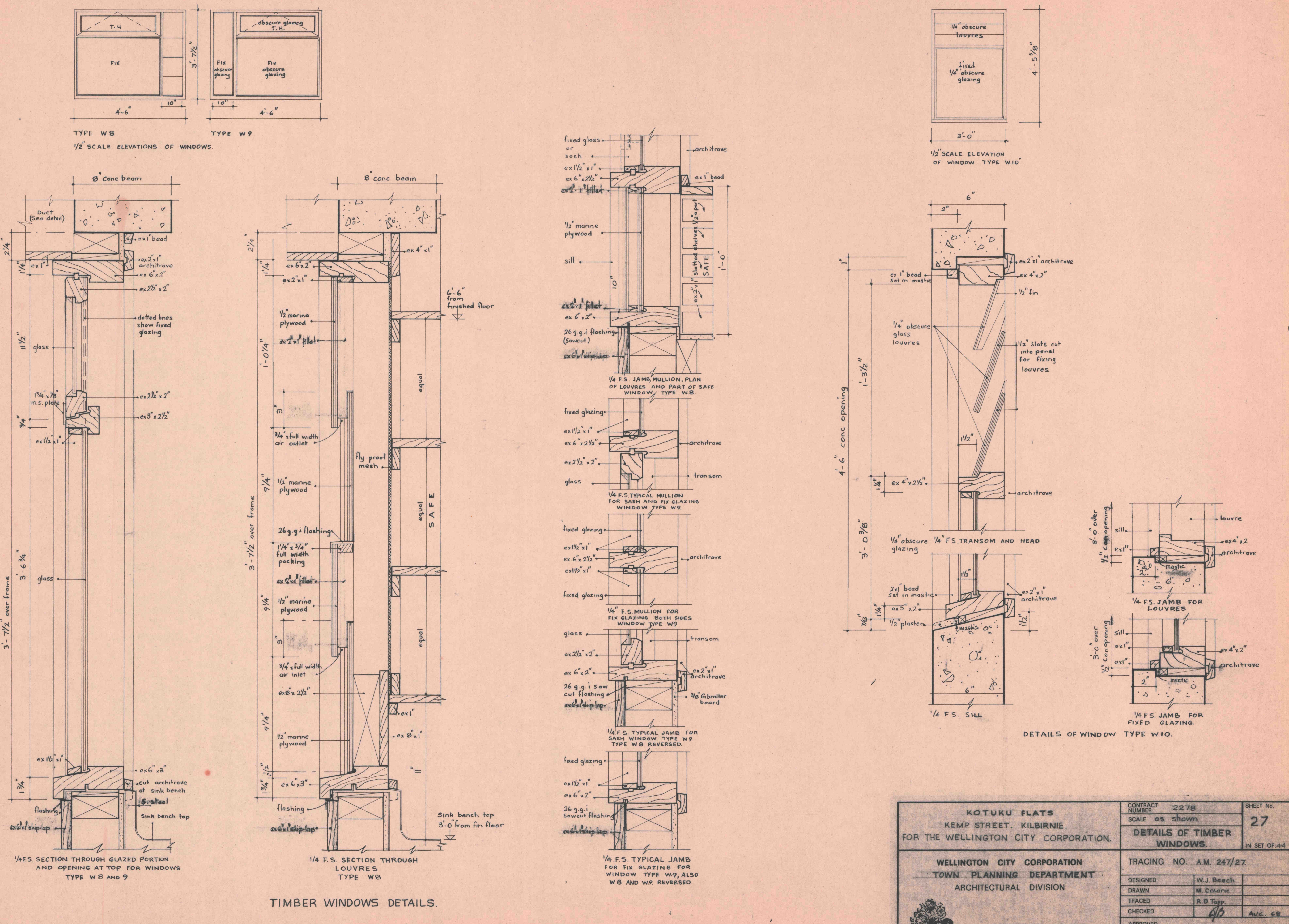
CONTRACT NUMBER	2278
SCALE:	as shown
	DETAILS OF METAL WINDOWS
SHEET No.	26
IN SET OF:	44

WELLINGTON CITY CORPORATION
TOWN PLANNING DEPARTMENT
ARCHITECTURAL DIVISION

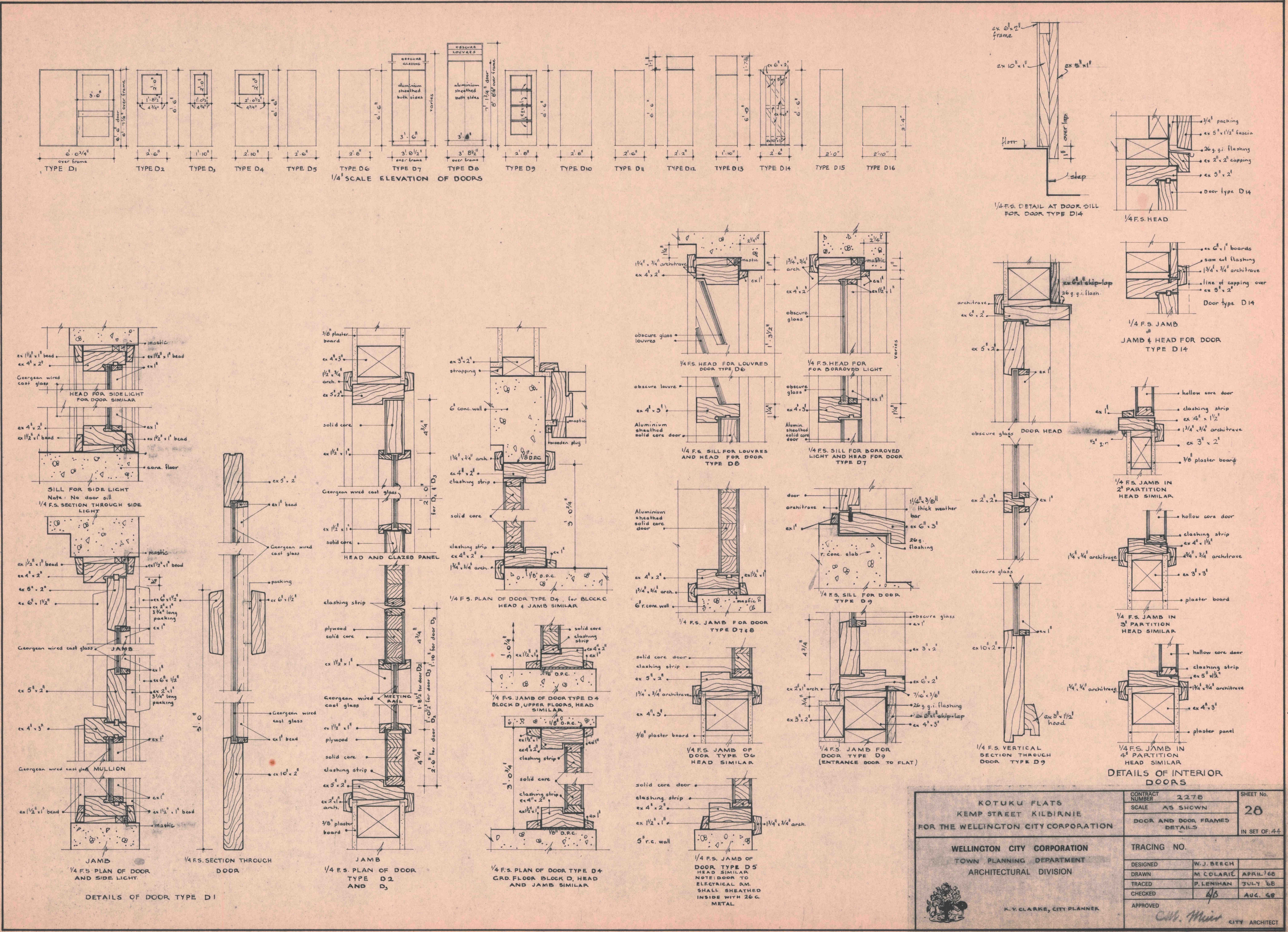
H. V. CLARKE, CITY PLANNER

TRACING NO. AM. 247/26

DESIGNED	W. J. BEECH	
DRAWN	M. COLARIĆ	APR '68
TRACED	P. LENIHAN	JULY '68
CHECKED	6/B	AUG. 68
APPROVED	C.M. Muir	CITY ARCHITECT



KOTUKU FLATS KEMP STREET. KILBIRNIE. FOR THE WELLINGTON CITY CORPORATION.	CONTRACT NUMBER 2278 SCALE as shown DETAILS OF TIMBER WINDOWS.	SHEET No. 27 IN SET OF 44
WELLINGTON CITY CORPORATION TOWN PLANNING DEPARTMENT ARCHITECTURAL DIVISION K.V. CLARKE CITY PLANNER	TRACING NO. A.M. 247/27	
	DESIGNED W.J. Beech	
	DRAWN M. Colaric	
	TRACED R.D. Topp	
	CHECKED	AUG. 68
	APPROVED C.M. Muir CITY ARCHITECT	



KOTUKU FLATS
KEMP STREET KILBIRNIE
FOR THE WELLINGTON CITY CORPORATION

CONTRACT NUMBER	2278
SCALE	AS SHOWN
SHEET No.	28
IN SET OF:	44

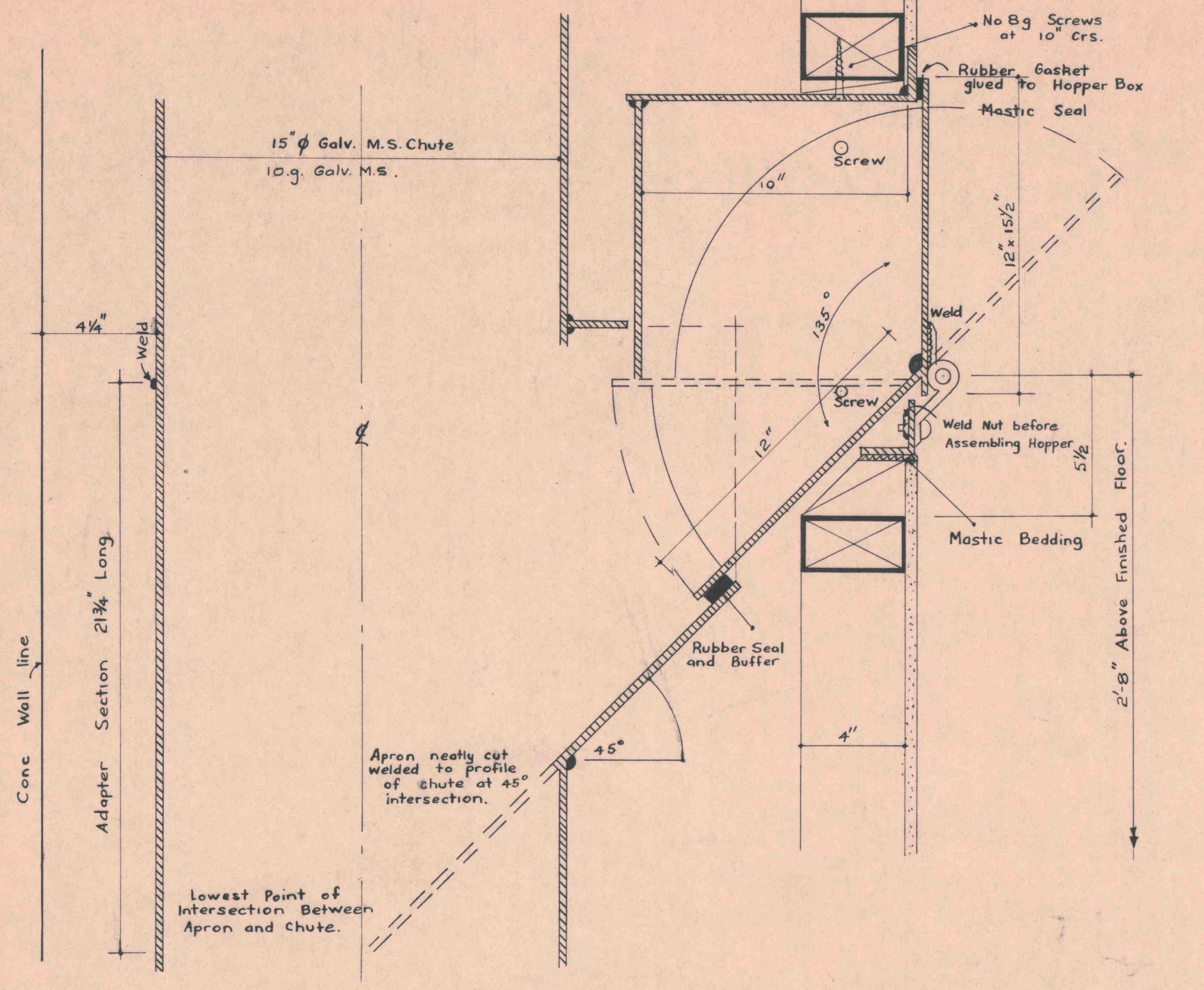
DOOR AND DOOR FRAMES DETAILS

WELLINGTON CITY CORPORATION
TOWN PLANNING DEPARTMENT
ARCHITECTURAL DIVISION

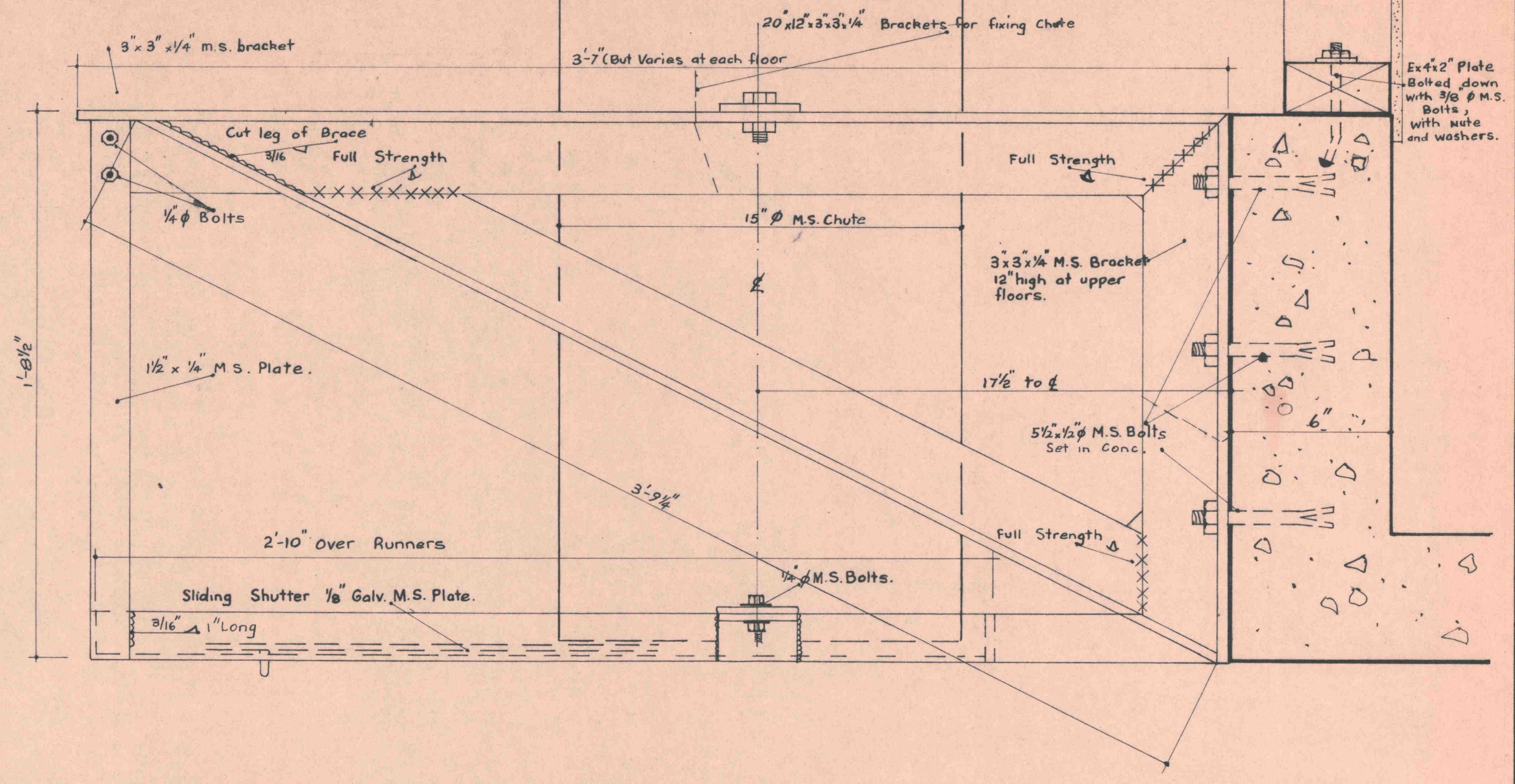
K.Y. CLARKE, CITY PLANNER

TRACING NO.

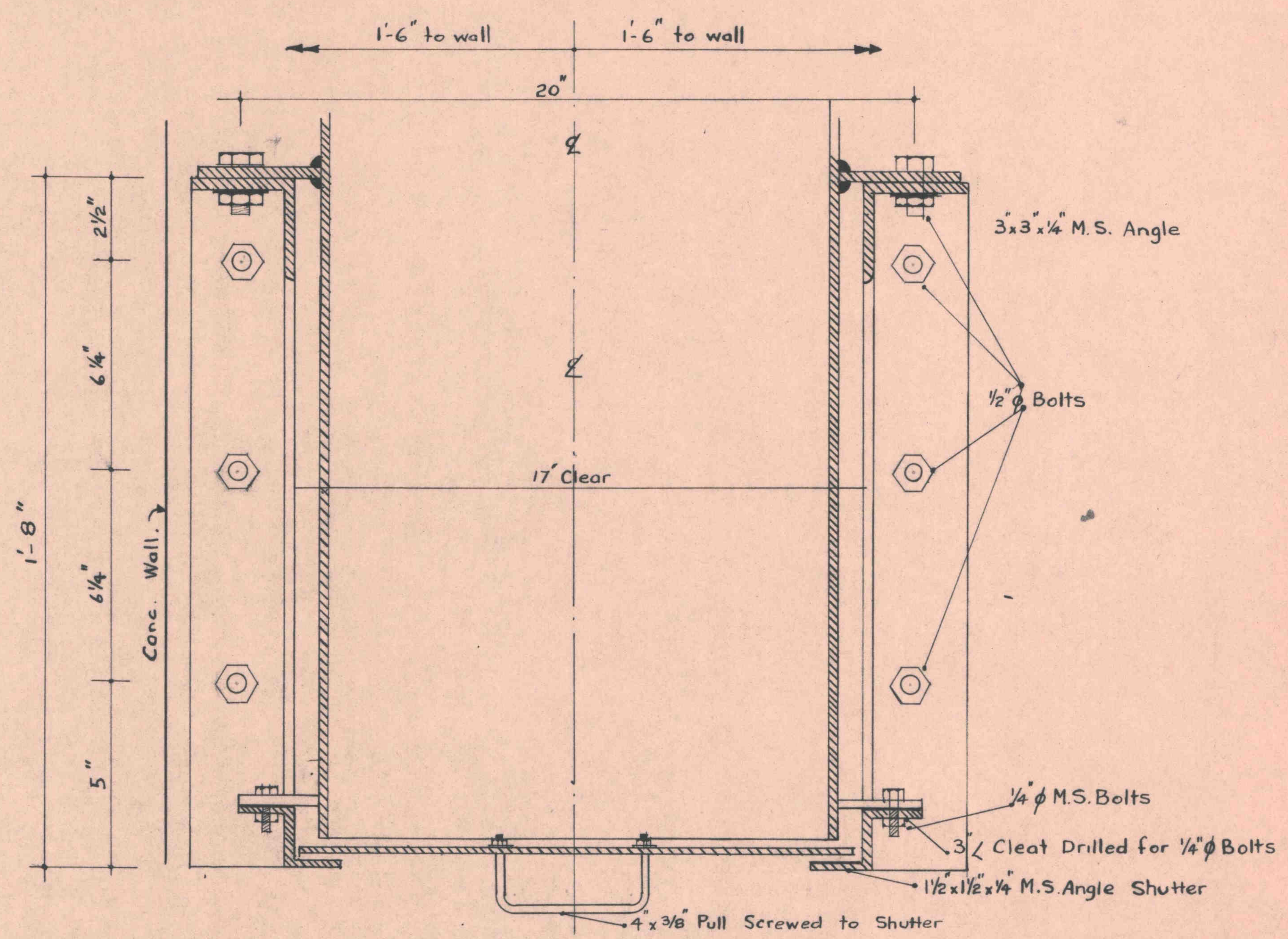
DESIGNED	W. J. BEECH	
DRAWN	M. COLARIĆ	APRIL '68
TRACED	P. LENIHAN	JULY '68
CHECKED	G/B	AUG. 68
APPROVED	C.M. Muir	CITY ARCHITECT



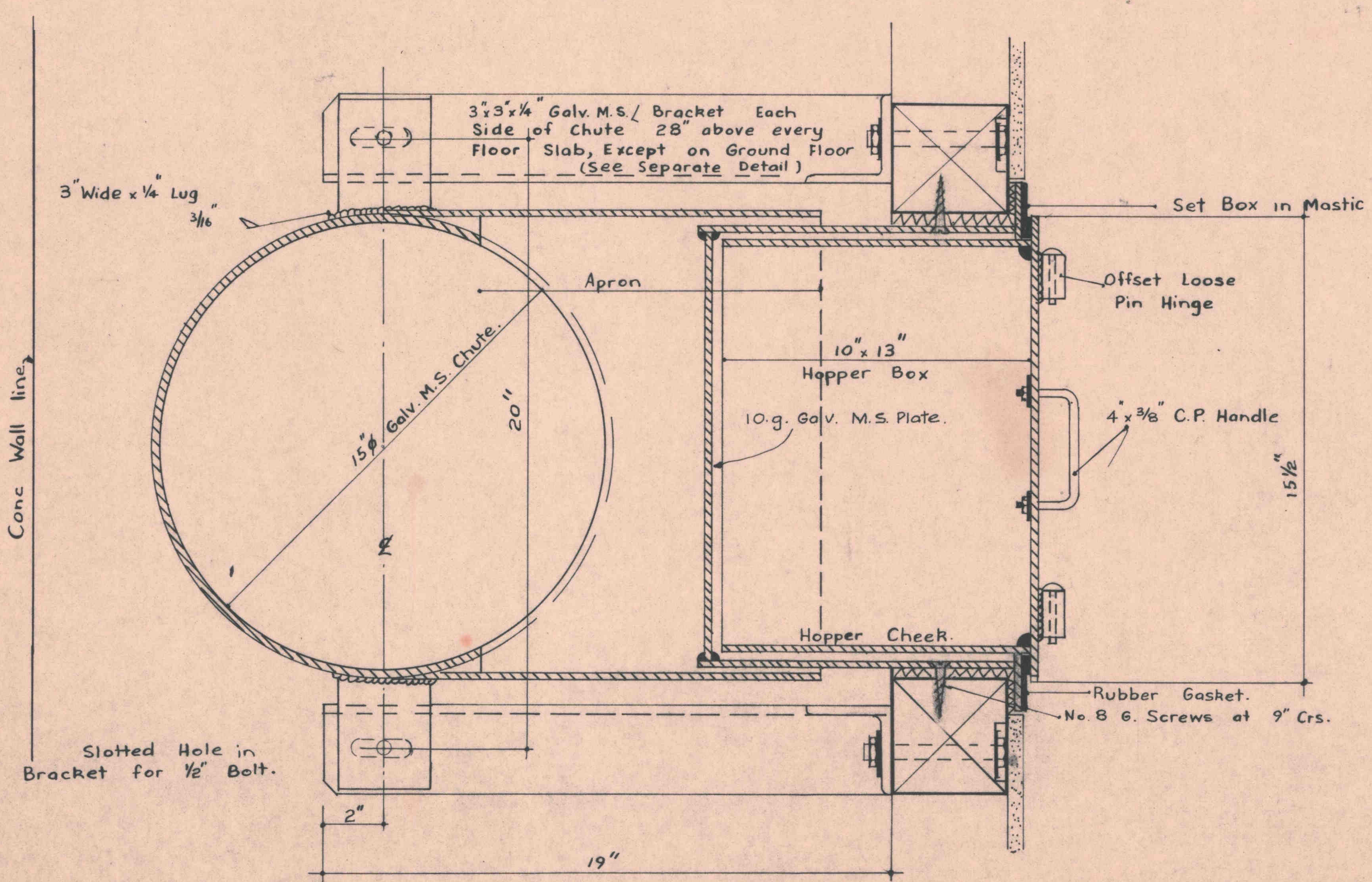
Section thro' Chute and Hopper Box



Side Elevation of Chute and Sliding Shutter frame at Bottom of Chute.

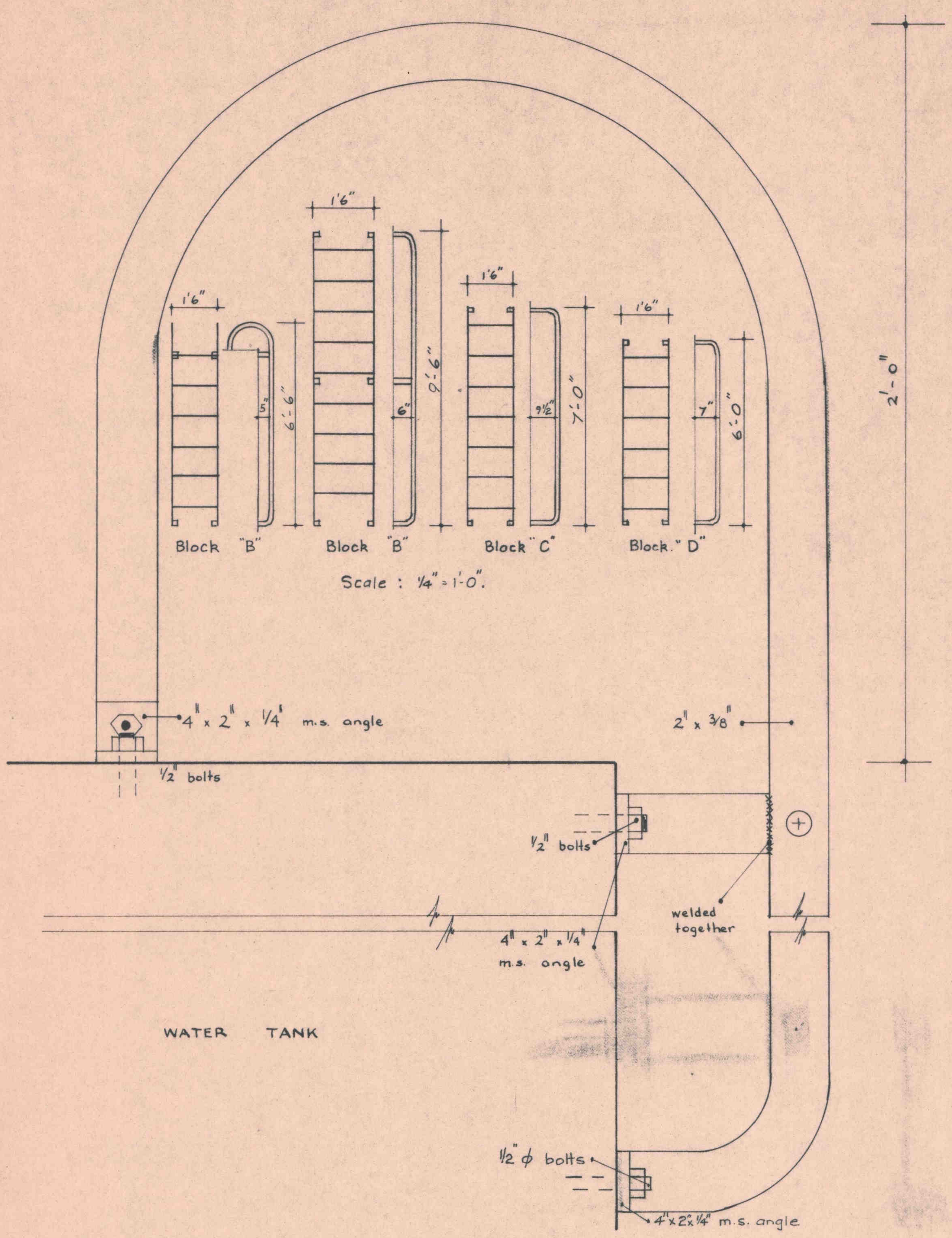


Section thro' Bottom of Chute.

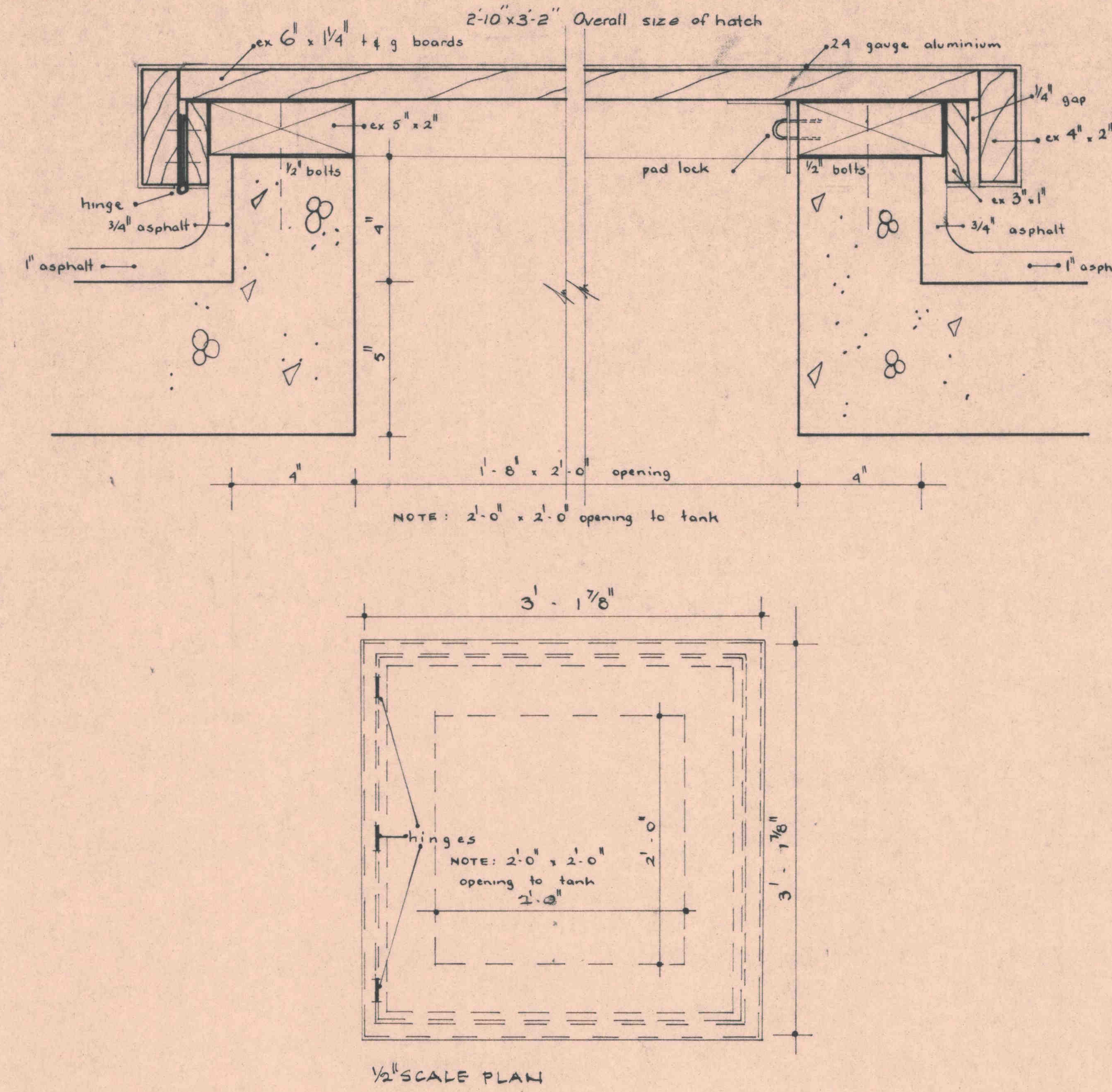


Plan of Chute and Hopper Box.

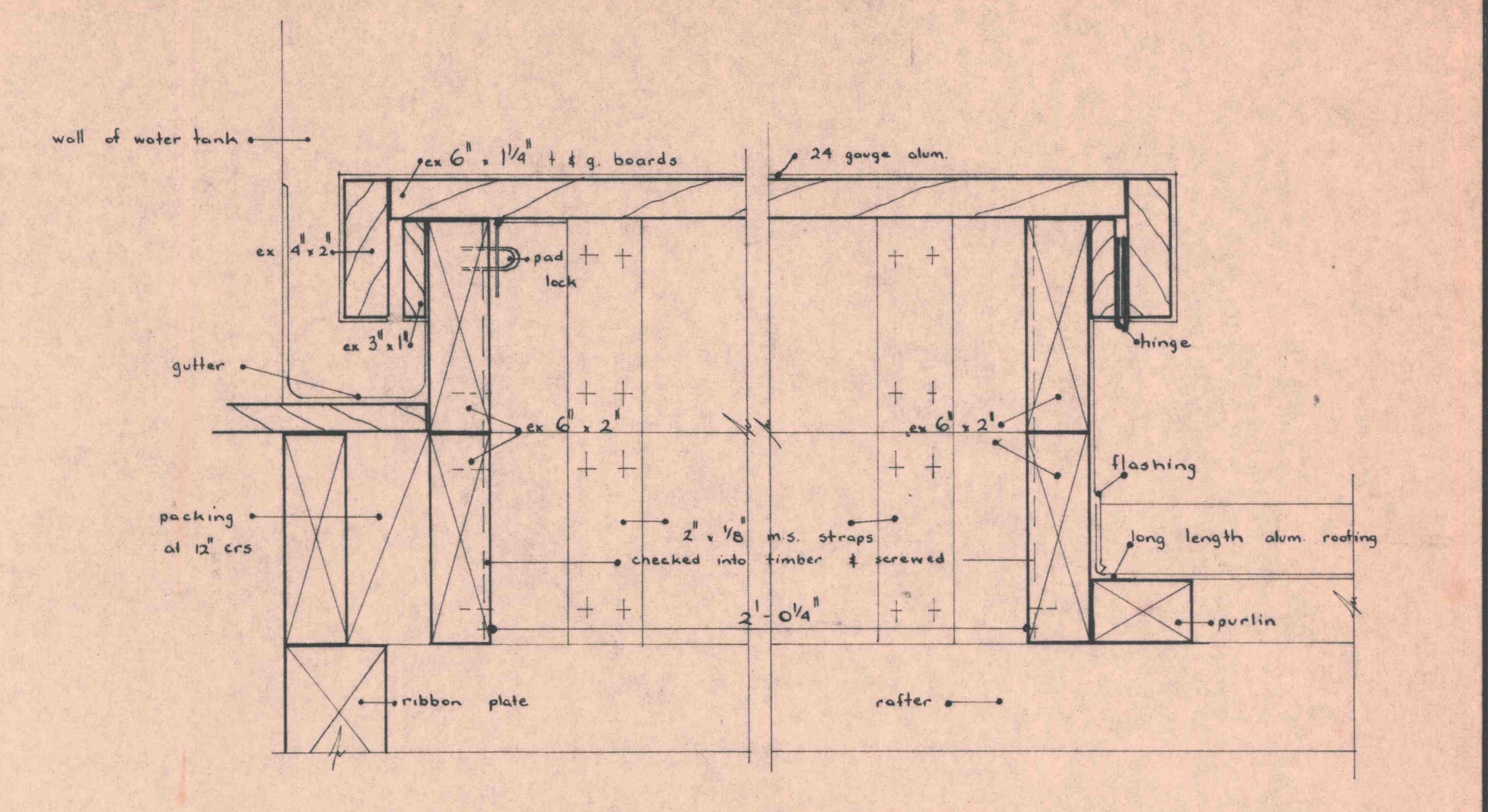
KOTUKU FLATS KEMP STREET KILBIRNIE FOR THE WELLINGTON CITY CORPORATION.	CONTRACT NUMBER 2278 SCALE. ¼ F.S. RUBBISH CHUTE DETAILS	SHEET No. 29 IN SET OF 44
WELLINGTON CITY CORPORATION TOWN PLANNING DEPARTMENT ARCHITECTURAL DIVISION K.V. CLARKE CITY PLANNER	TRACING NO. A.M. 247/29 DESIGNED W.J. BEECH DRAWN R.D. TAPP TRACED R.D. TAPP CHECKED [signature] AUG. 68 APPROVED C.M. Muir CITY ARCHITECT	



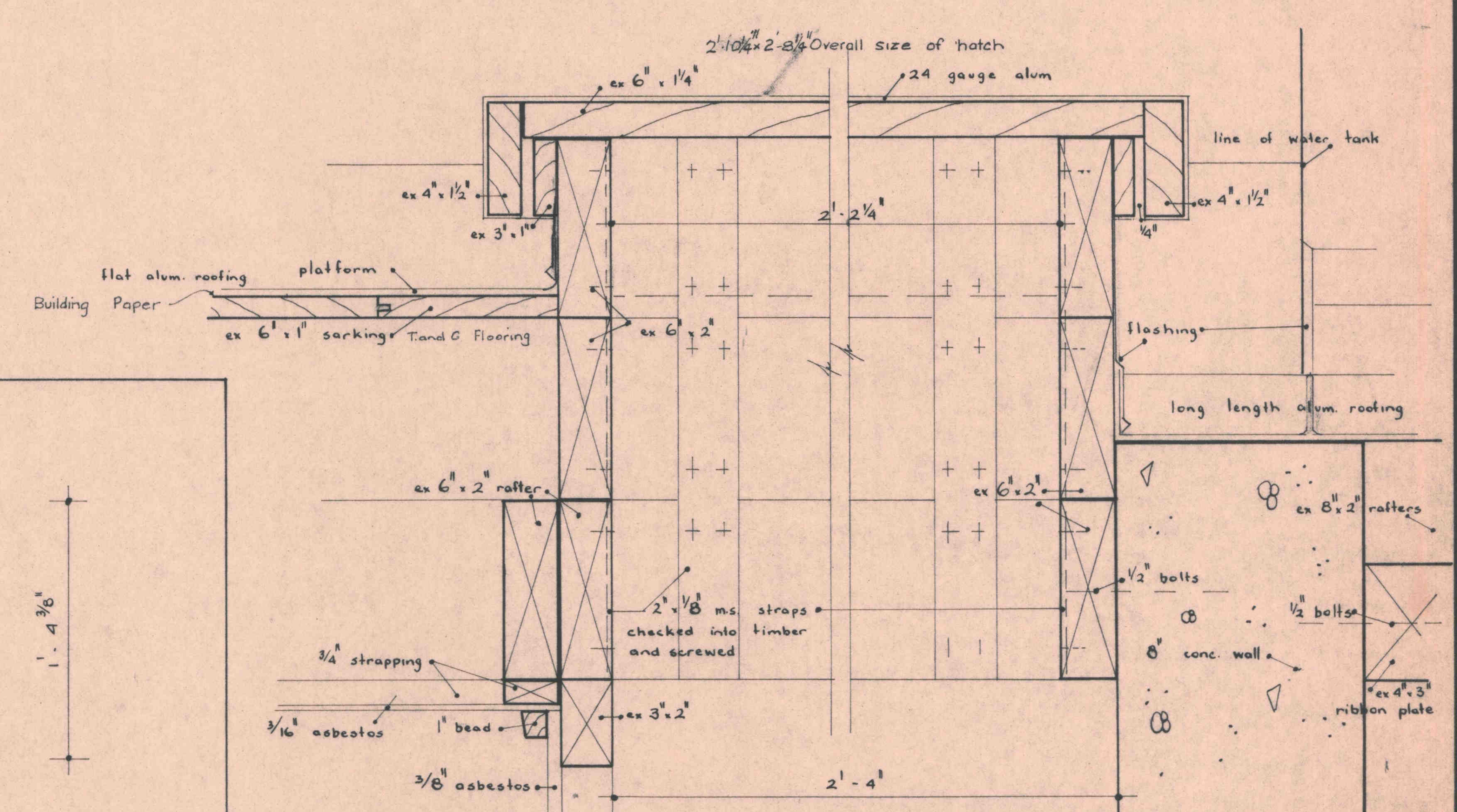
1/4 F.S. DETAIL OF LADDER TO TANK BLOCK B



1/4 F.S. HATCH DETAILS BLOCK C & D

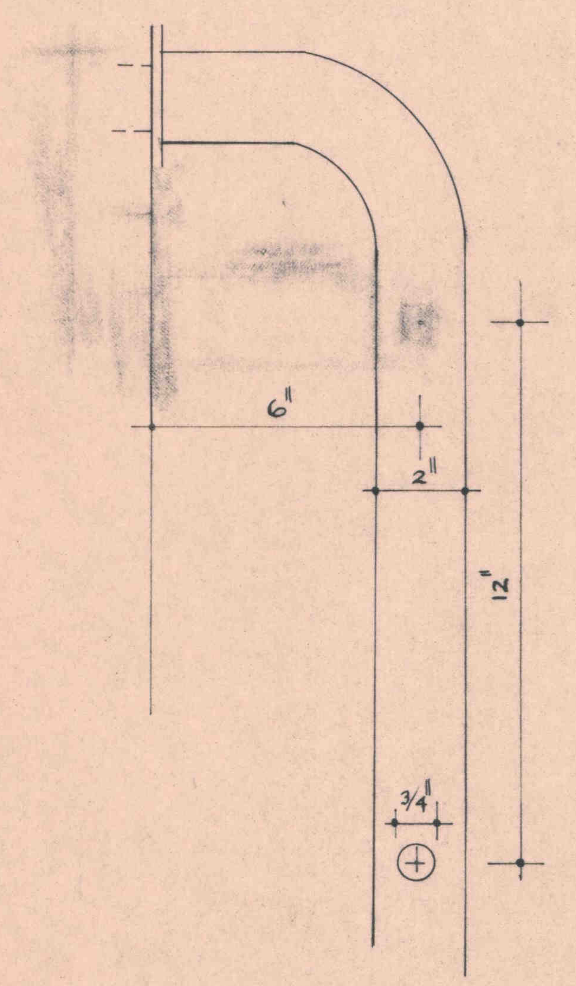


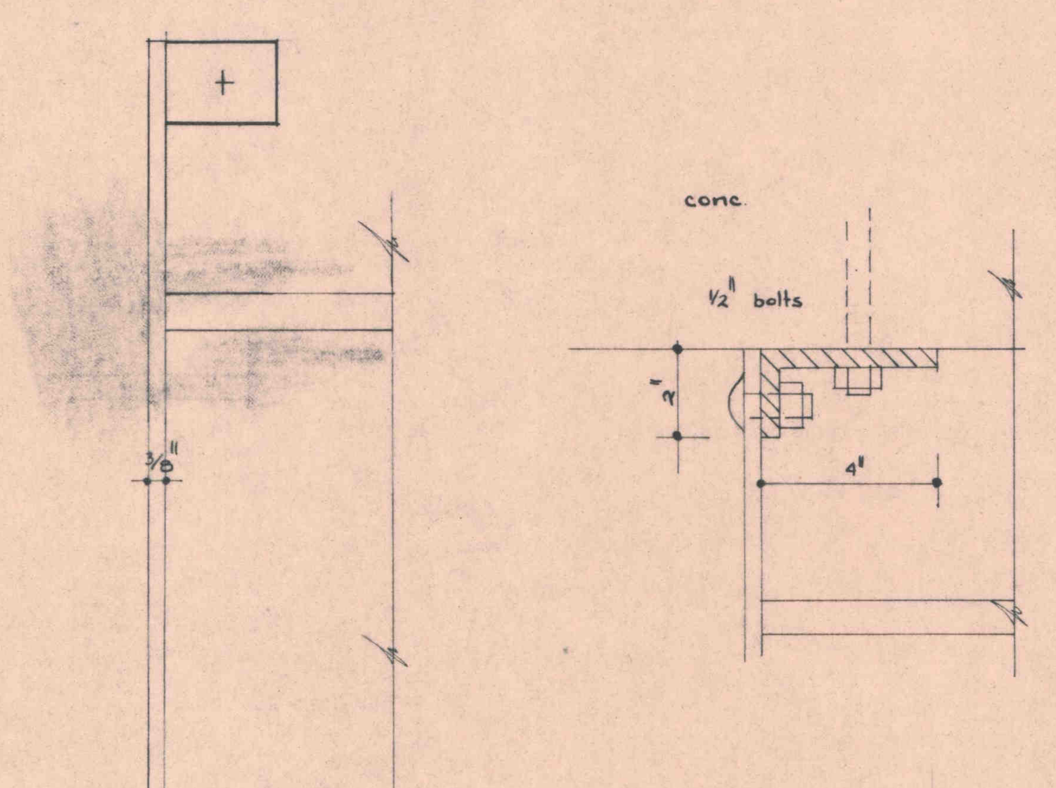
LONGITUDINAL SECTION



CROSS SECTION

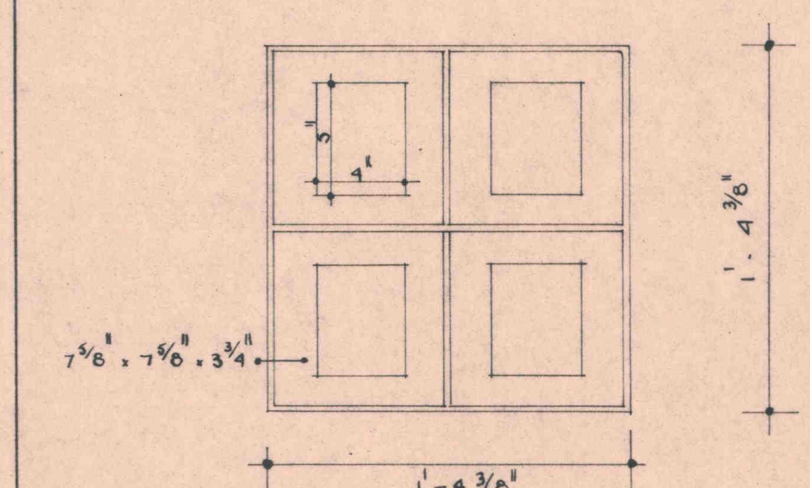
1/4 F.S. HATCH DETAILS BLOCK B NORTH END



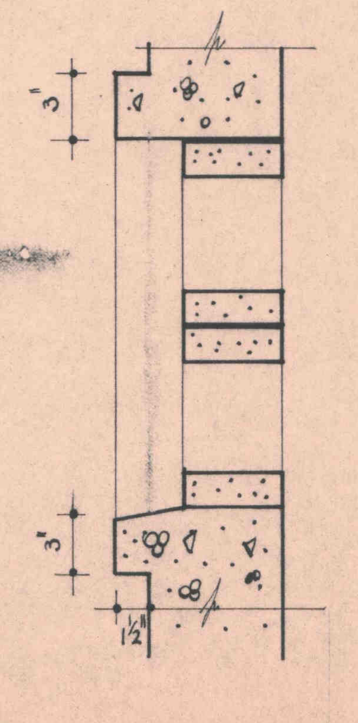


FIXING TO TIMBER , FIXING TO CONCRETE

1/4 F.S. DETAILS OF STEEL LADDERS

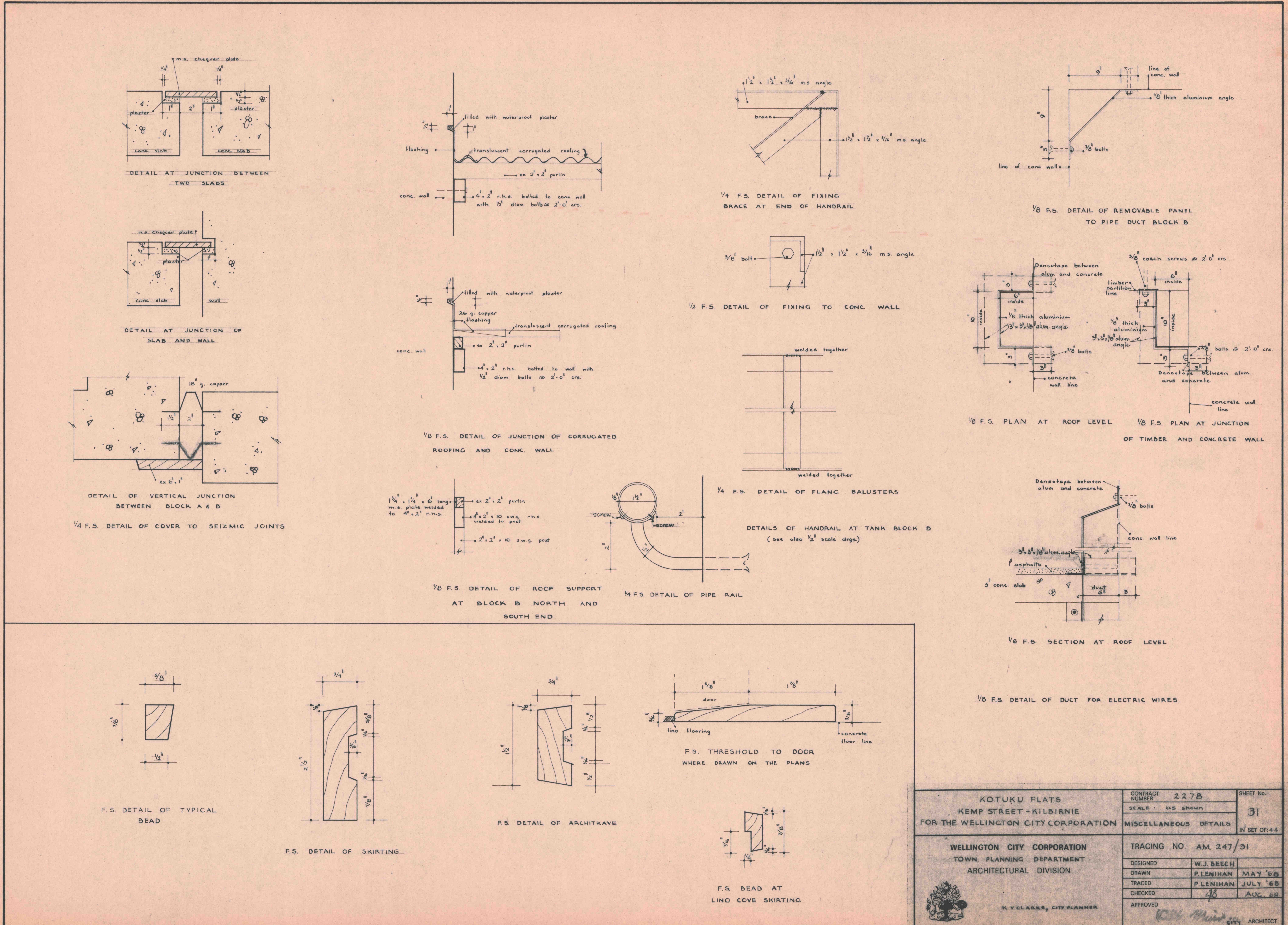


SB2 SCREEN BLOCK



1/8 F.S. DETAIL OF CONC. BLOCK WINDOW
(WHERE NOT GLASS BLOCKS)

KOTUKU FLATS KEMP STREET - KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	CONTRACT NUMBER 2278	SCALE as shown	SHEET No. 30 IN SET OF 44
	MISCELLANEOUS DETAILS		
WELLINGTON CITY CORPORATION TOWN PLANNING DEPARTMENT ARCHITECTURAL DIVISION	TRACING NO. AM 247/30		
	DESIGNED	W.J BEECH	
	DRAWN	P. LENIHAN	MAY '68
	TRACED	P. LENIHAN	JULY '68
	CHECKED	4/8	AUG. 68
K.V. CLARKE, CITY PLANNER	APPROVED	[signature] CITY ARCHITECT	



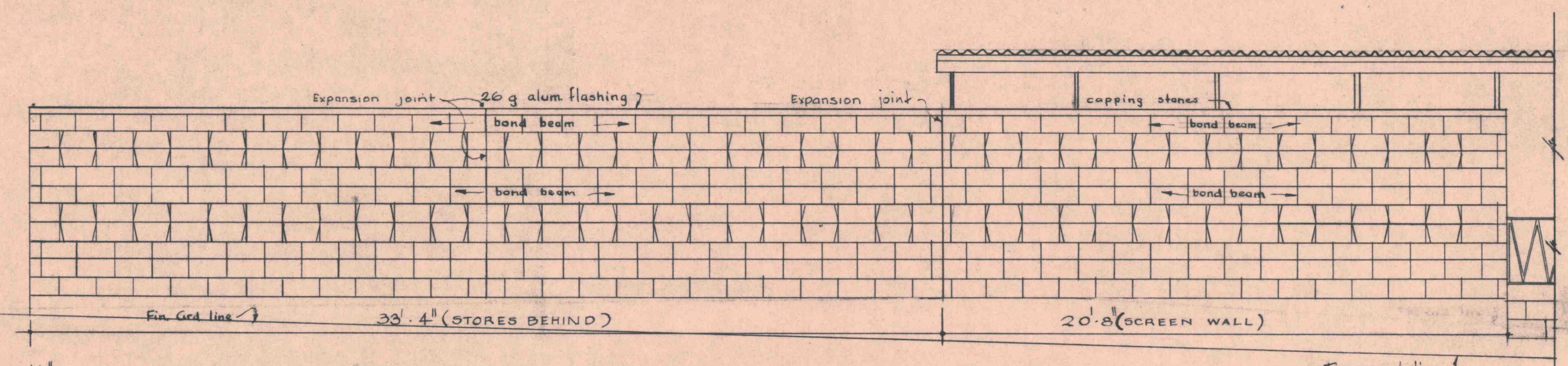
KOTUKU FLATS
KEMP STREET - KILBIRNIE
FOR THE WELLINGTON CITY CORPORATION

CONTRACT NUMBER 2278
SCALE: as shown
MISCELLANEOUS DETAILS
SHEET No. 31 IN SET OF 44

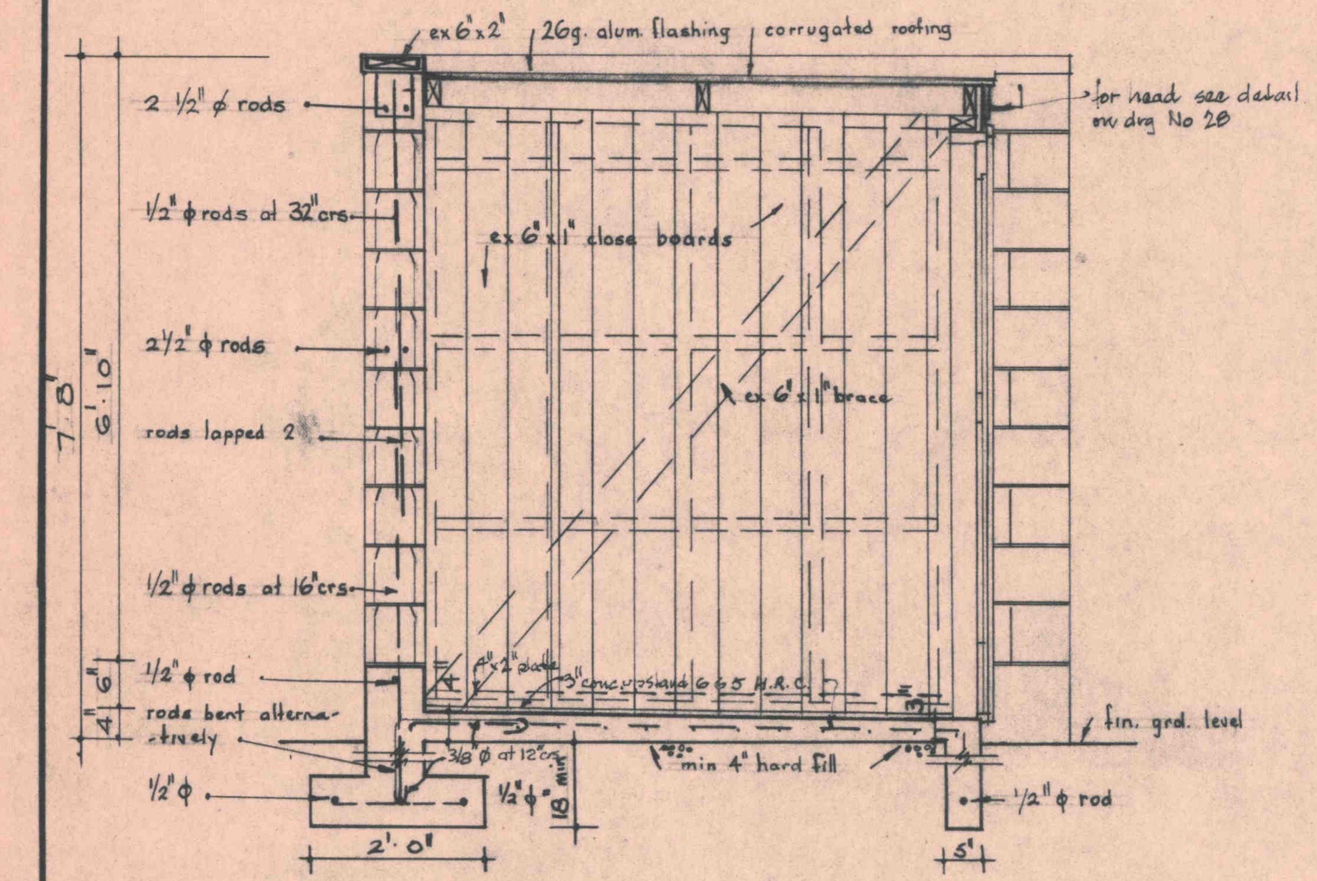
WELLINGTON CITY CORPORATION
TOWN PLANNING DEPARTMENT
ARCHITECTURAL DIVISION
K. V. CLARKE, CITY PLANNER

TRACING NO. AM. 247/31

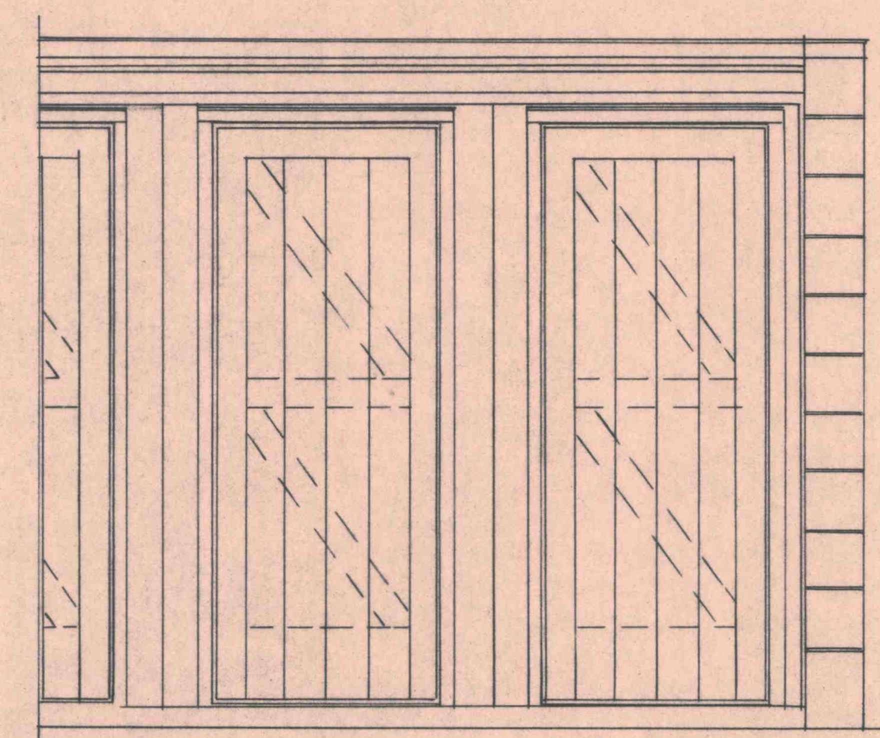
DESIGNED	W.J. BEECH	
DRAWN	P. LENIHAN	MAY '68
TRACED	P. LENIHAN	JULY '68
CHECKED		AUG. 68
APPROVED		CITY ARCHITECT



1/4" SCALE ELEVATION OF DECORATIVE CONCRETE BLOCK WALLS AT SOUTH OF BLOCK B

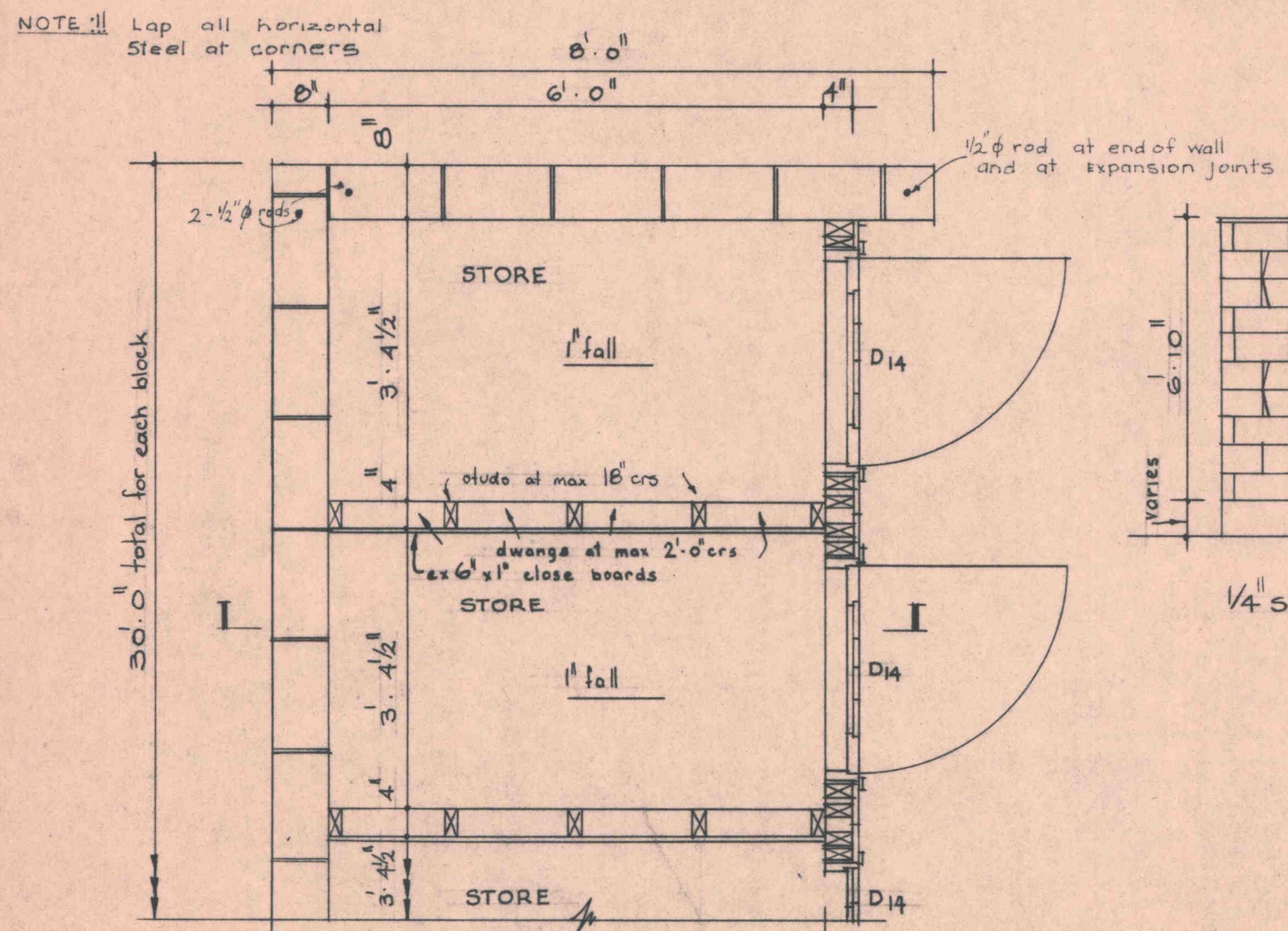


1/2" SCALE TYPICAL SECTION

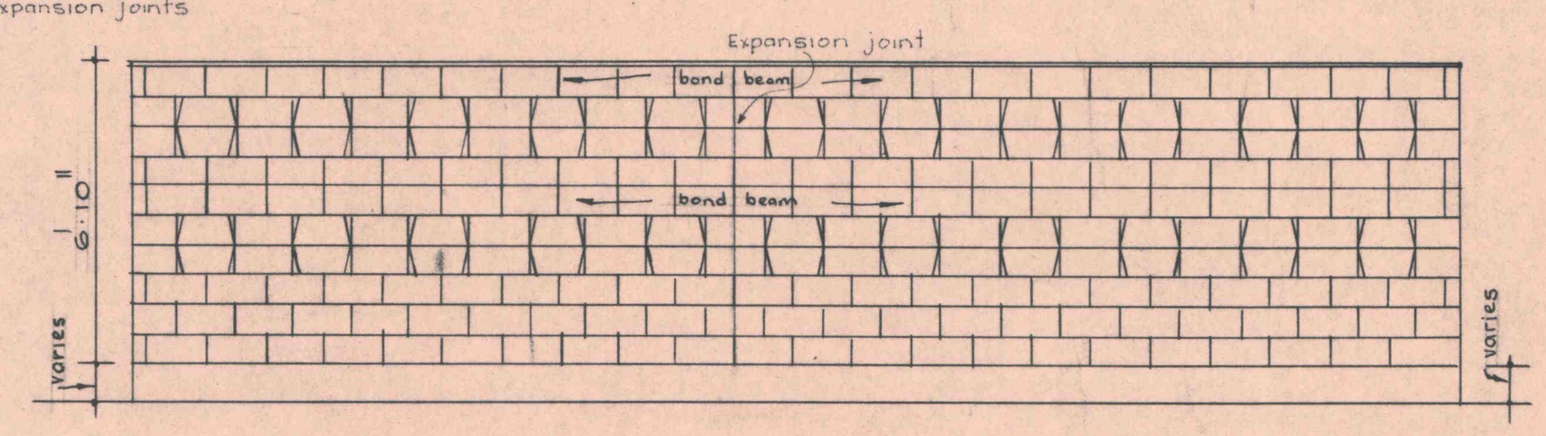


1/2" SCALE PART FRONT ELEVATION

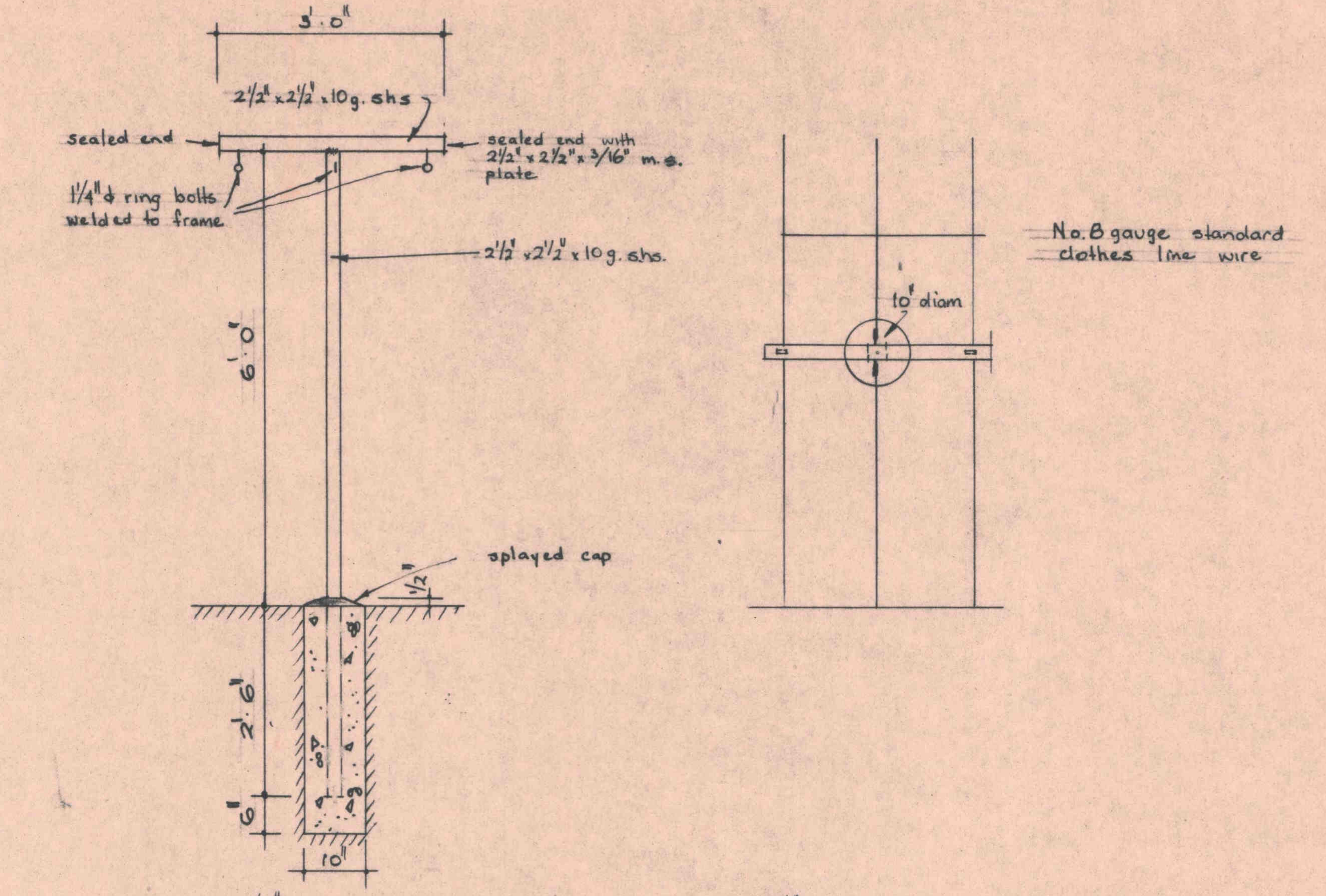
NOTE:- Lap all horizontal Steel at corners



1/2" SCALE TYPICAL PART PLAN



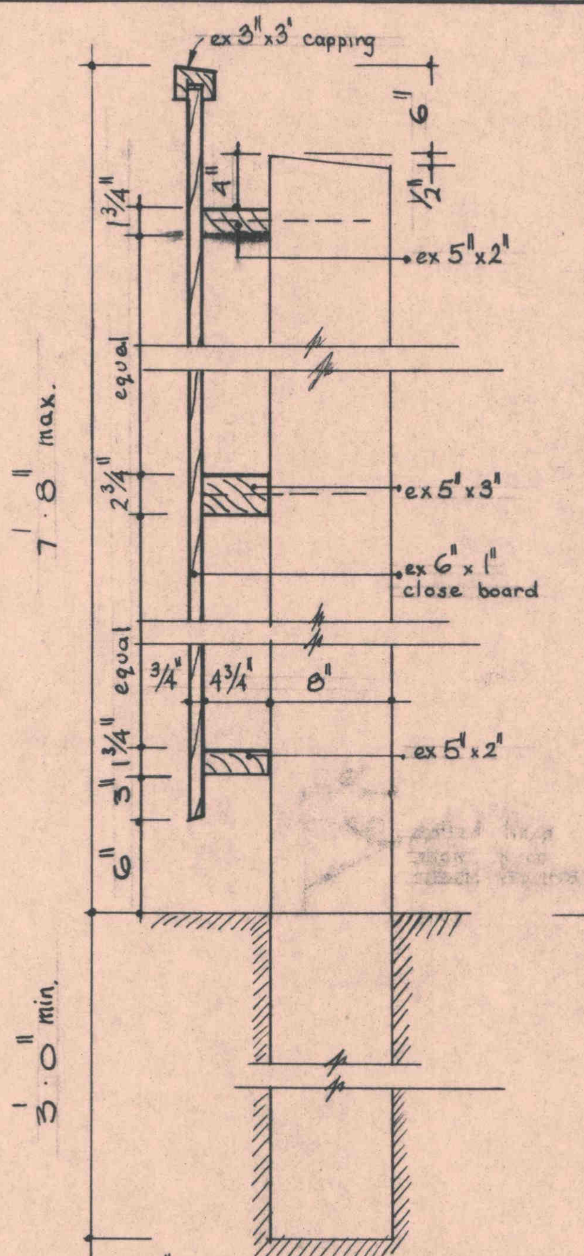
1/4" SCALE TYPICAL ELEVATION OF 30'-0" LONG DECORATIVE CONCRETE BLOCK WALL
(REAR WALL OF STORES)



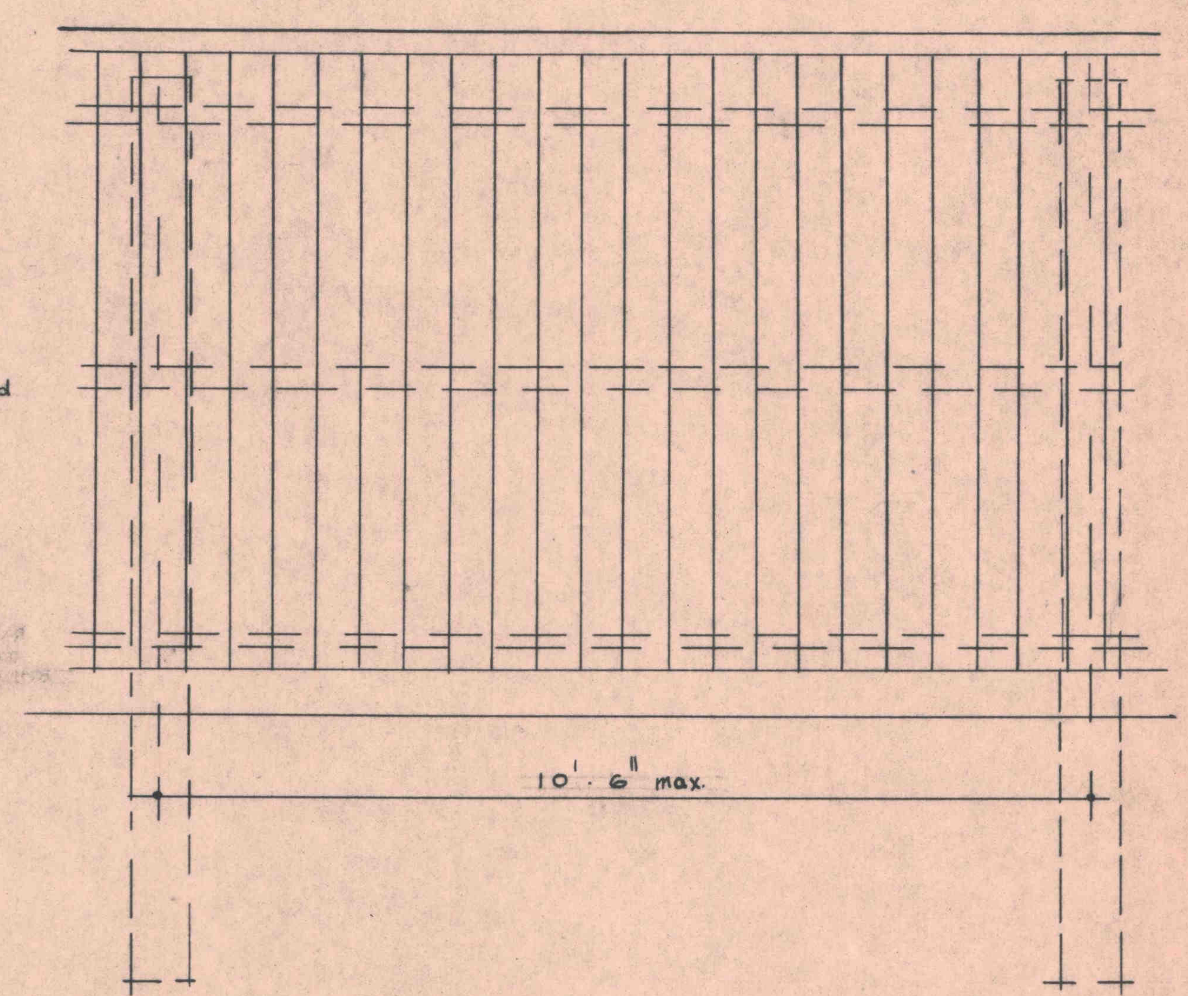
1/2" SCALE SECTION

1/2" SCALE PLAN

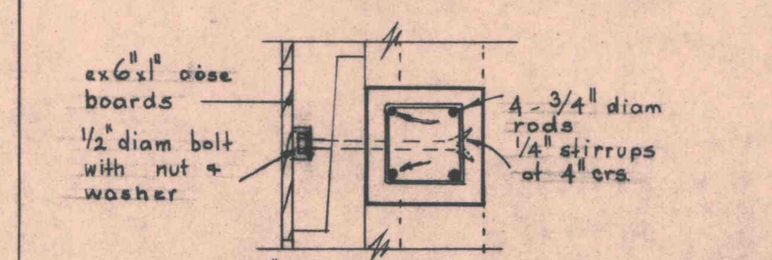
DETAILS OF CLOTHES DRYER



1" SCALE TYPICAL SECTION



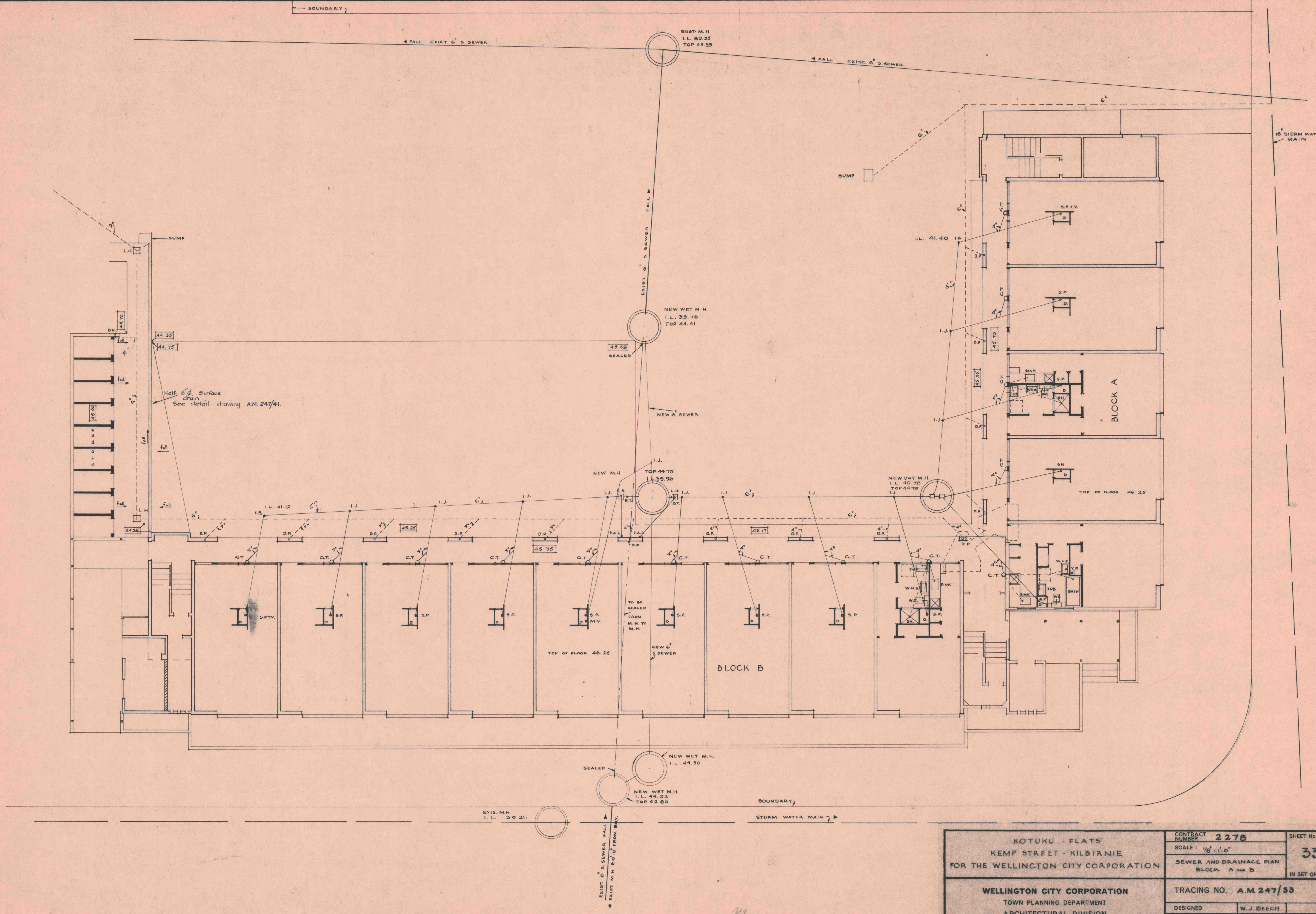
1/2" SCALE TYPICAL FRONT ELEVATION



1" SCALE TYPICAL PLAN

DETAILS OF FENCES

KOTUKU FLATS KEMP STREET · KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	CONTRACT NUMBER 2278 as shown MISCELLANEOUS DETAILS		SHEET No. 32 IN SET OF 44
WELLINGTON CITY CORPORATION TOWN PLANNING DEPARTMENT ARCHITECTURAL DIVISION R.V. CLARKE, CITY PLANNER	TRACING NO AM 247/32		
	DESIGNED	W.J. BEECH	
	DRAWN	M. COLARIC	
	TRACED	P.J. LENIHAN	MAY '68
	CHECKED	[signature]	Aug. 68
	APPROVED	[signature] CITY ARCHITECT	



KOTUKU - FLATS KEMP STREET - KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	CONTRACT NUMBER 2278 SCALE: 1/8" = 1'-0" SEWER AND DRAINAGE PLAN BLOCK A AND B
SHEET No. 33 IN SET OF: 44	

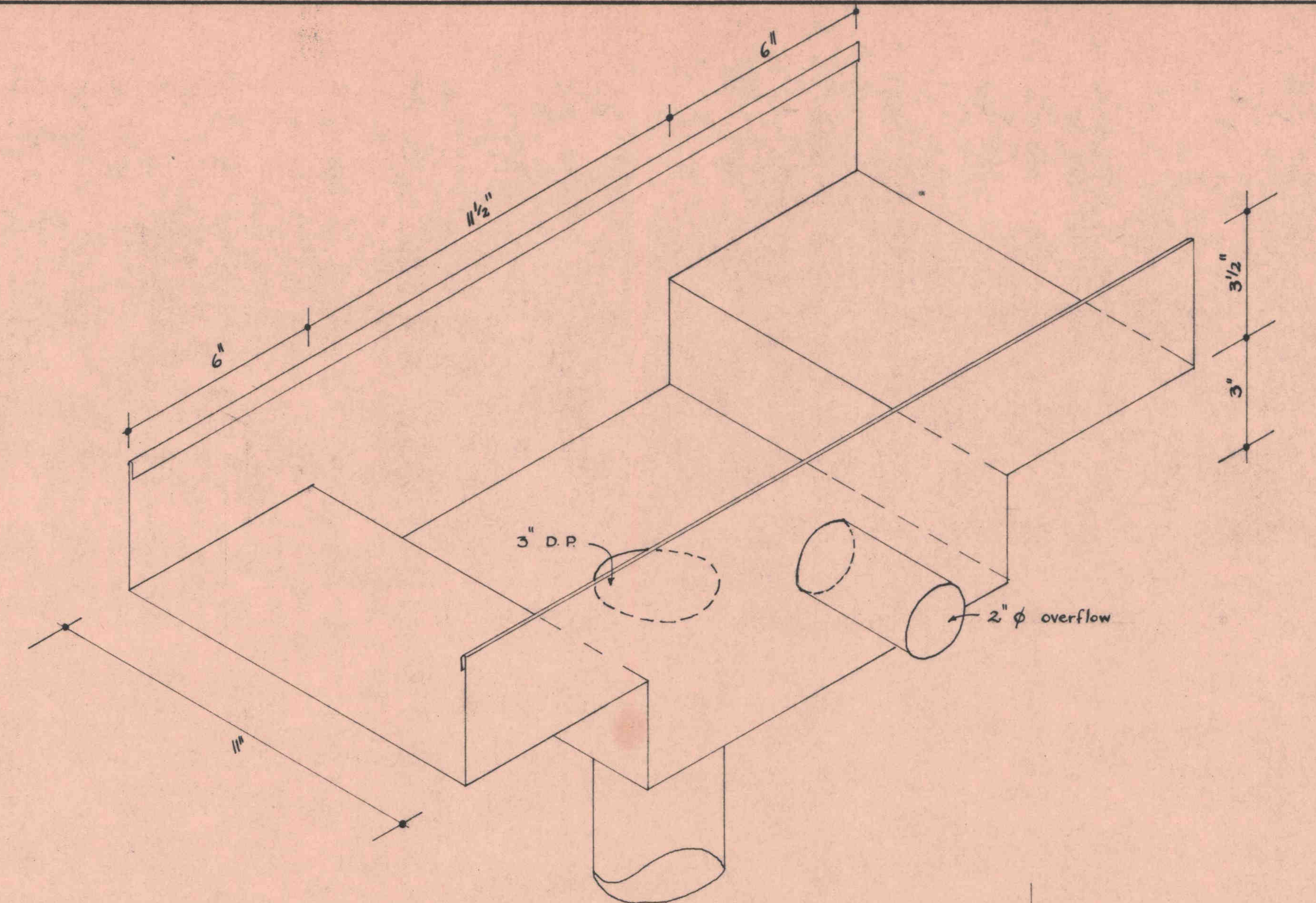
WELLINGTON CITY CORPORATION
TOWN PLANNING DEPARTMENT
ARCHITECTURAL DIVISION

K.V. CLARKE, CITY PLANNER

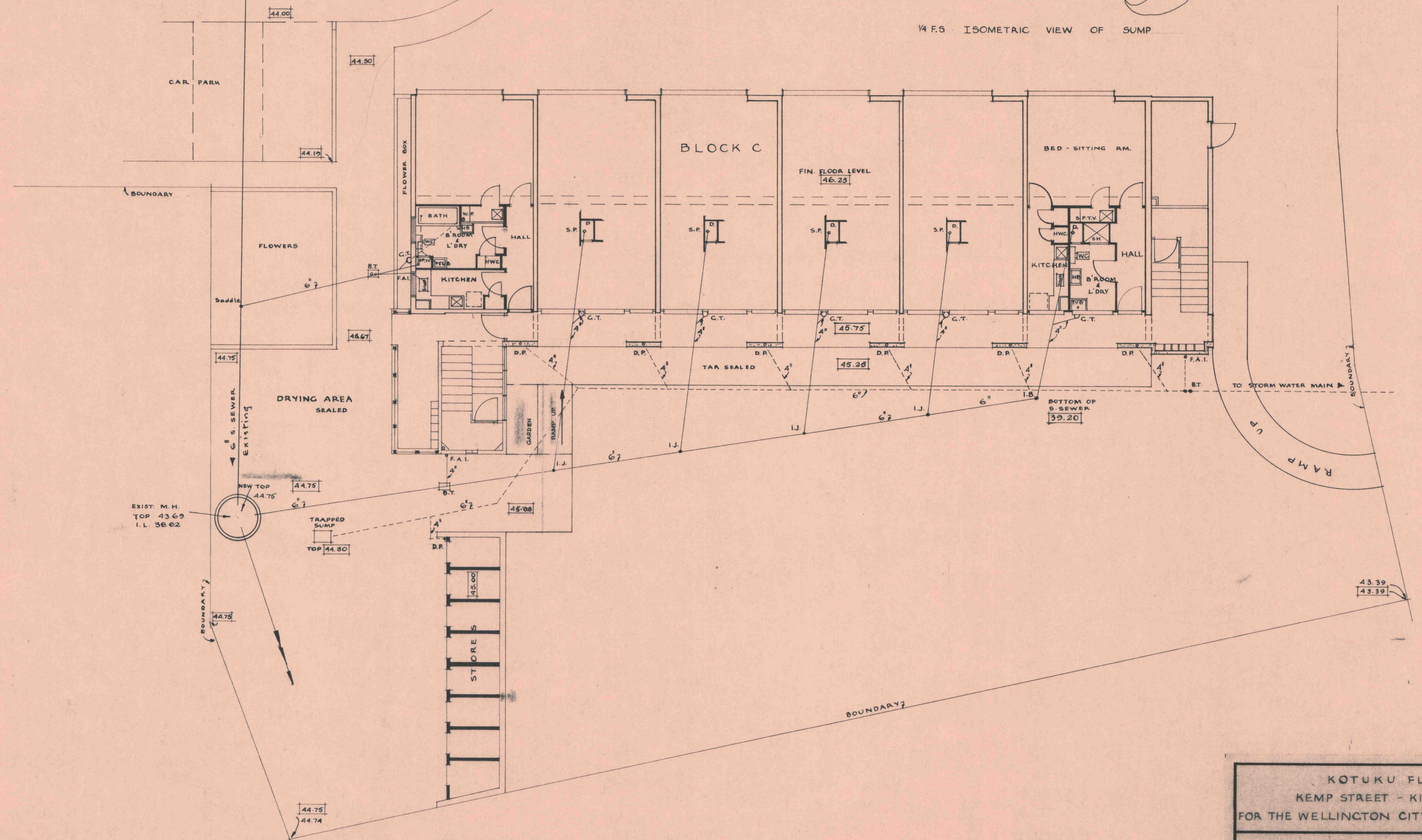
TRACING NO. A.M. 247/33

DESIGNED	W. J. BEECH	
DRAWN	M. COLARIĆ	
TRACED	P. LENIHAN	SEPT '68
CHECKED	G/B	" "

APPROVED C.M. Muir CITY ARCHITECT

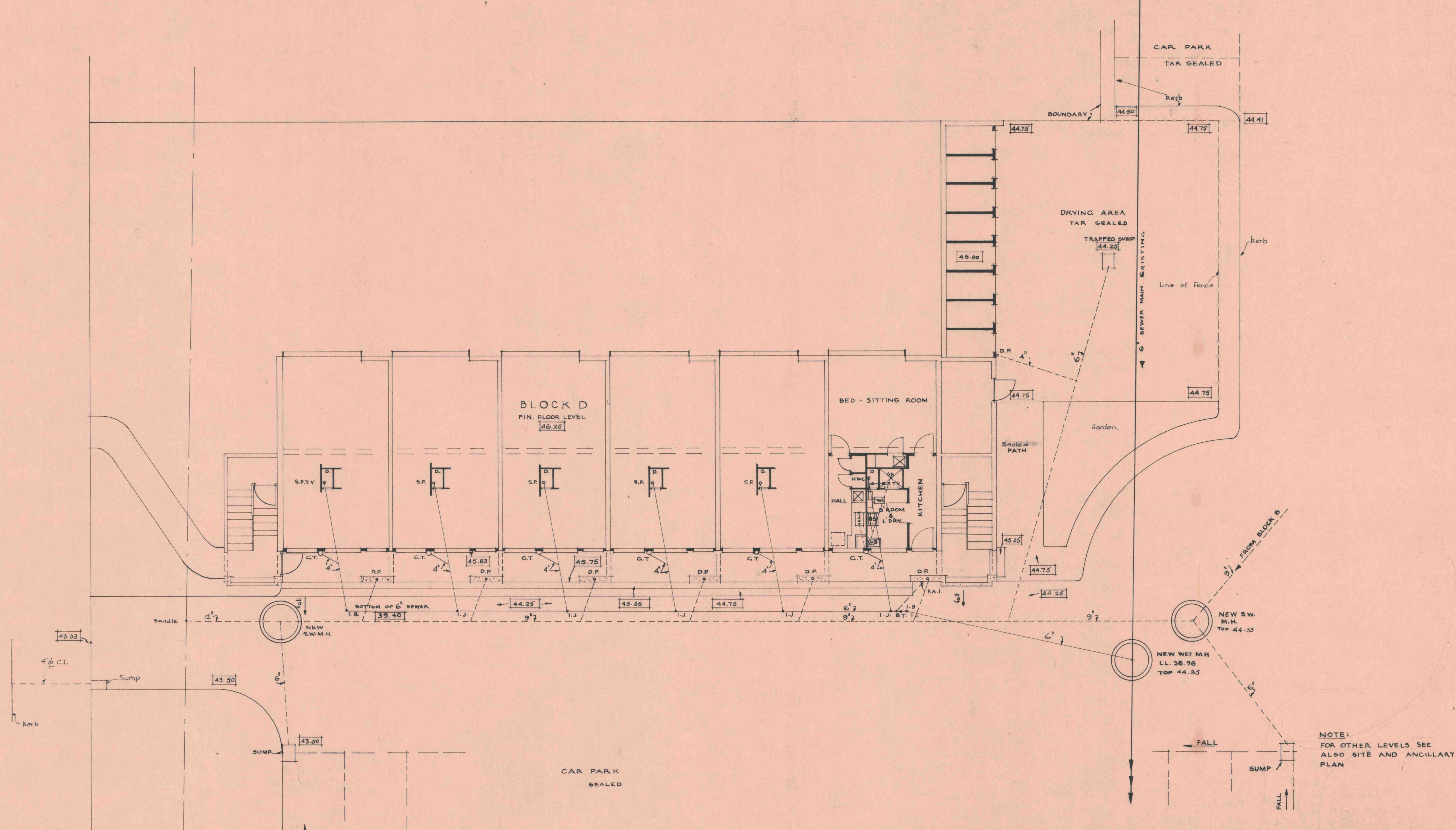


1/4 F.S ISOMETRIC VIEW OF SUMP



NOTE
FOR OTHER LEVELS SEE
ALSO SITE AND ANCILLARY
PLAN

KOTUKU FLATS KEMP STREET - KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	CONTRACT NUMBER 2278		SHEET No. 34
	SCALE as shown		
	1/8" SCALE SEWER AND DRAINAGE PLAN BLOCK C		IN SET OF: 44
WELLINGTON CITY CORPORATION TOWN PLANNING DEPARTMENT ARCHITECTURAL DIVISION K.V. CLARKE, CITY PLANNER	TRACING NO. A.M. 247/34		
	DESIGNED	W.J. BEECH	
	DRAWN	M. COLARIĆ	
	TRACED	P. LENIHAN	SEPT. '68
	CHECKED	WB	" "
	APPROVED	C.M. Muir	CITY ARCHITECT



KOTUKU FLATS KEMP STREET - KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	CONTRACT NUMBER 2278 SCALE: as SHOWN SEWER AND DRAINAGE PLAN BLOCK D	SHEET No. 35 IN SET OF: 44

WELLINGTON CITY CORPORATION
TOWN PLANNING DEPARTMENT
ARCHITECTURAL DIVISION

K.V. CLARKE, CITY PLANNER

TRACING NO. A.M. 247/35

DESIGNED	W.J. BEECH	
DRAWN	M. COLARIĆ	
TRACED	P. LENIHAN	SEPT. '68
CHECKED	W/B	SEPT. 68
APPROVED	C.M. Muir	CITY ARCHITECT

LEGEND

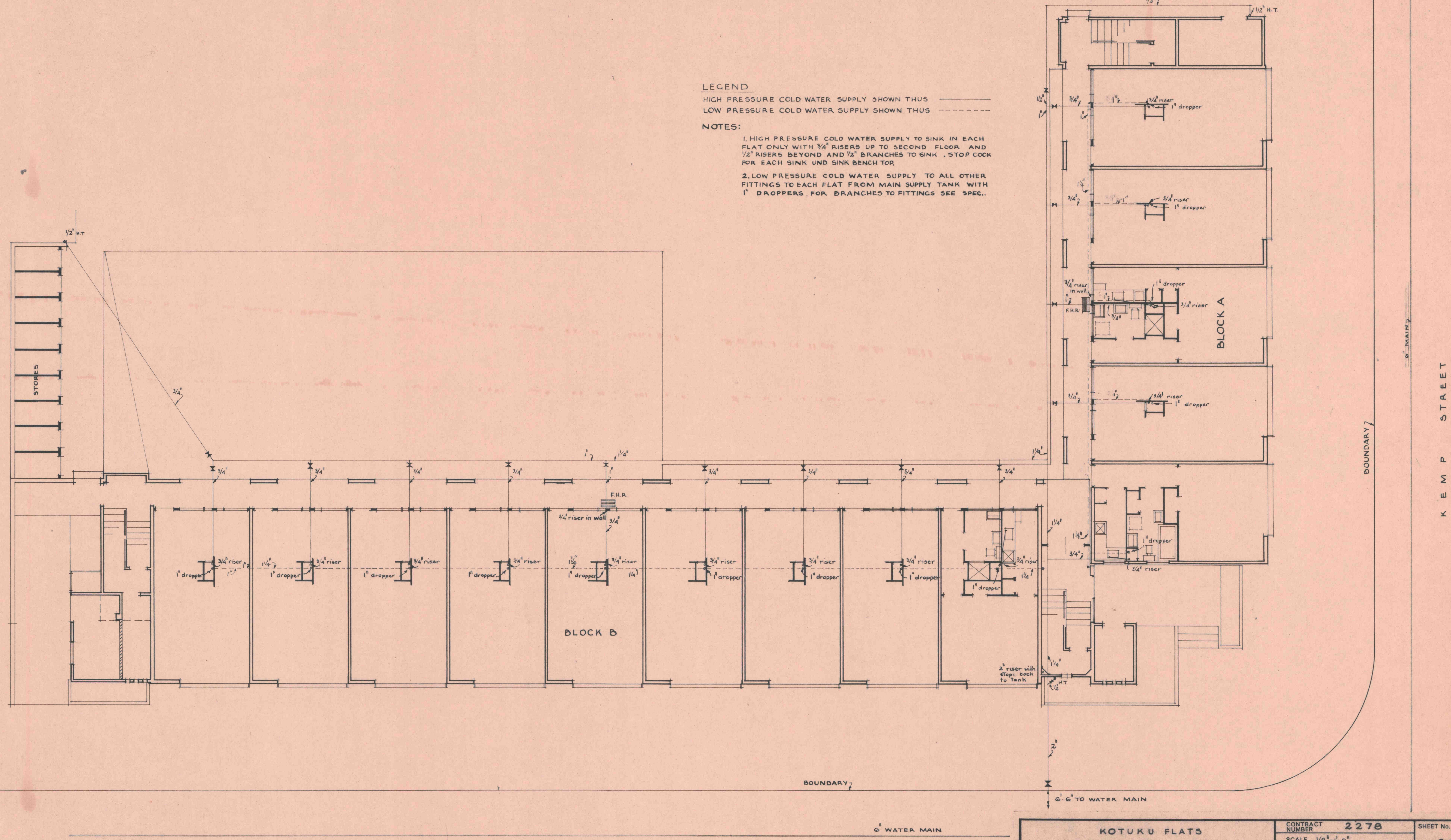
HIGH PRESSURE COLD WATER SUPPLY SHOWN THUS ————————

LOW PRESSURE COLD WATER SUPPLY SHOWN THUS - - - - - - - -

NOTES:

1. HIGH PRESSURE COLD WATER SUPPLY TO SINK IN EACH FLAT ONLY WITH 3/4" RISERS UP TO SECOND FLOOR AND 1/2" RISERS BEYOND AND 1/2" BRANCHES TO SINK . STOP COCK FOR EACH SINK UND SINK BENCH TOP.

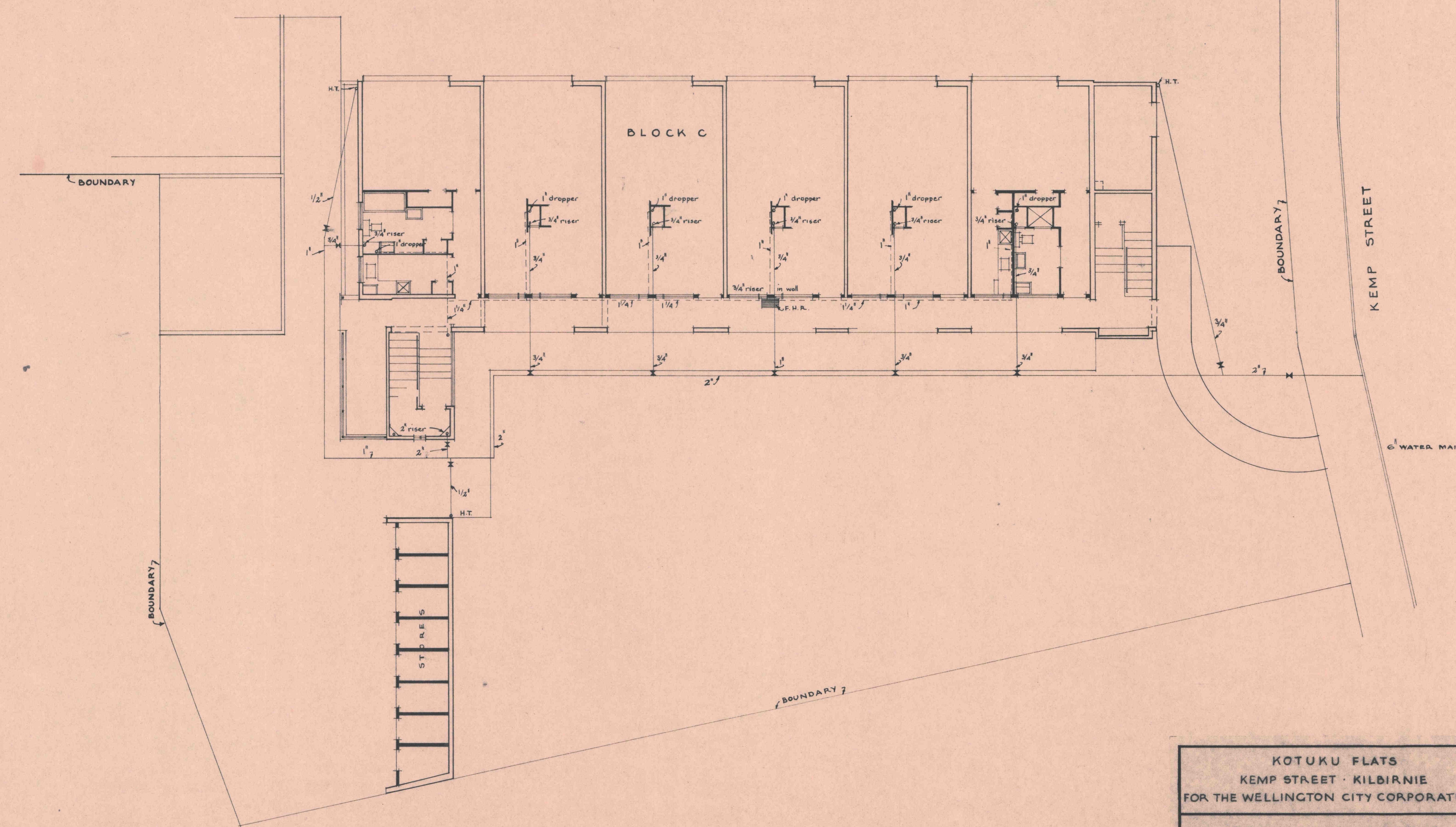
2. LOW PRESSURE COLD WATER SUPPLY TO ALL OTHER FITTINGS TO EACH FLAT FROM MAIN SUPPLY TANK WITH 1" DROPPERS. FOR BRANCHES TO FITTINGS SEE SPEC..



K E M P   S T R E E T

KOTUKU FLATS KEMP STREET · KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	CONTRACT NUMBER 2278	SHEET No. 36
	SCALE 1/8" = 1'-0"	
	COLD WATER RETICULATION BLOCK A & B	IN SET OF: 44
WELLINGTON CITY CORPORATION TOWN PLANNING DEPARTMENT ARCHITECTURAL DIVISION **K.V. CLARKE, CITY PLANNER**	TRACING NO. A.M. 247/36	

DESIGNED	W.J. BEECH	
DRAWN	M.COLARIĆ	
TRACED	P. LENIHAN	SEPT. '68
CHECKED	W.J.B.	" "
APPROVED	[signature]	CITY ARCHITECT



LEGEND

HIGH PRESSURE COLD WATER SUPPLY SHOWN THUS ————————

LOW PRESSURE COLD WATER SUPPLY SHOWN THUS - - - - - - - - -

NOTES:

1. HIGH PRESSURE COLD WATER SUPPLY TO SINK IN EACH FLAT ONLY WITH 3/4" RISERS UP TO SECOND FLOOR AND 1/2" RISERS BEYOND AND 1/2" BRANCHES TO SINK, STOP COCK FOR EACH SINK UNDER SINK BENCH TOP.

2. LOW PRESSURE COLD WATER SUPPLY TO ALL OTHER FITTINGS TO EACH FLAT FROM MAIN SUPPLY TANK WITH 1" DROPPERS. FOR BRANCHES TO FITTINGS SEE SPEC.

KOTUKU FLATS KEMP STREET · KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	CONTRACT NUMBER 2278 SCALE 1/8" - 1'·0" COLD WATER RETICULATION BLOCK C		SHEET No. 37 IN SET OF:
WELLINGTON CITY CORPORATION TOWN PLANNING DEPARTMENT ARCHITECTURAL DIVISION K.V. CLARKE, CITY PLANNER	TRACING NO. A.M. 247/37		
	DESIGNED	W.J. BEECH	
	DRAWN	M. COLARIĆ	
	TRACED	P. LENIHAN	SEPT. '68
	CHECKED	WB	SEPT. 68
	APPROVED	CM. Muir	CITY ARCHITECT

LEGEND

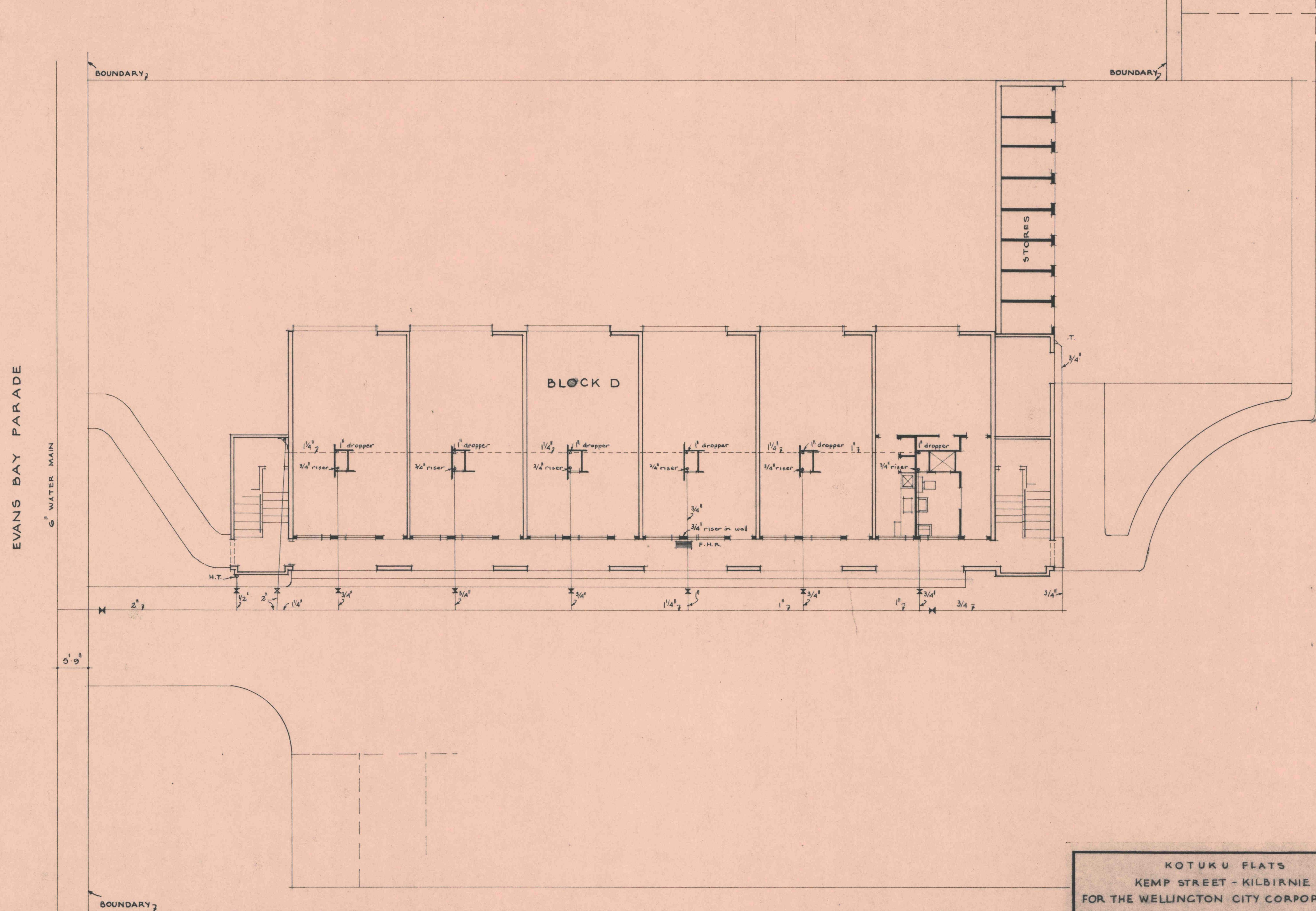
HIGH PRESSURE COLD WATER SUPPLY SHOWN THUS ————

LOW PRESSURE COLD WATER SUPPLY SHOWN THUS - - - - -

NOTES:

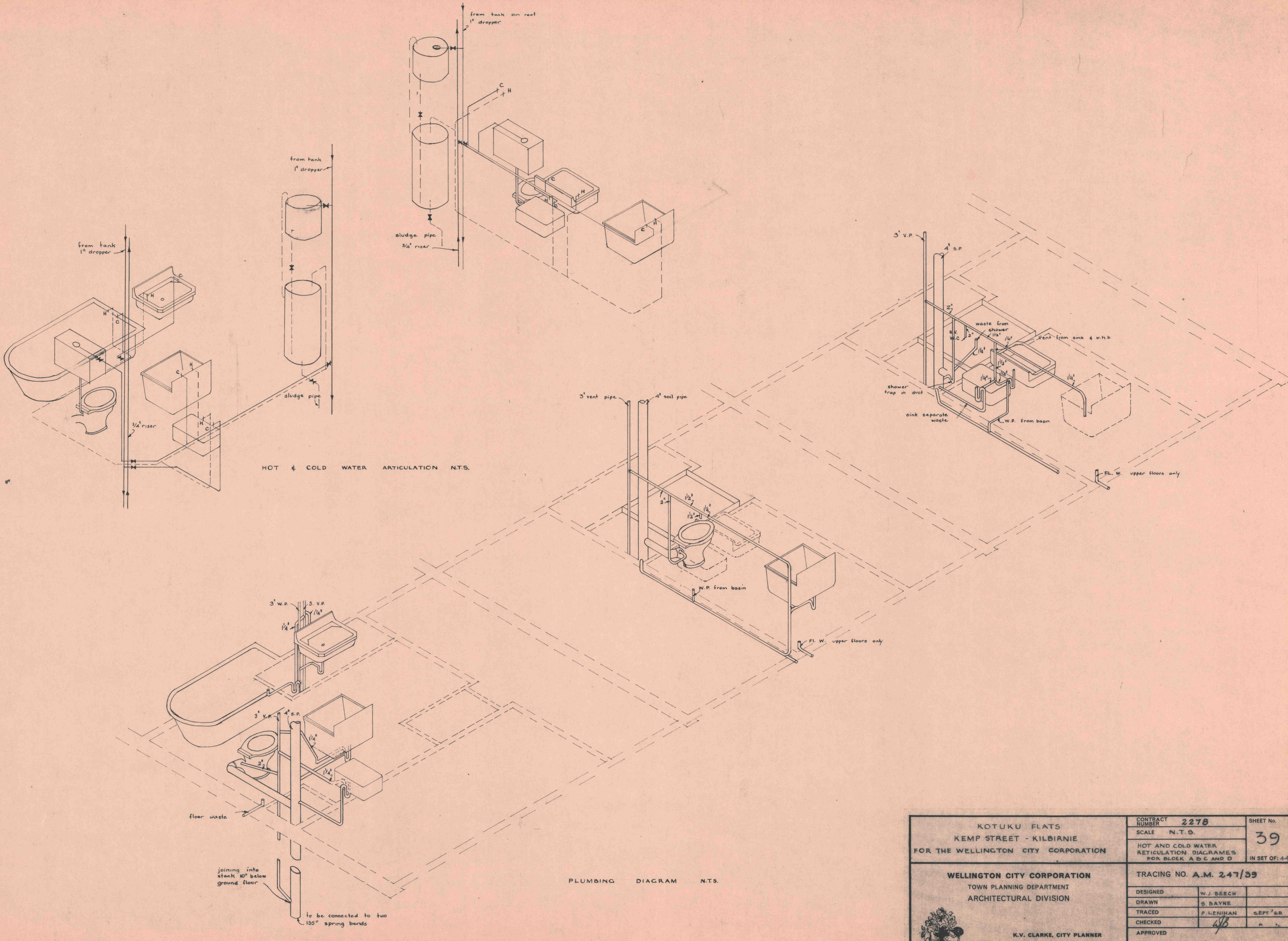
1. HIGH PRESSURE COLD WATER SUPPLY TO SINK IN EACH FLAT ONLY WITH 3/4" RISERS UP TO SECOND FLOOR AND 1/2" RISERS BEYOND AND 1/2" BRANCHES TO SINK. STOP COCK FOR EACH SINK UNDER SINK BENCH TOP.

2. LOW PRESSURE COLD WATER SUPPLY TO ALL OTHER FITTINGS TO EACH FLAT FROM MAIN SUPPLY TANK WITH 1" DROPPERS. FOR BRANCHES TO FITTINGS SEE SPEC..



KOTUKU FLATS KEMP STREET - KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	CONTRACT NUMBER 2278 SCALE 1/8" = 1'-0" COLD WATER RETICULATION BLOCK D	SHEET No. 38 IN SET OF:
WELLINGTON CITY CORPORATION TOWN PLANNING DEPARTMENT ARCHITECTURAL DIVISION K.V. CLARKE, CITY PLANNER	TRACING NO. A.M. 247/38	

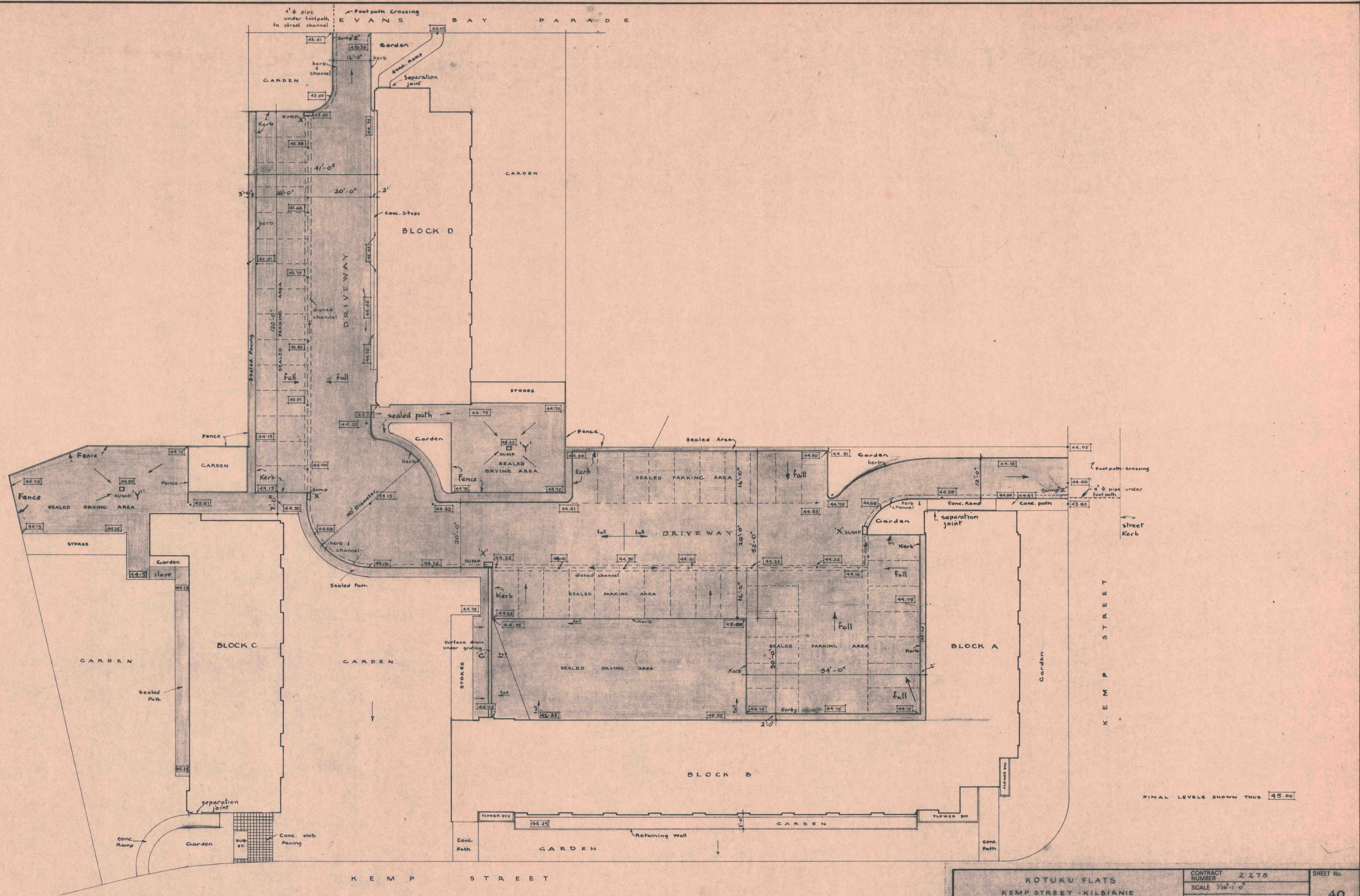
DESIGNED	W. J. BEECH	
DRAWN	M. COLARIC	
TRACED	P. LENIHAN	SEPT '68
CHECKED	WB	" "
APPROVED	C.M. Muir	CITY ARCHITECT



HOT & COLD WATER ARTICULATION N.T.S.

PLUMBING DIAGRAM N.T.S.

KOTUKU FLATS KEMP STREET - KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	CONTRACT NUMBER 2278 SCALE N.T.S. HOT AND COLD WATER RETICULATION DIAGRAMES FOR BLOCK A B C AND D	SHEET No. 39 IN SET OF: 44
WELLINGTON CITY CORPORATION TOWN PLANNING DEPARTMENT ARCHITECTURAL DIVISION K.V. CLARKE, CITY PLANNER	TRACING NO. A.M. 247/39	
	DESIGNED	W.J. BEECH
	DRAWN	S. BAYNE
	TRACED	P. LENIHAN SEPT '68
	CHECKED	[signature]
	APPROVED	C.H. Muir CITY ARCHITECT



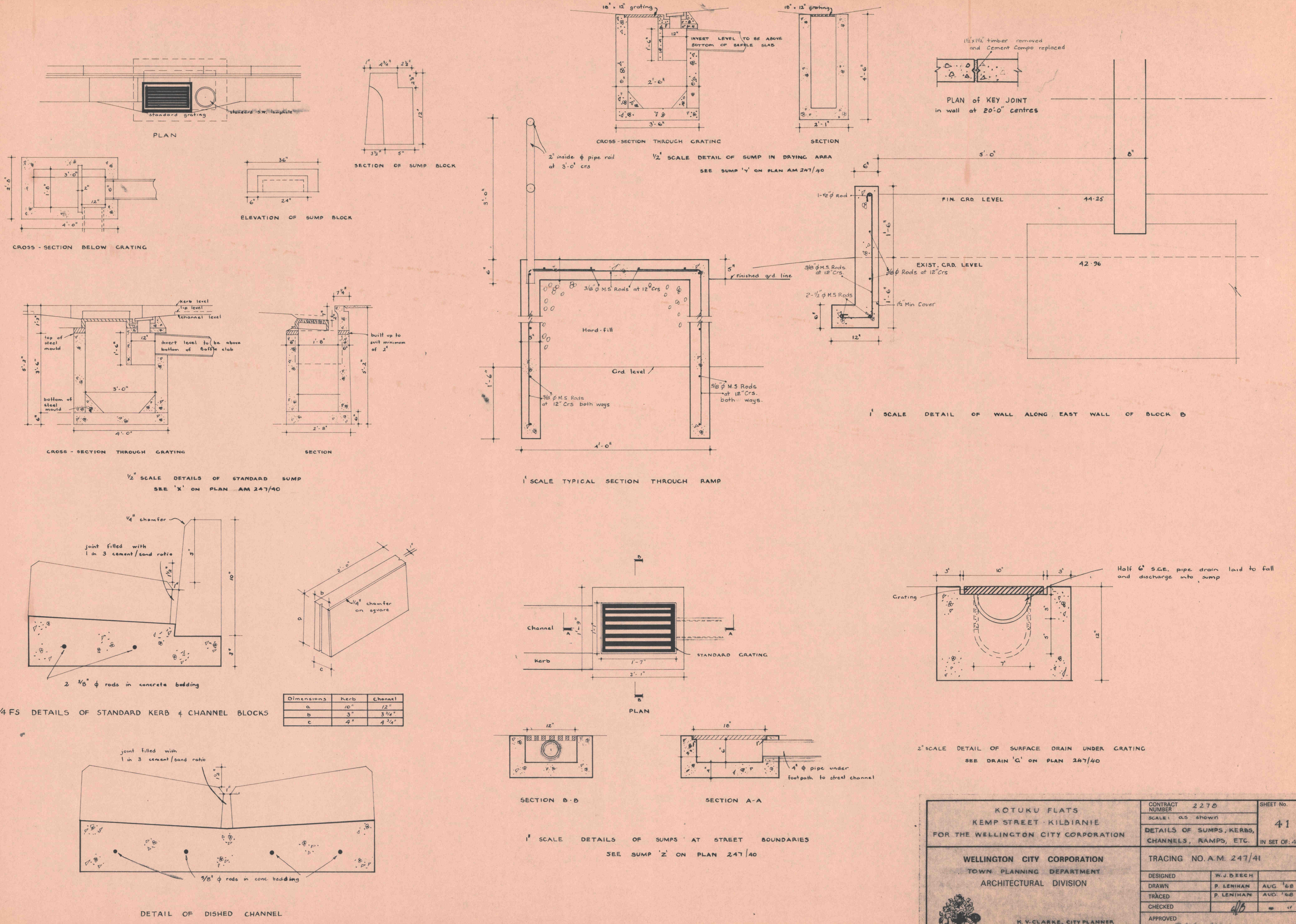
KOTUKU FLATS KEMP STREET - KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	CONTRACT NUMBER 2278 SCALE 1/16":1'0" PLAN OF SEALED AREAS	SHEET No. 40 IN SET OF: 44

WELLINGTON CITY CORPORATION
TOWN PLANNING DEPARTMENT
ARCHITECTURAL DIVISION

K. V. CLARKE, CITY PLANNER

TRACING NO. A.M. 247/40

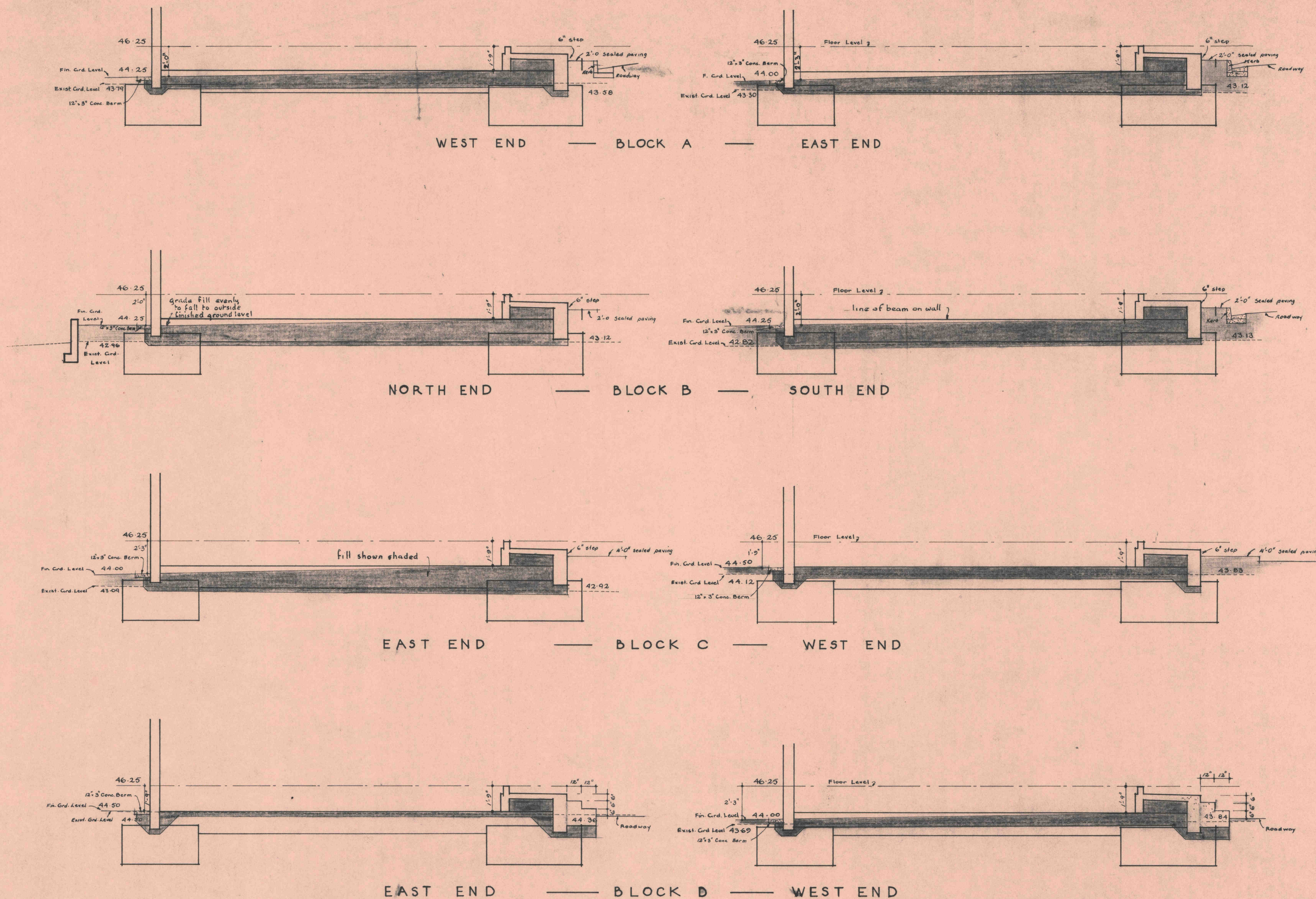
DESIGNED	W.J. BEECH	
DRAWN	P. LENIHAN	AUG. '68
TRACED	P. LENIHAN	AUG. '68
CHECKED		
APPROVED	C.M. Muir CITY ARCHITECT	



Dimensions	kerb	Channel
a	10"	12"
b	3"	3 3/4"
c	4"	4 3/4"

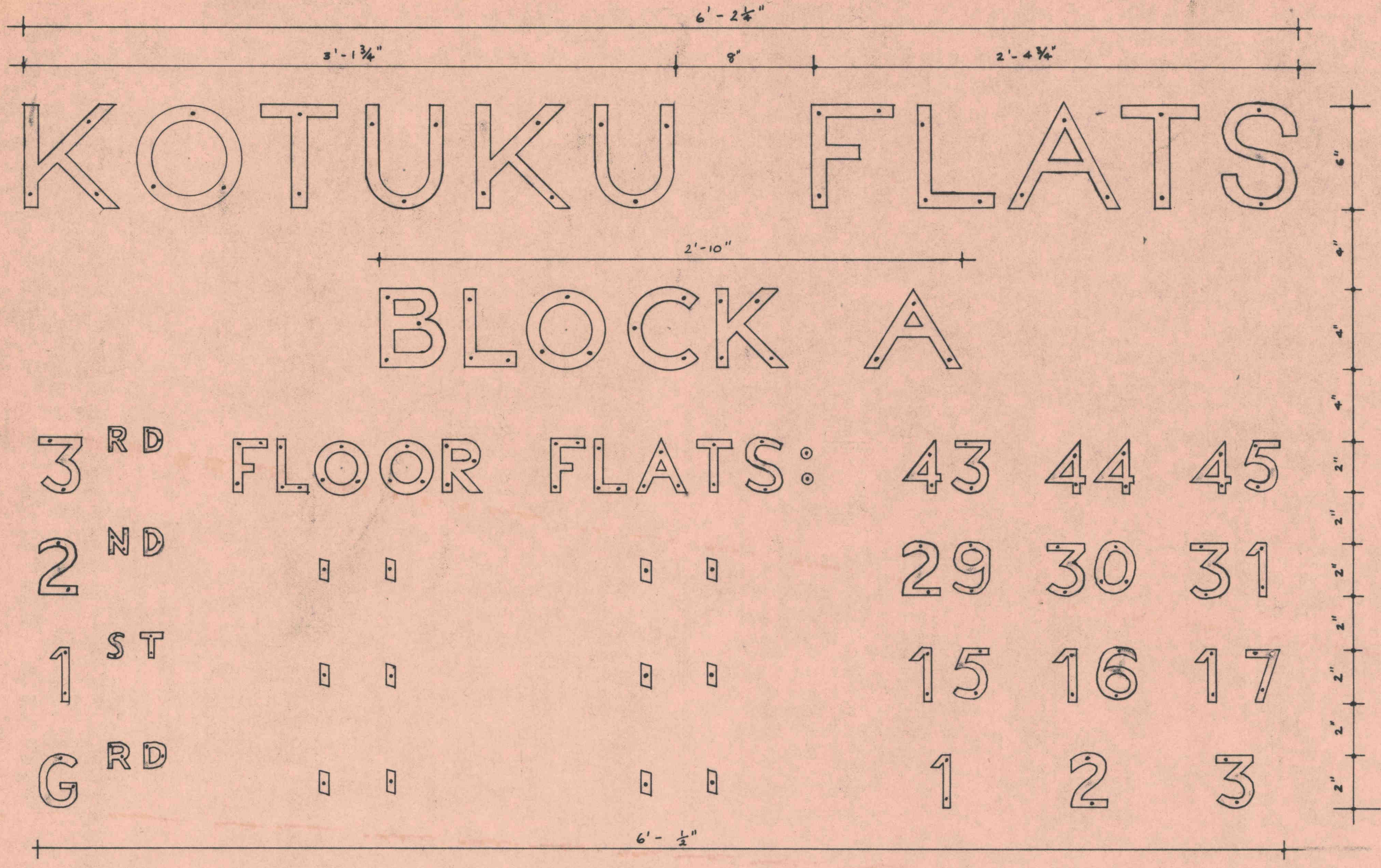
KOTUKU FLATS KEMP STREET · KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	CONTRACT NUMBER 2278 SCALE: as shown DETAILS OF SUMPS, KERBS, CHANNELS, RAMPS, ETC.	SHEET No. 41 IN SET OF: 44
WELLINGTON CITY CORPORATION TOWN PLANNING DEPARTMENT ARCHITECTURAL DIVISION K. V. CLARKE, CITY PLANNER	TRACING NO. A.M. 247/41	

DESIGNED	W. J. BEECH	
DRAWN	P. LENIHAN	AUG. '68
TRACED	P. LENIHAN	AUG. '68
CHECKED	W.B	" "
APPROVED	C.M. Muir	CITY ARCHITECT

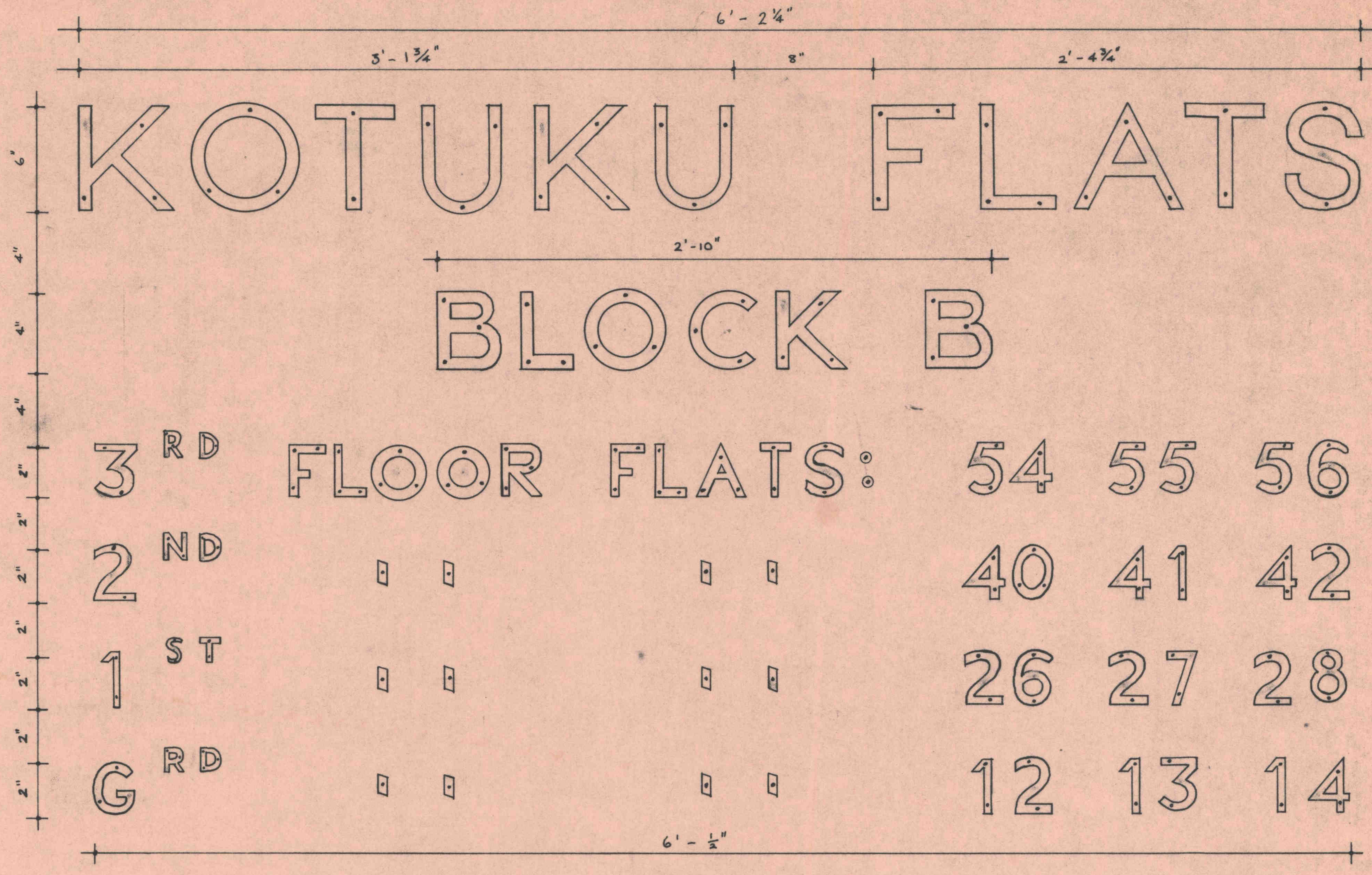


KOTUKU FLATS KEMP STREET - KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	CONTRACT NUMBER 2278 SCALE : 1/4" : 1 foot GROUND LEVELS UNDER BLOCKS	SHEET No. 42 IN SET OF 42
WELLINGTON CITY CORPORATION TOWN PLANNING DEPARTMENT ARCHITECTURAL DIVISION K.V. CLARKE, CITY PLANNER	TRACING NO. AM 247/42	

DESIGNED	W.J. BEECH	
DRAWN	W.J. BEECH	
TRACED	P. LENIHAN	SEPT '68
CHECKED	WJB	" "
APPROVED	C.M. Mair	CITY ARCHITECT

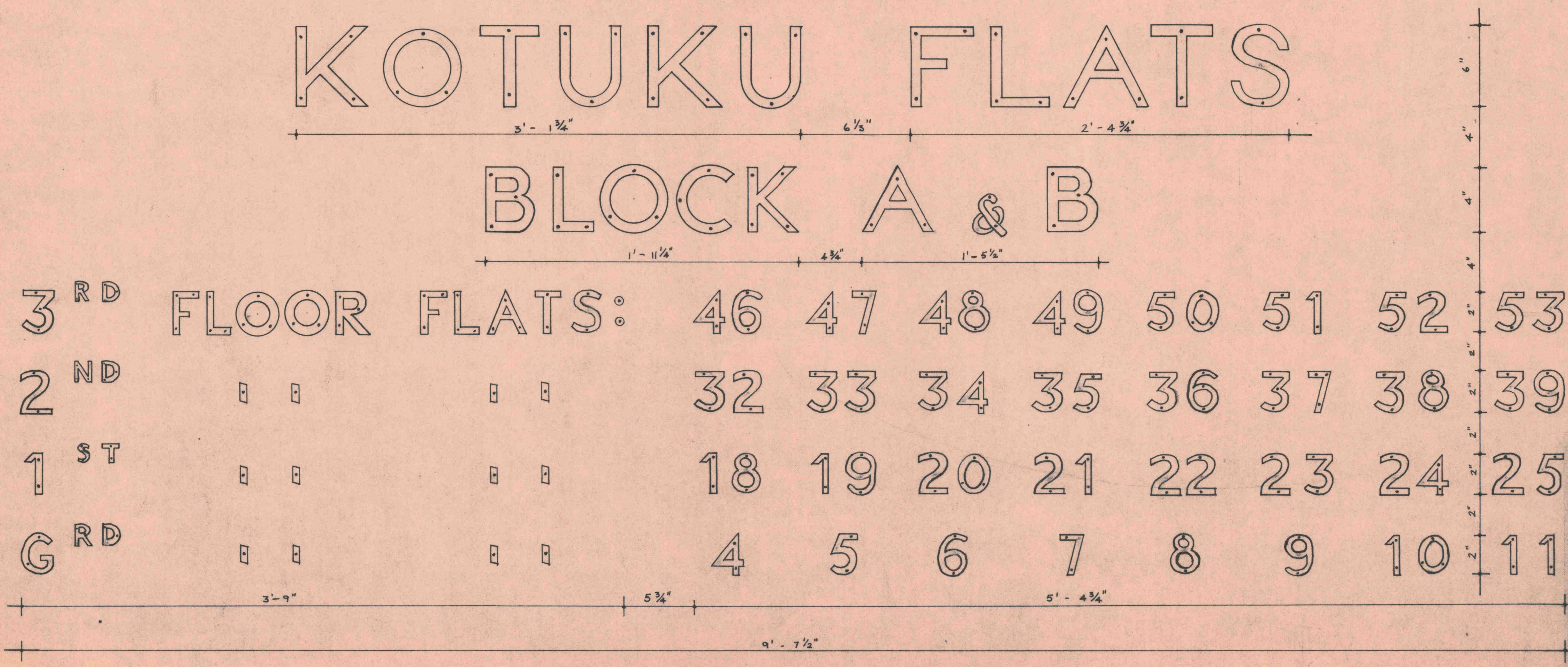


SIGN AT WEST ENTRANCE BLOCK A

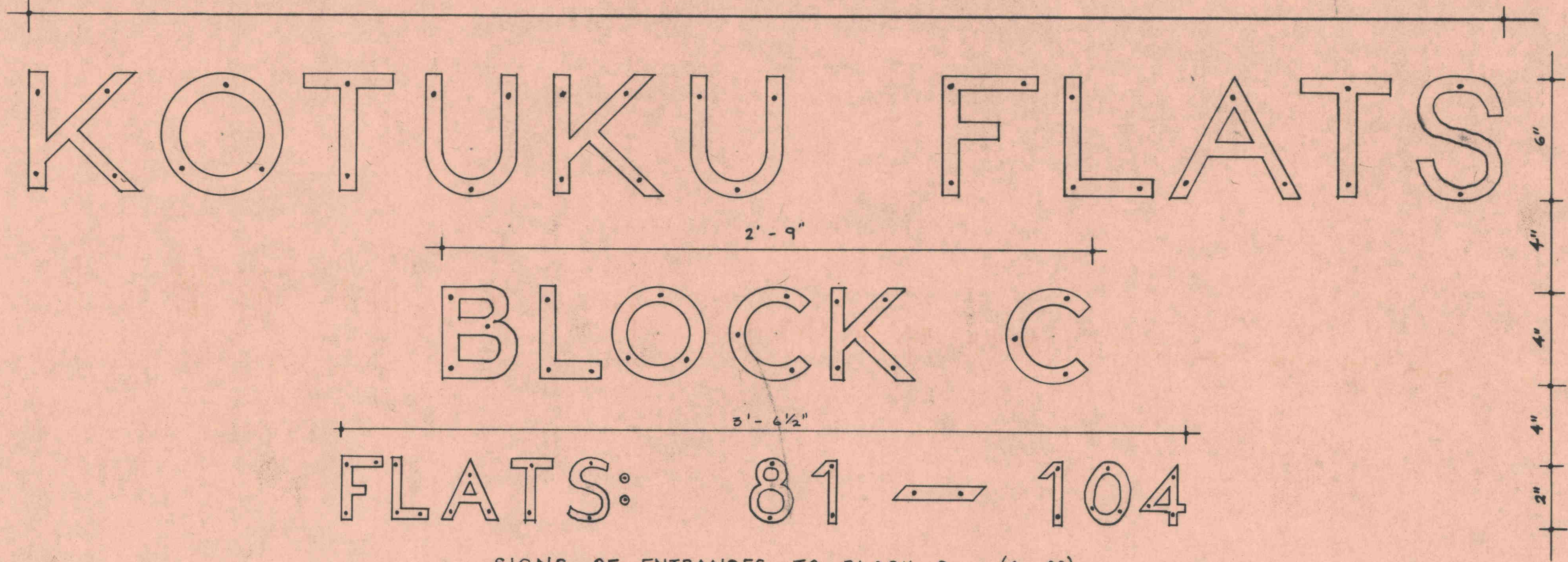


SIGN AT SOUTH ENTRANCE BLOCK B

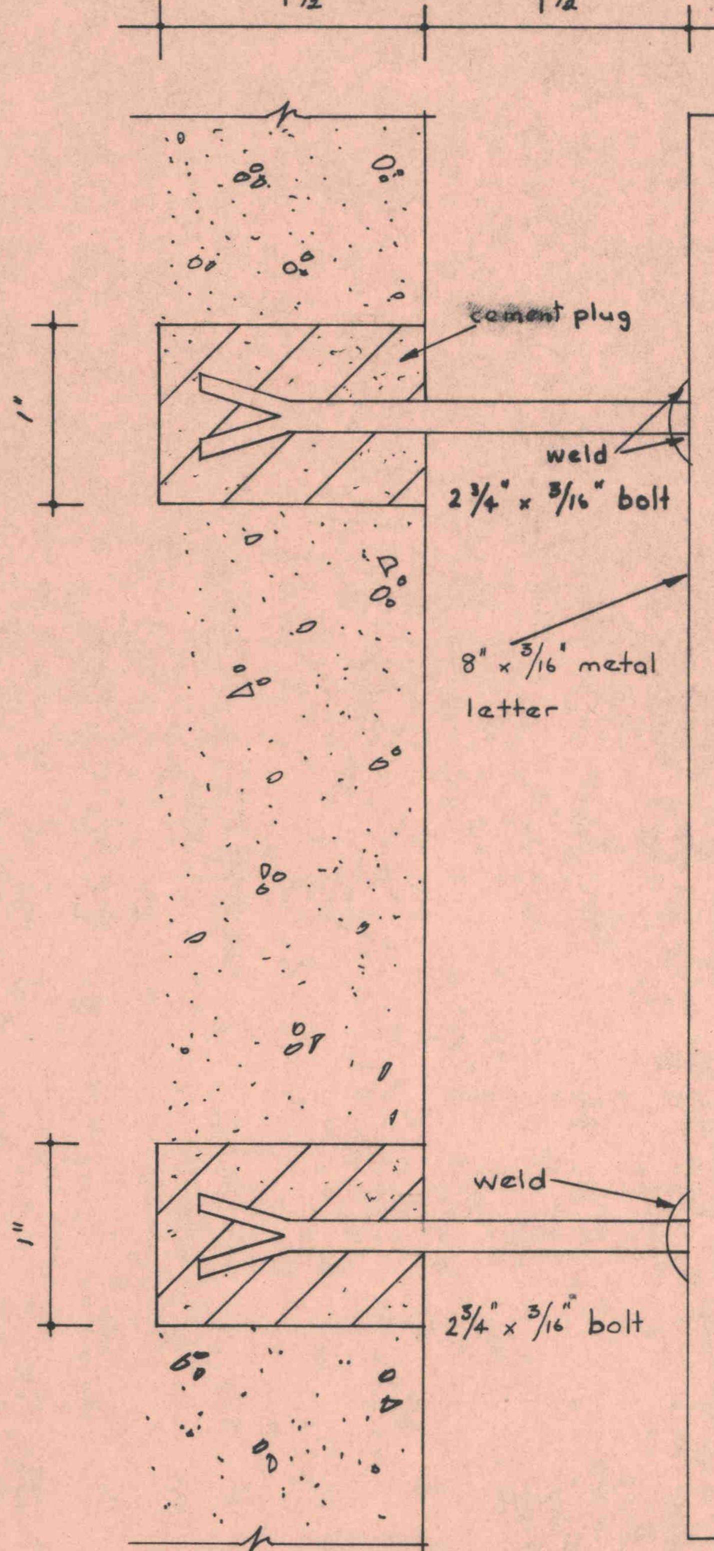
SIGN AT NORTH-EAST CORNER ENTRANCE BLOCKS A & B



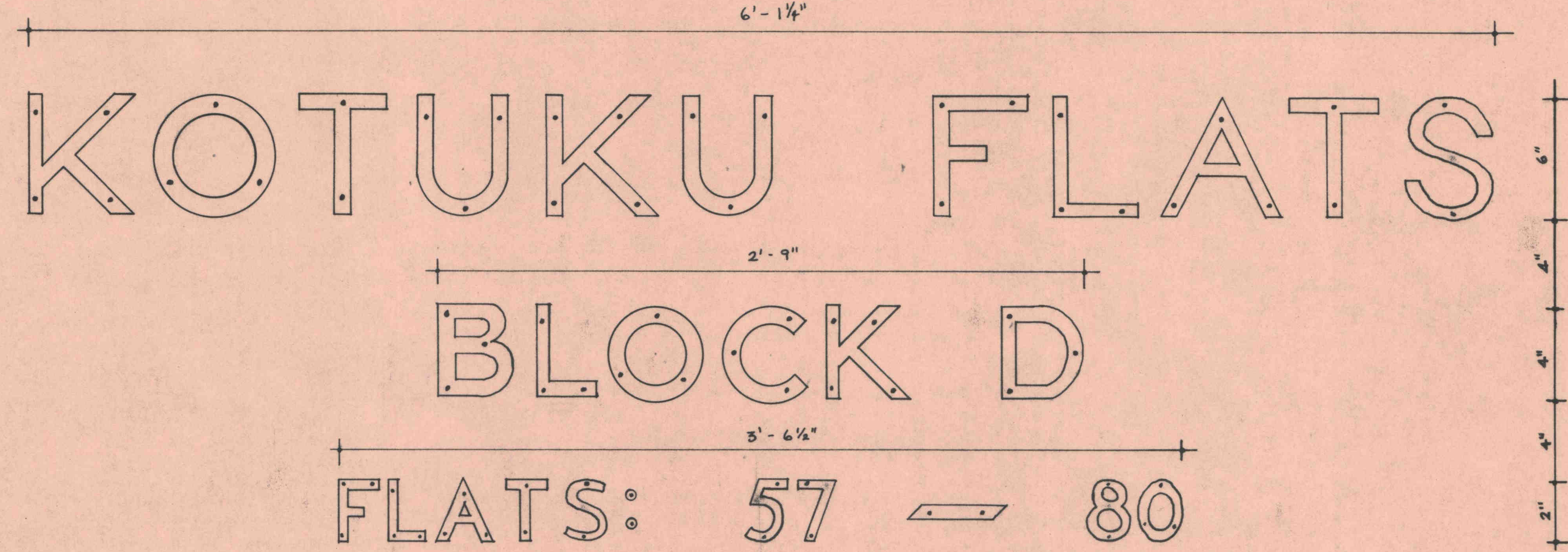
KOTUKU FLATS KEMP STREET KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	CONTRACT NUMBER 2278 SCALE 1" = 6" METAL LETTERING	SHEET No. 43 IN SET OF: 44
WELLINGTON CITY CORPORATION TOWN PLANNING DEPARTMENT ARCHITECTURAL DIVISION K.V. CLARKE, CITY PLANNER	TRACING NO. A.M. 247/43	
	DESIGNED	W.J. BEECH
	DRAWN	S. ZARAVINOS
	TRACED	S. ZARAVINOS
	CHECKED	46
	APPROVED	C.M. Muir CITY ARCHITECT



SIGNS OF ENTRANCES TO BLOCK C (2 off)



DETAIL SHOWING FIXING OF LETTERS



SIGNS OF WEST ENTRANCE TO BLOCK D

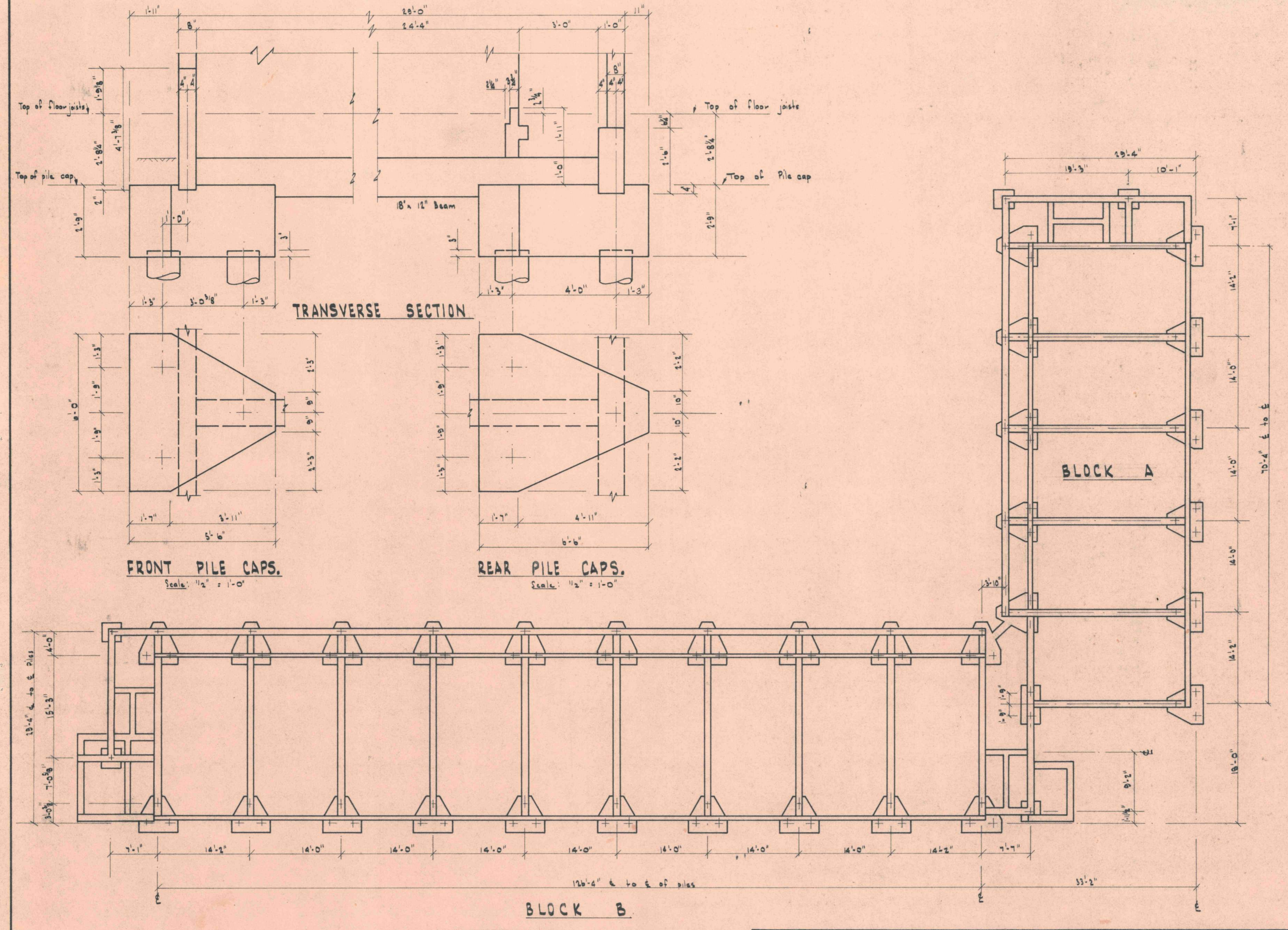
KOTUKU FLATS KEMP STREET KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	CONTRACT NUMBER 2278 SCALE 1" = 6" METAL LETTERING	SHEET No. 44 IN SET OF: 44
WELLINGTON CITY CORPORATION TOWN PLANNING DEPARTMENT ARCHITECTURAL DIVISION **K.V. CLARKE, CITY PLANNER**	TRACING NO. A.M 247/44 DESIGNED W. J. BEECH DRAWN S. ZARAVINOS TRACED S. ZARAVINOS CHECKED WJB APPROVED C.M. Muir CITY ARCHITECT	

KOTUKU FLATS
KEMP ST. – KILBIRNIE
FOR
THE WELLINGTON CITY CORPORATION

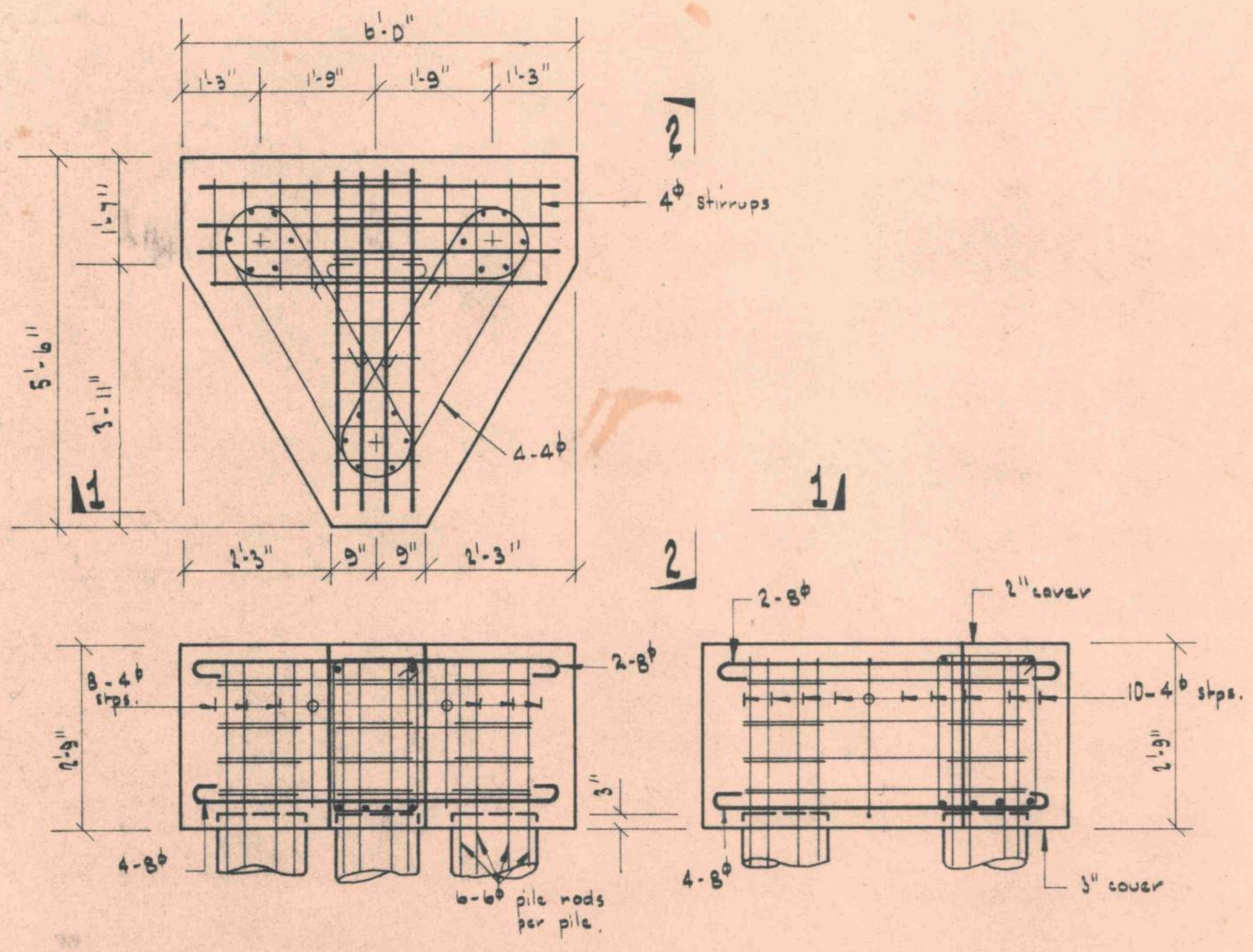
STEWART G. REES & ASSOCIATES CONSULTING ENGINEERS

THE WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION

CONTRACT No 2278.
SET No 1

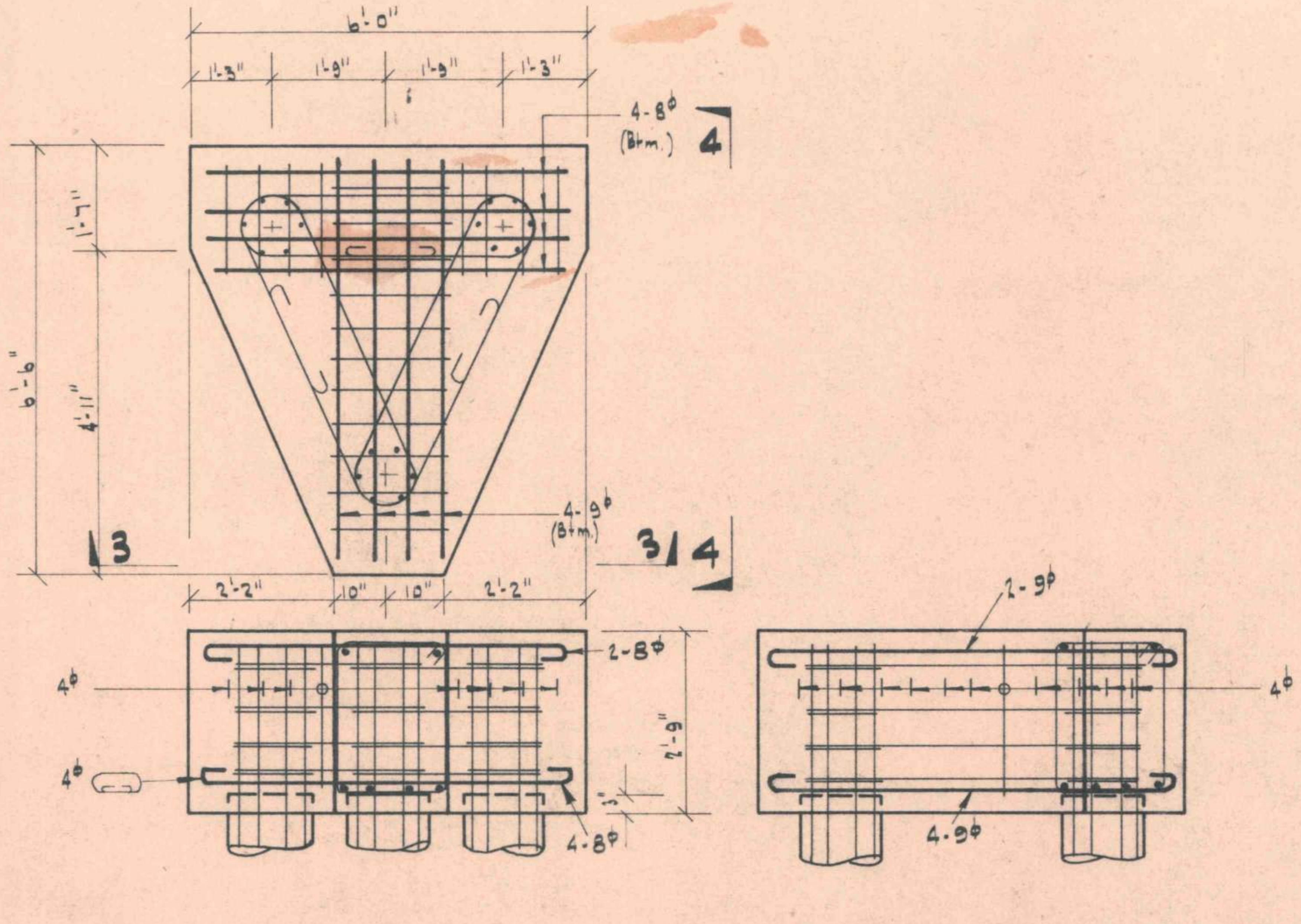


KOTUKU FLATS – KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCKS A & B. FOUNDATION PLAN DRAWN: SGR TRACED: OBS. CHECKED: DATE: 31-1-68 SCALES: 1/8" & 1/4" = 1'-0"	STEWART G. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON. PH. 46321 WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION.	DWG NO: 879/1



SECTION 1-1 SECTION 2-2

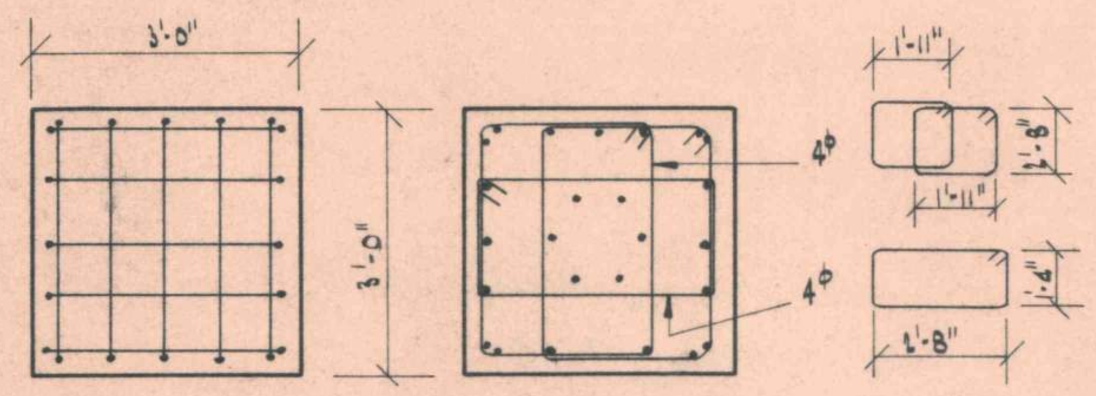
REINFORCEMENT DETAILS FRONT PILECAPS 'A'



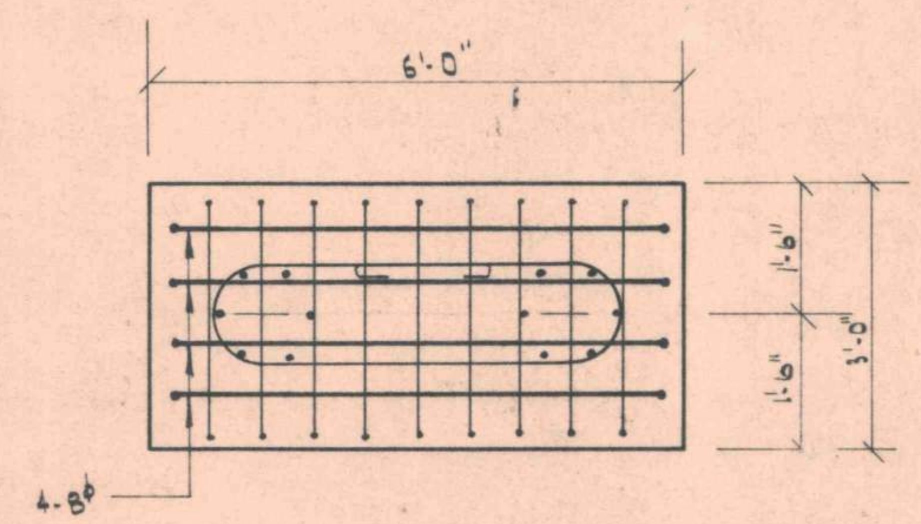
SECTION 3-3 SECTION 4-4

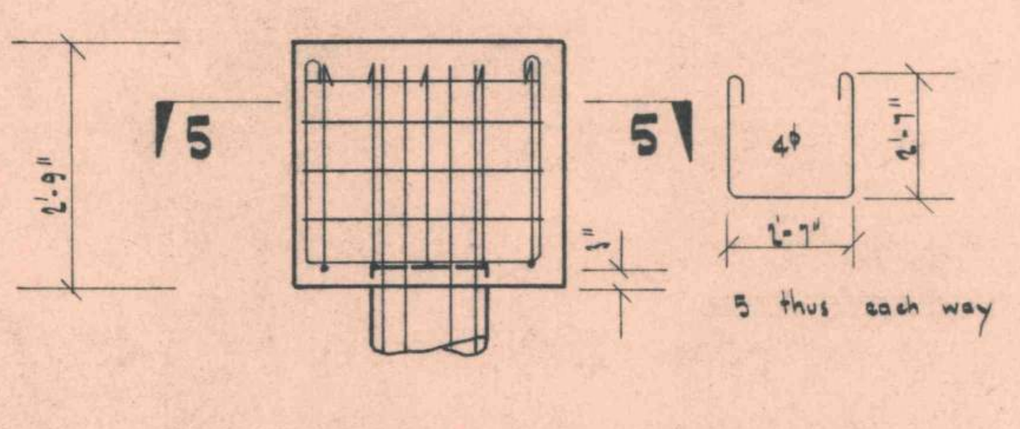
REINFORCEMENT DETAILS REAR PILECAPS 'B'

NOTE:
See foundation beam drawings for details of foundation reinforcing which runs into pilecaps.

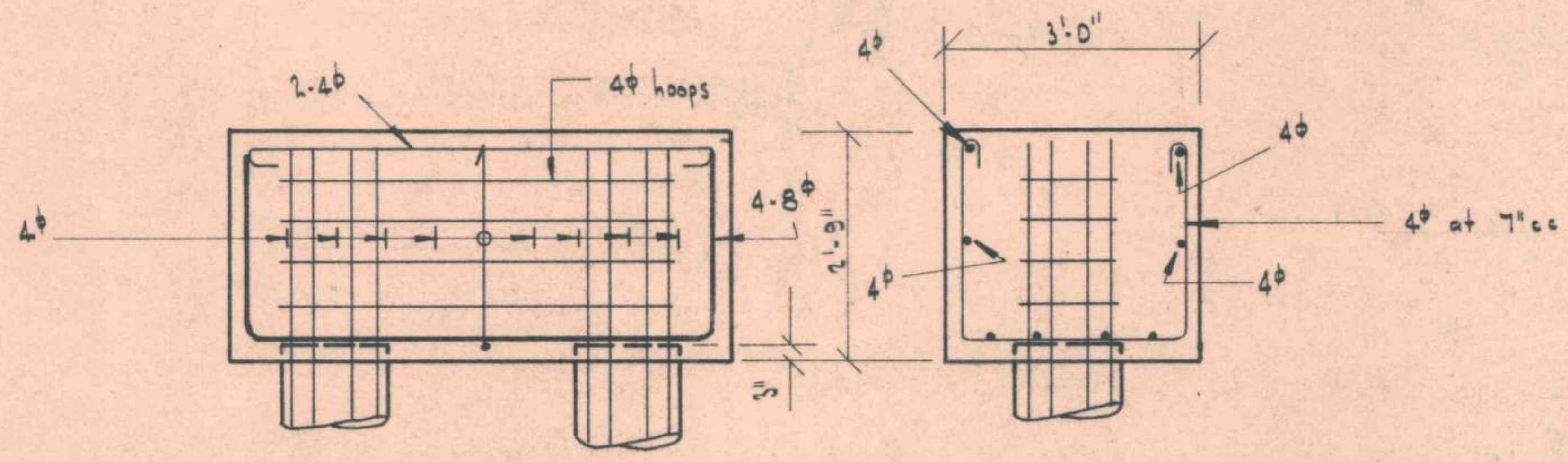


SECTION 5-5





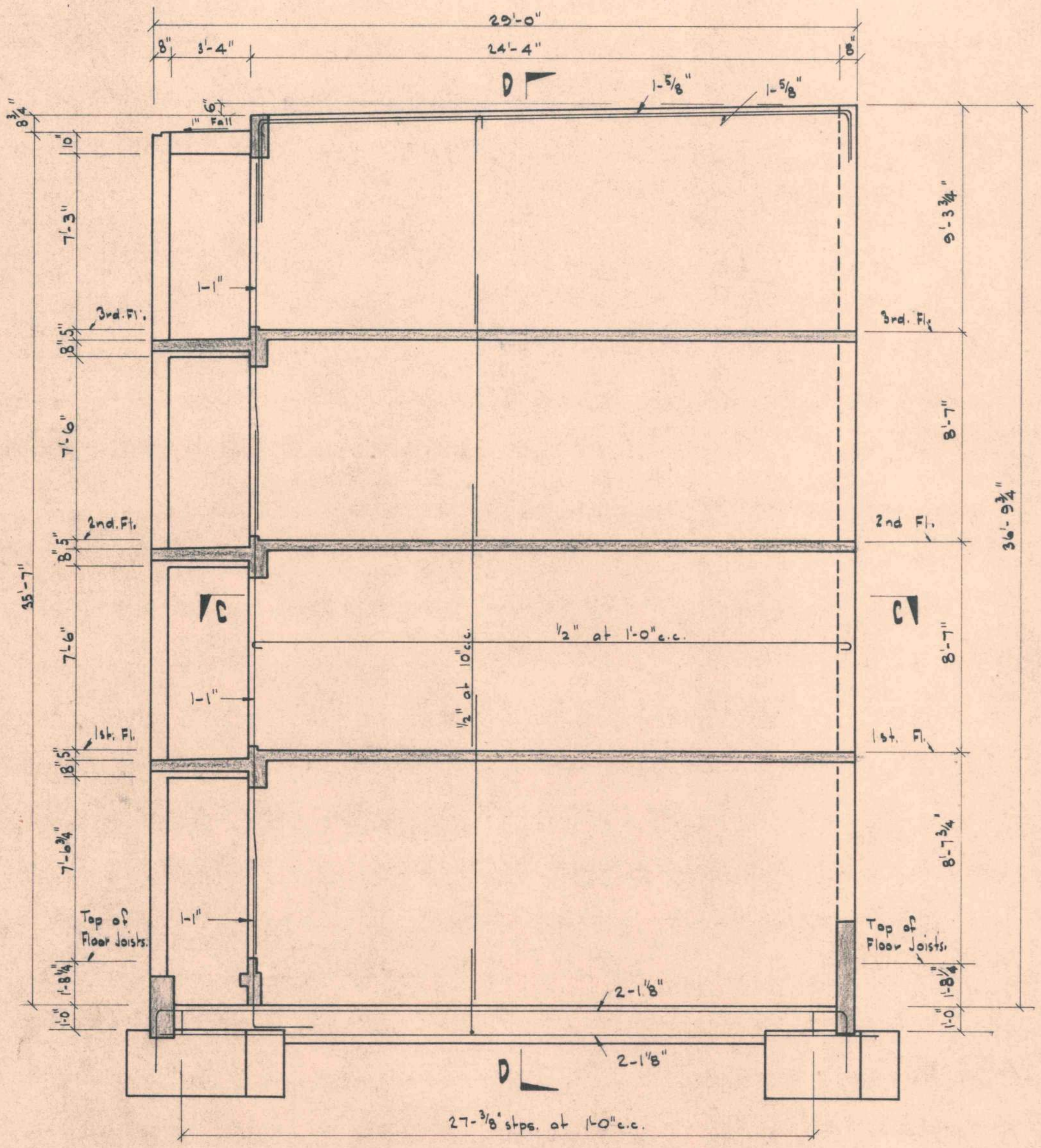
PILECAP 'C'



PILECAP 'D'

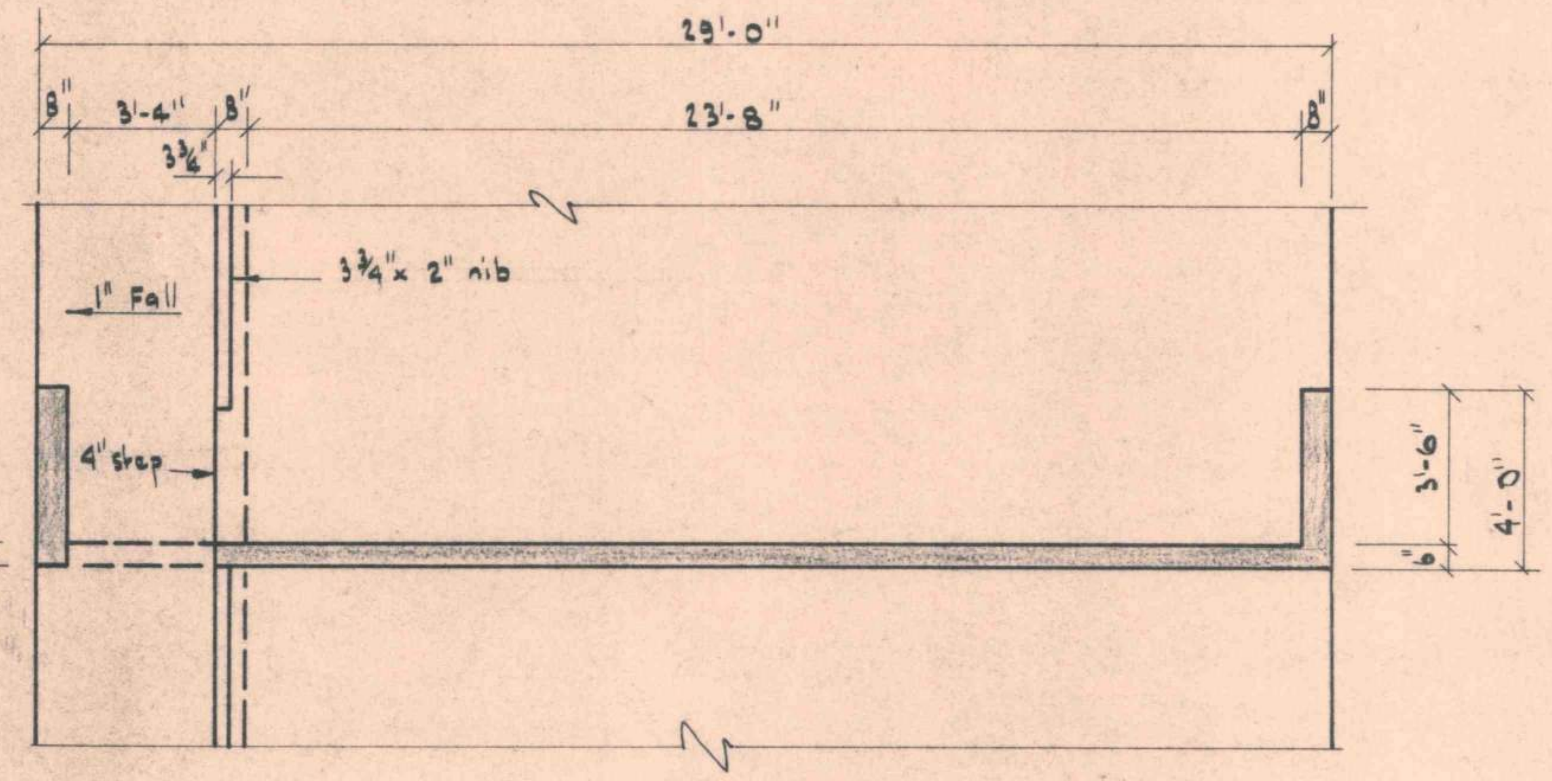
KOTUKU FLATS - KEMP ST. KILBIRNIE. FOR THE WELLINGTON CITY CORPORATION	PILECAP REINFORCING DETAILS. DRAWN: SGR TRACED: CBS CHECKED: DATE: 8-2-68 SCALES: 1/2" = 1'-0"	STEWART G. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21 EVERTON TERRACE, WELLINGTON. PH. 46-321 WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	DWG. NO. 879/2

KOTUKU FLATS - KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCKS A & B. GROUND FL. SLAB PLANS	STEWART G. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE WELLINGTON PHONE: 46-321	DWG. NO: 879/3
	DRAWN: J.J.Q. TRACED: C.B.S. CHECKED:	WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	
	DATE: 29-11-67 SCALES: 1/4", 1/2" : 1'-0"		NO. OF SHEETS:

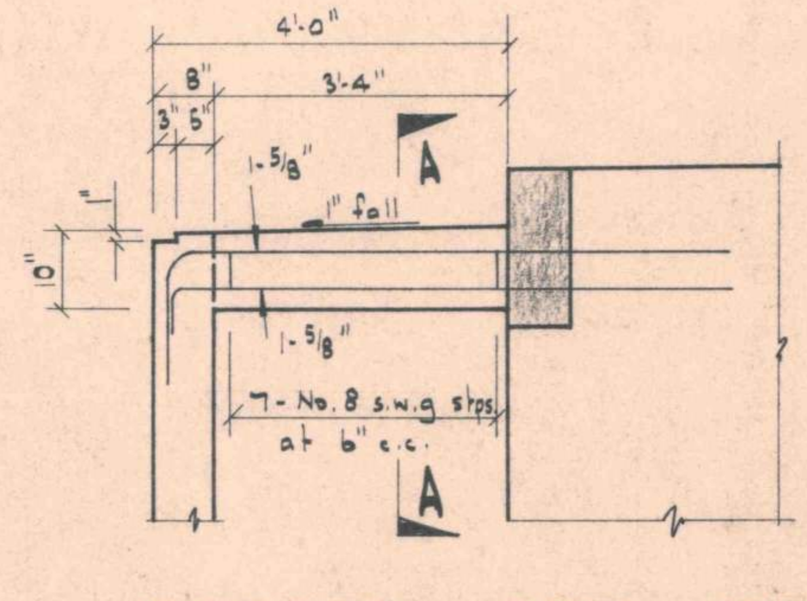


ELEVATION, TYPICAL INTERIOR TRANSVERSE WALL.

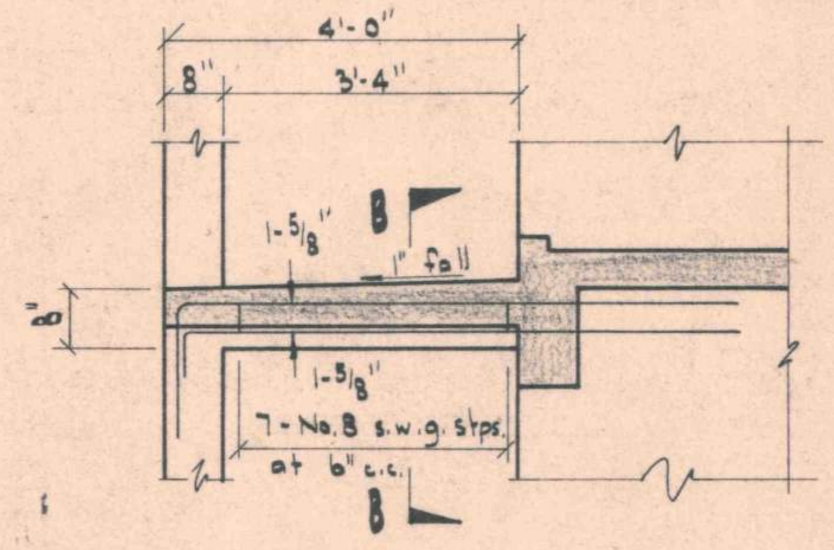
Wall is 6" thick reinforced with 1/2"φ at 10"c.c. vertically and 1/2"φ at 1'-0"c.c. horizontally. Typical bars have been shown.



HORIZONTAL SECTION, TYPICAL INTERIOR TRANSVERSE WALL AT 1ST., 2ND., & 3RD. FLOOR LEVELS.

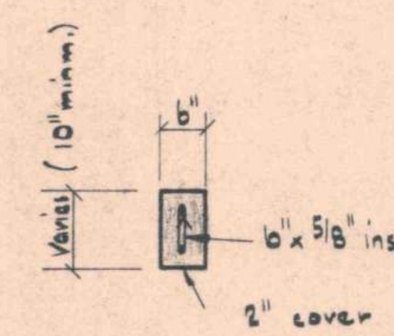


ELEVATION ROOF BEAM

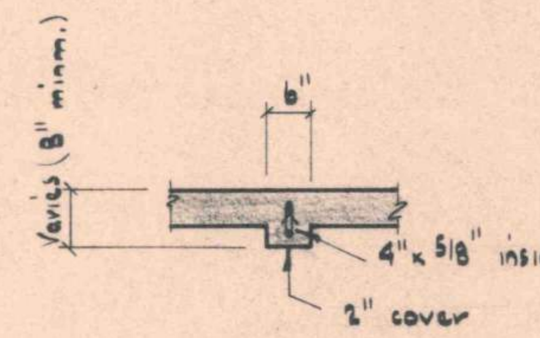


ELEVATION SLAB BEAM

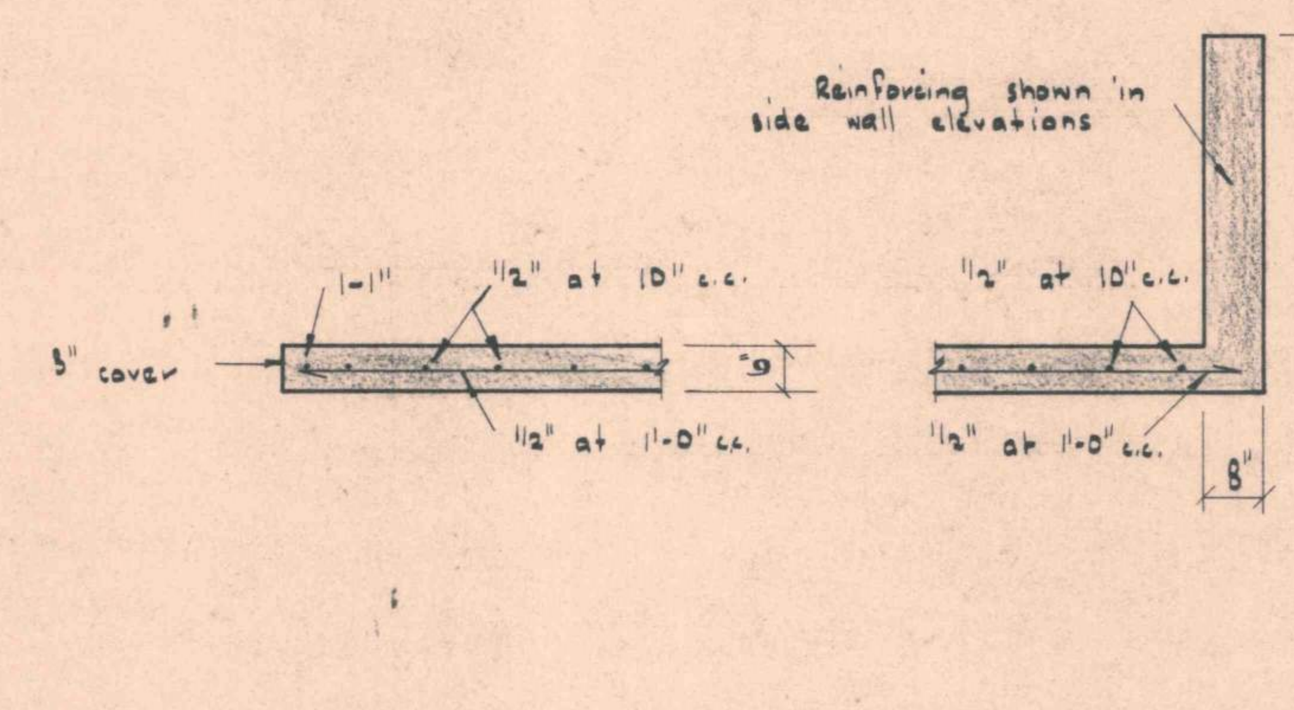
(Typical for 1st., 2nd. & 3rd. floors



A-A

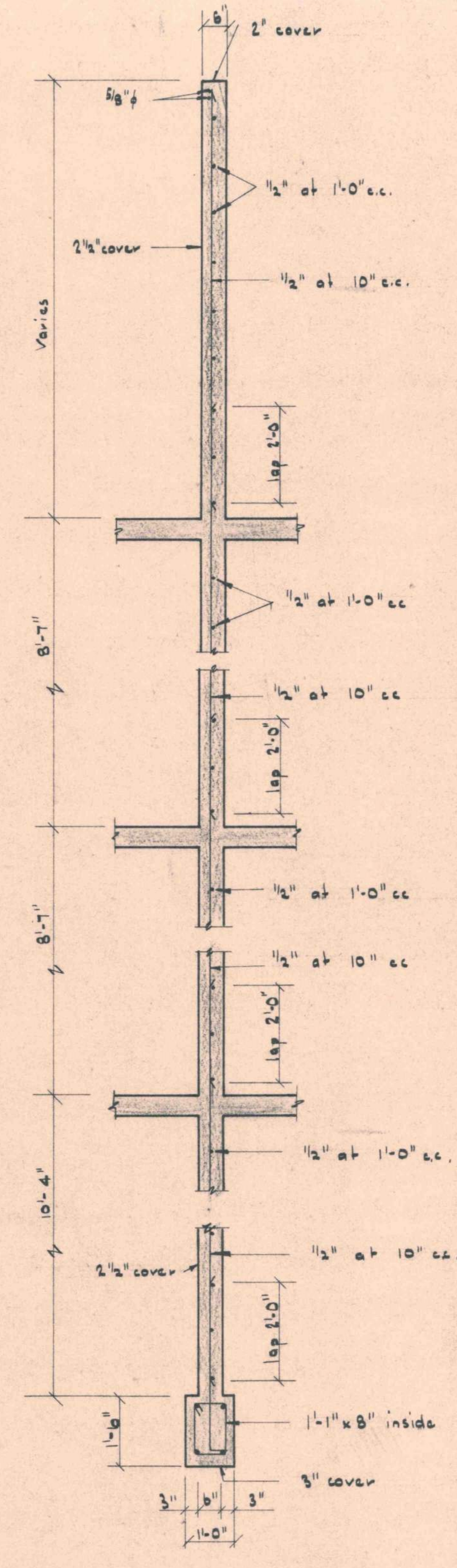


B-B



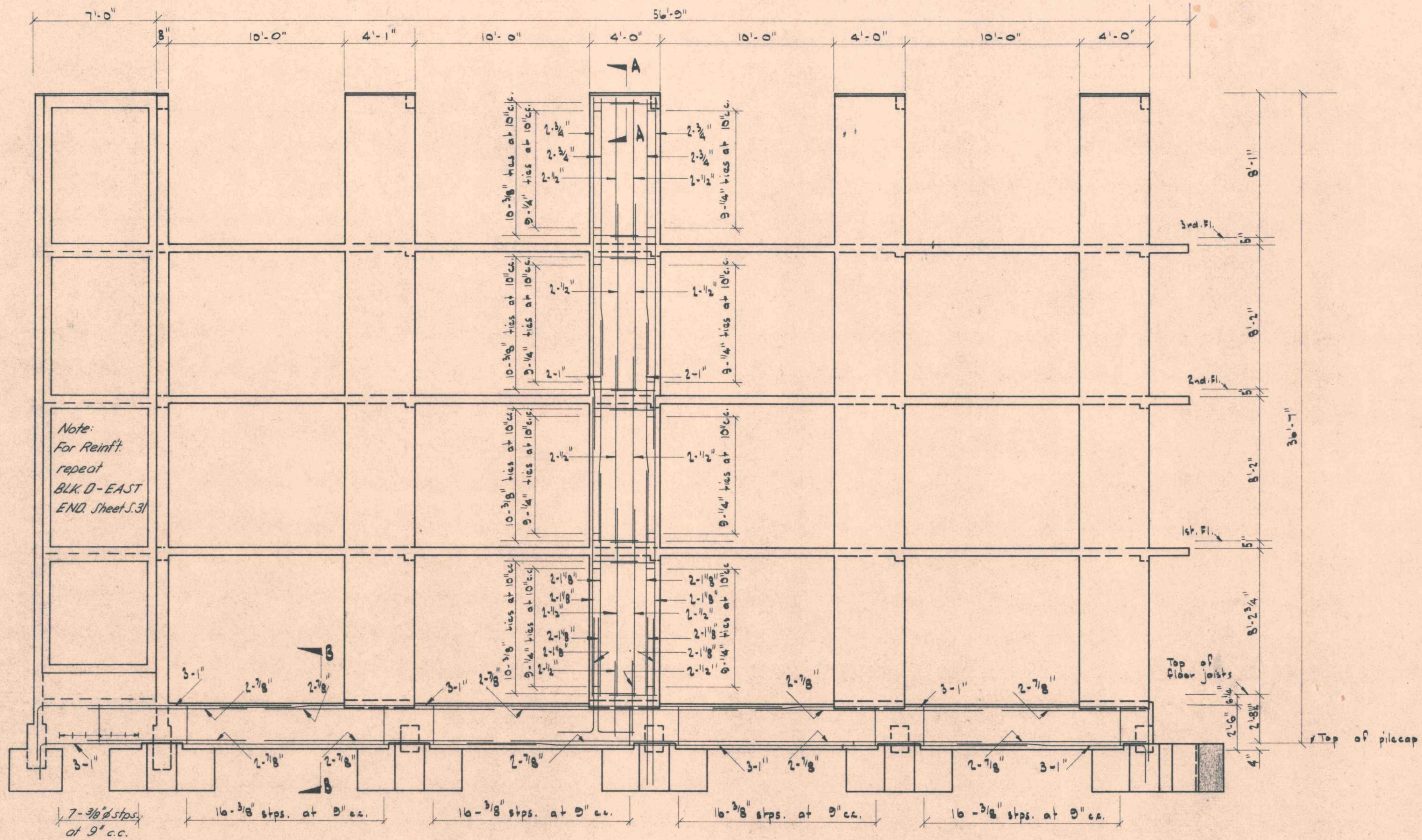
SECTION C-C

Typical for Wall



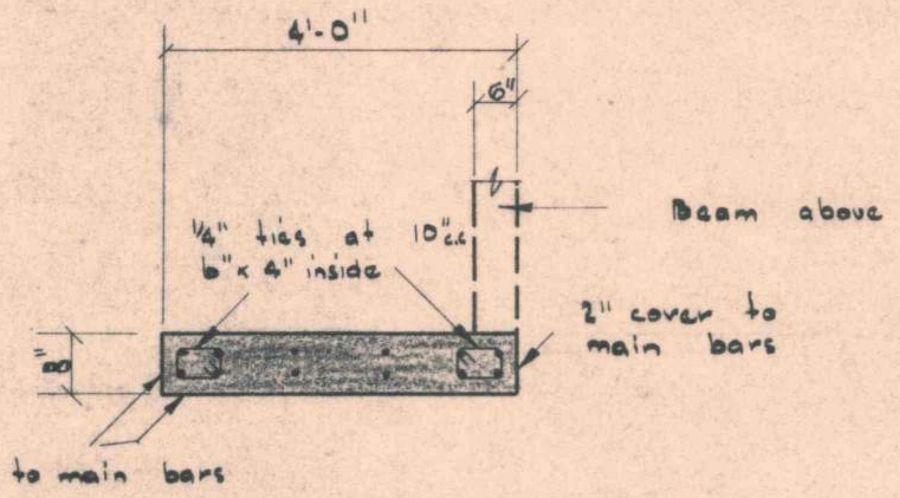
SECTION D-D

KOTUKU FLATS – KEMP ST., KILBIRNIE FOR THE WELLINGTON CITY CORPORATION.	INTERIOR TRANSVERSE WALL FOR ALL BLOCKS	STEWART G. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON. PH. 46321	DWG. NO: 879/4
	DRAWN: J.J.Q. TRACED: C.B.S. CHECKED:	WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	
	DATE: 20th. OCT. 1967 SCALES: 1/4", 1/2" = 1'-0"		NO. OF SHEETS:



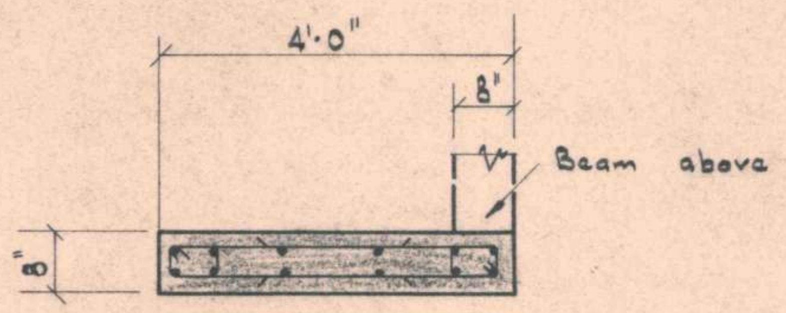
ELEVATION SOUTH WALL - BLOCK A.

Column reinforcing is similar for all columns in this wall.



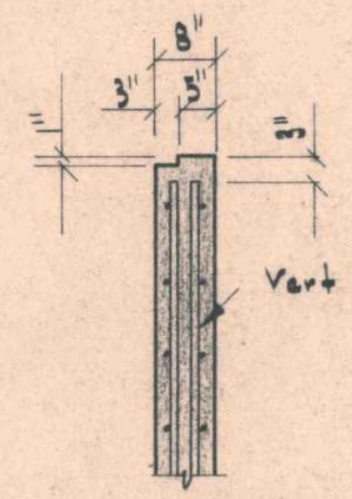
COLUMN SECTION

(To show ¼" ties.)

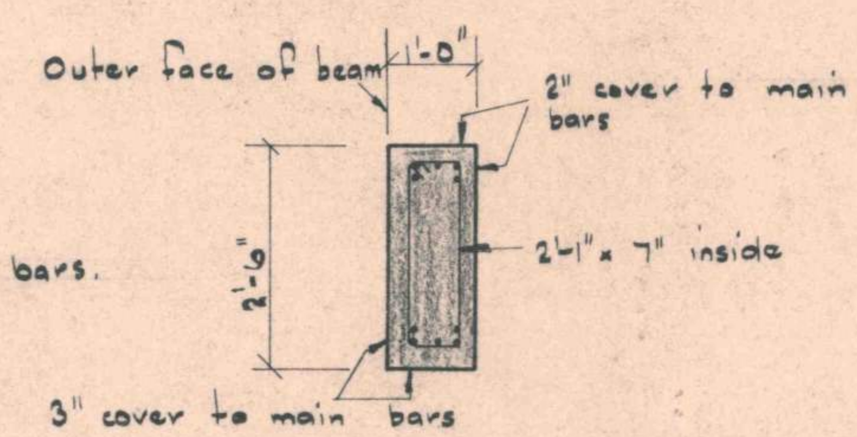


COLUMN SECTION AT END 8" WALL

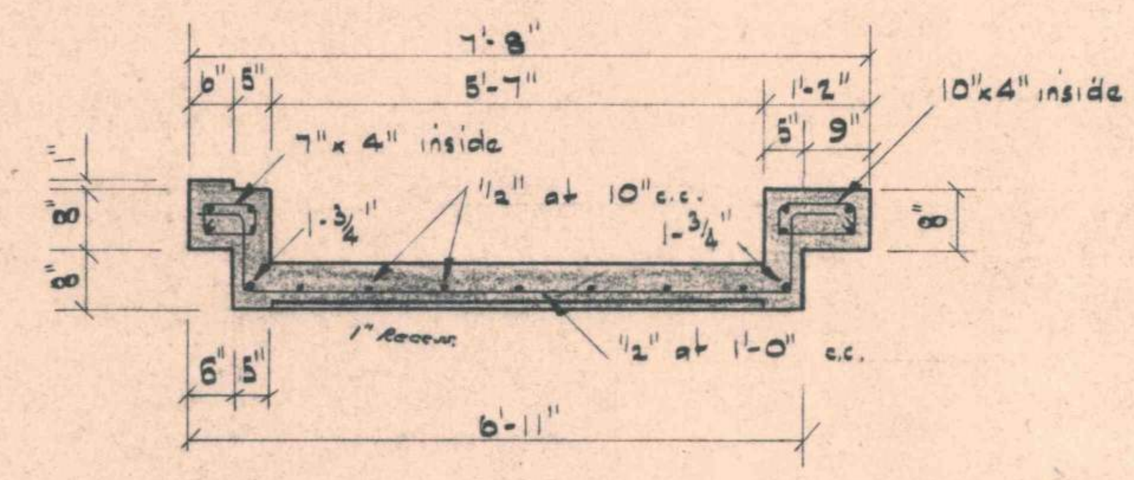
Note:- This section does not apply to Block A, but to Blocks B, C & D.



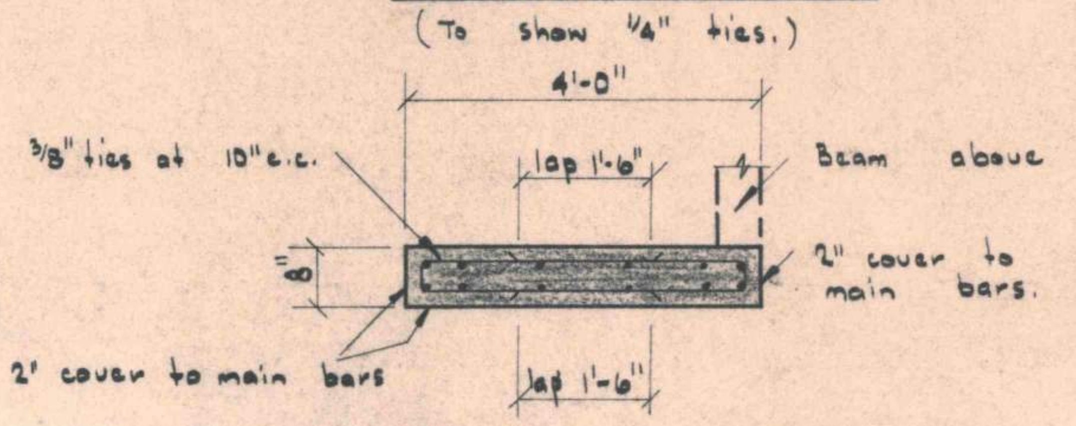
A - A



B - B



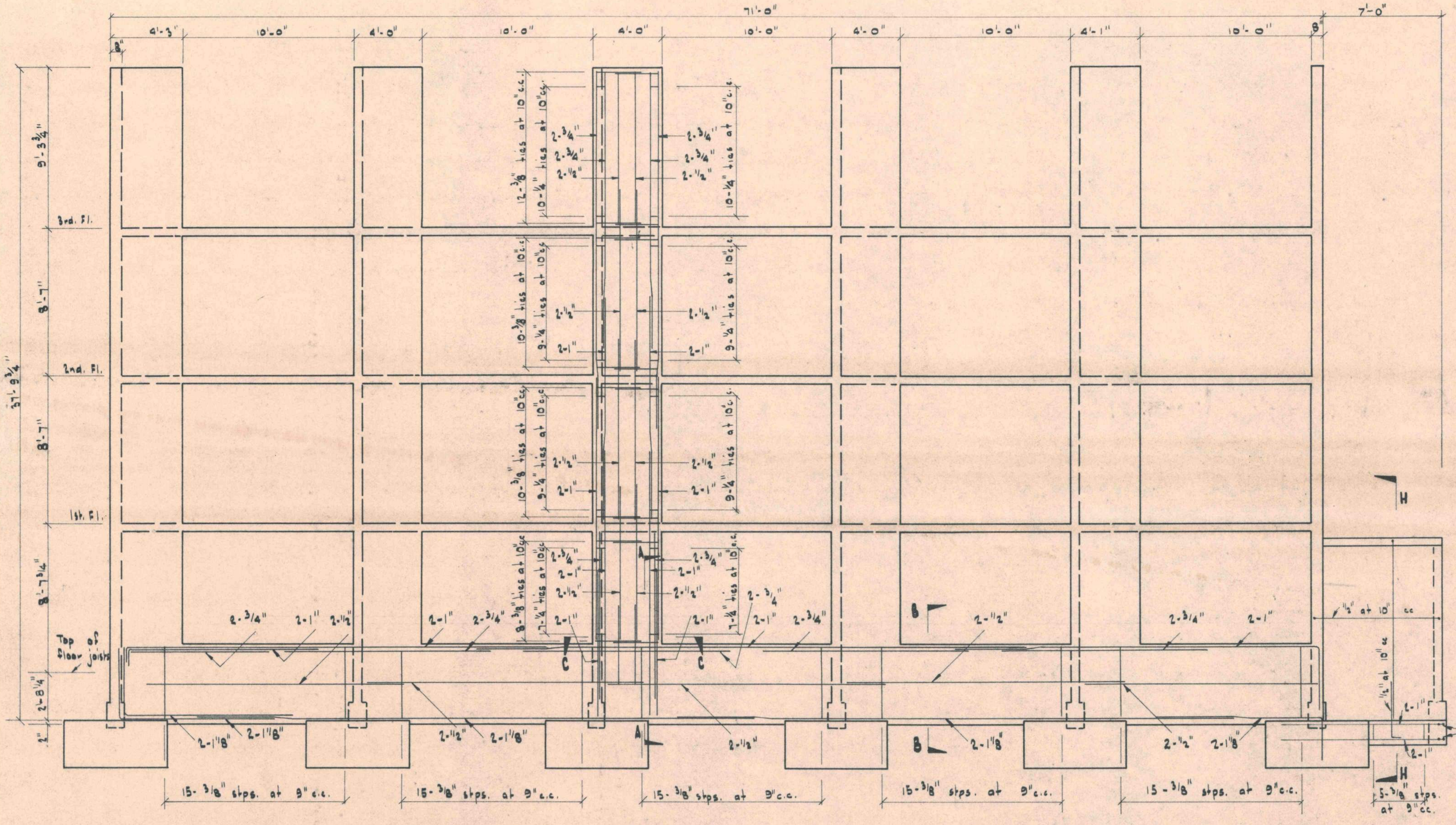
SECTION C - C



COLUMN SECTION

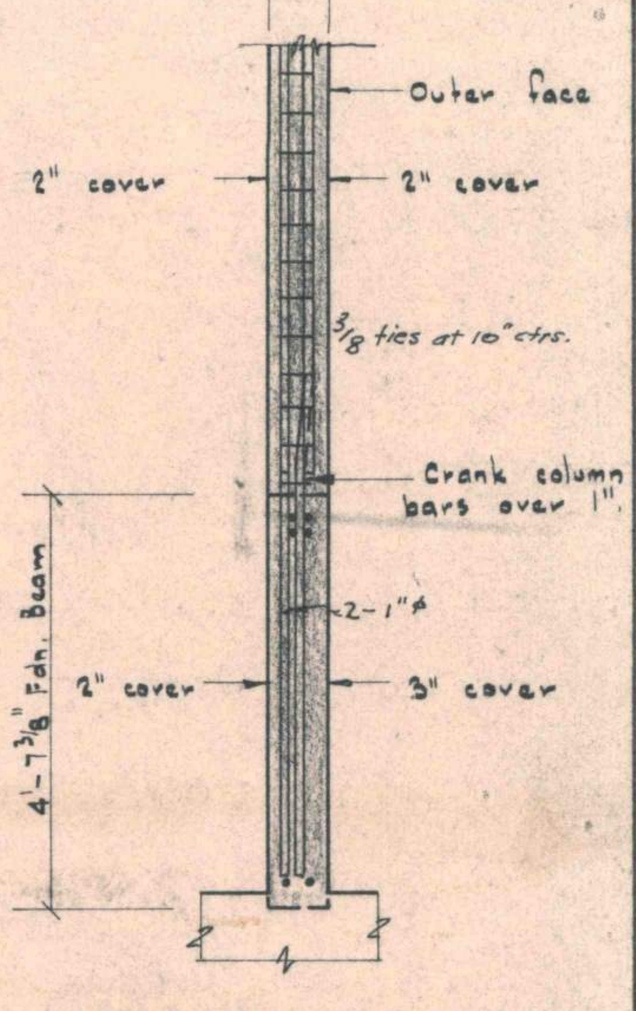
(To show ⅜" ties.)

KOTUKU FLATS - KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK A - SOUTH WALL DRAWN: J.J.D. TRACED: C.B.S. CHECKED: DATE: 26-10-67 SCALES: ⅛", ½" = 1'-0"	STEWART C. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON. PH. 46321 WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION.	DWG. NO. 879/5 NO. OF SHEETS



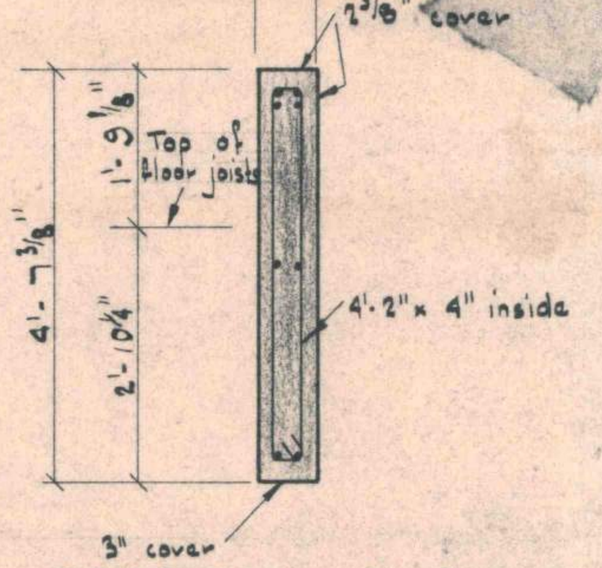
ELEVATION NORTH WALL BLOCK A

Column reinforcing is similar for all columns in this wall but note that column sizes vary. See Sections.

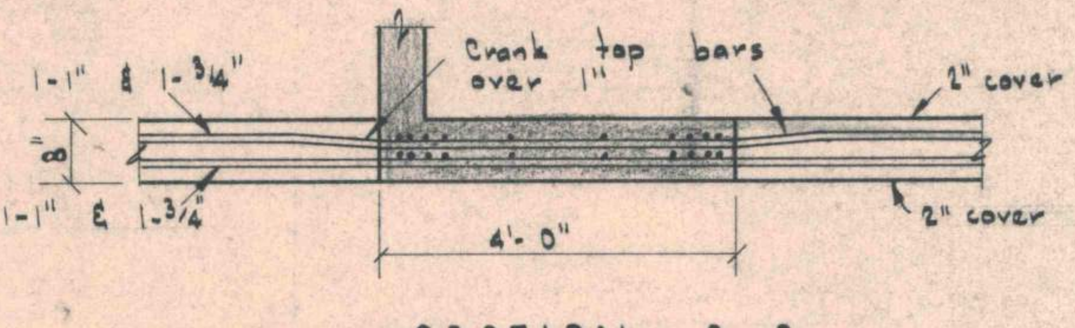


SECTION A-A

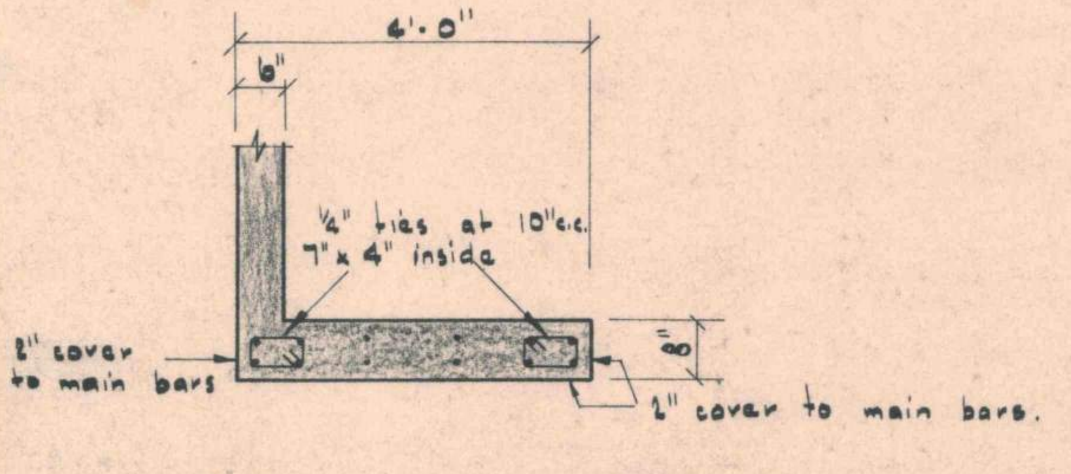
(Typical for all col. bars.)



SECTION B-B

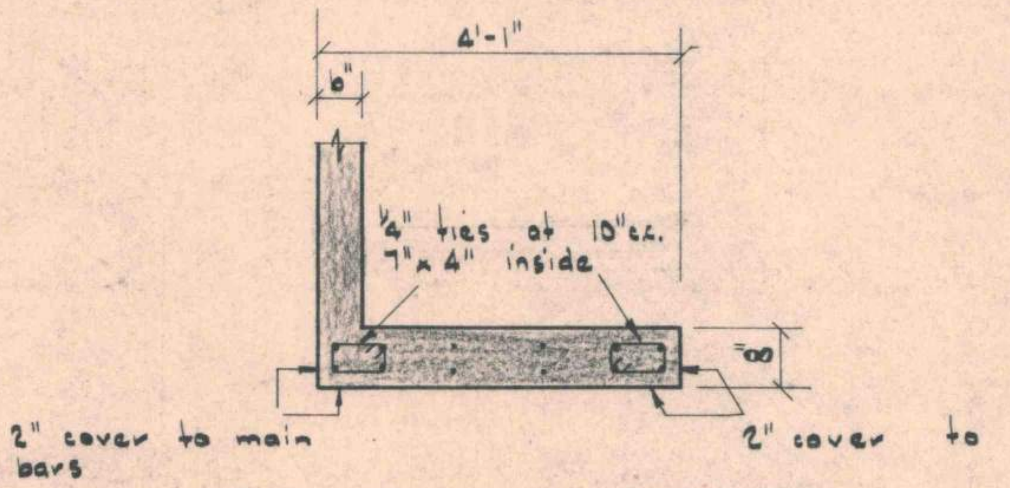


SECTION C-C



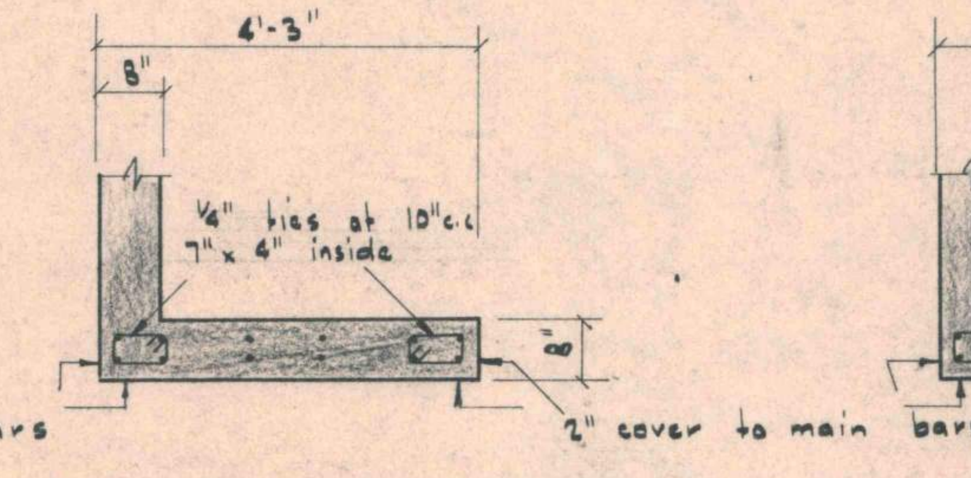
4'-0" COLUMN SECTION

(To show 1/4" ties.)



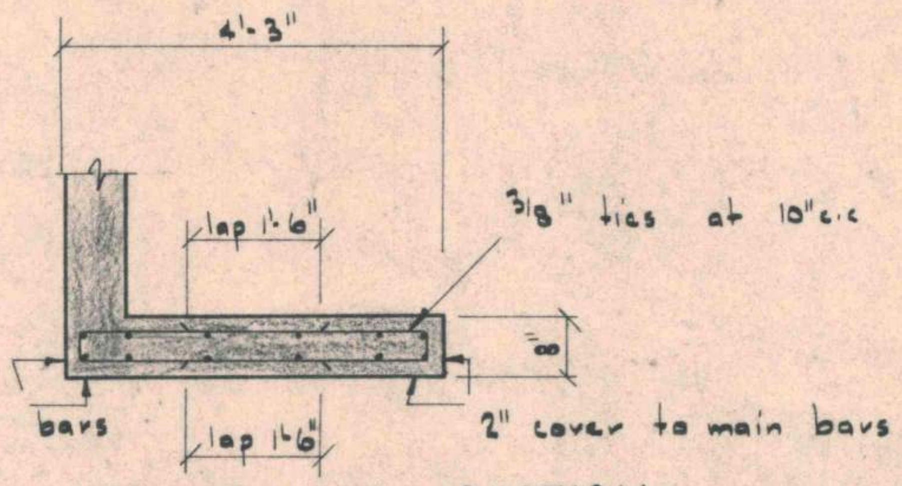
4'-1" COLUMN SECTION

(To show 1/4" ties.)



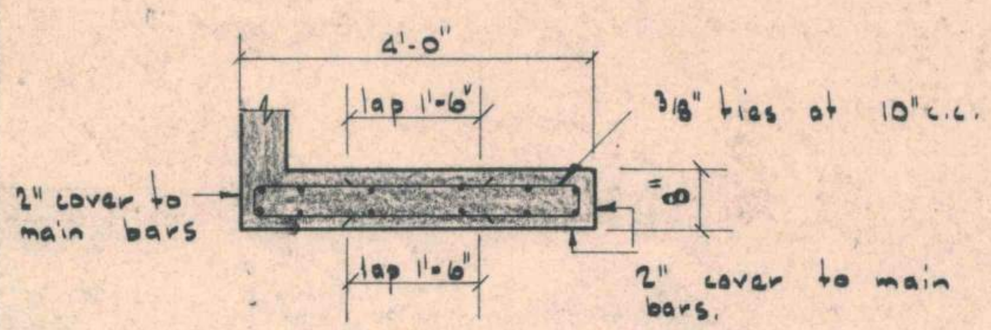
4'-3" COLUMN SECTION

(To show 1/4" ties.)



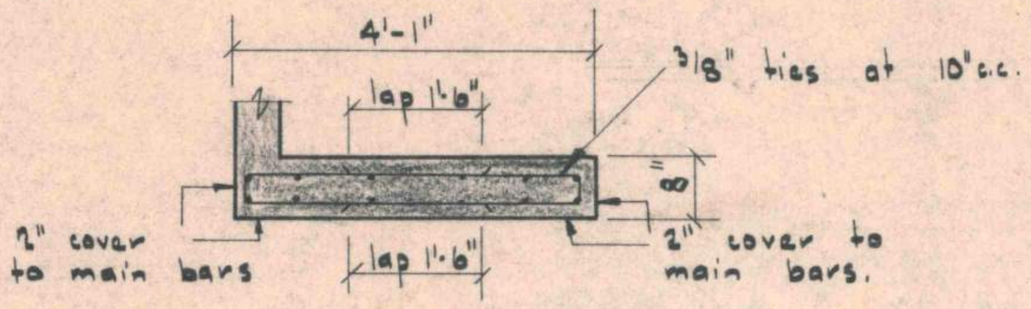
4'-3" COLUMN SECTION

(To show 3/8" ties.)



4'-0" COLUMN SECTION

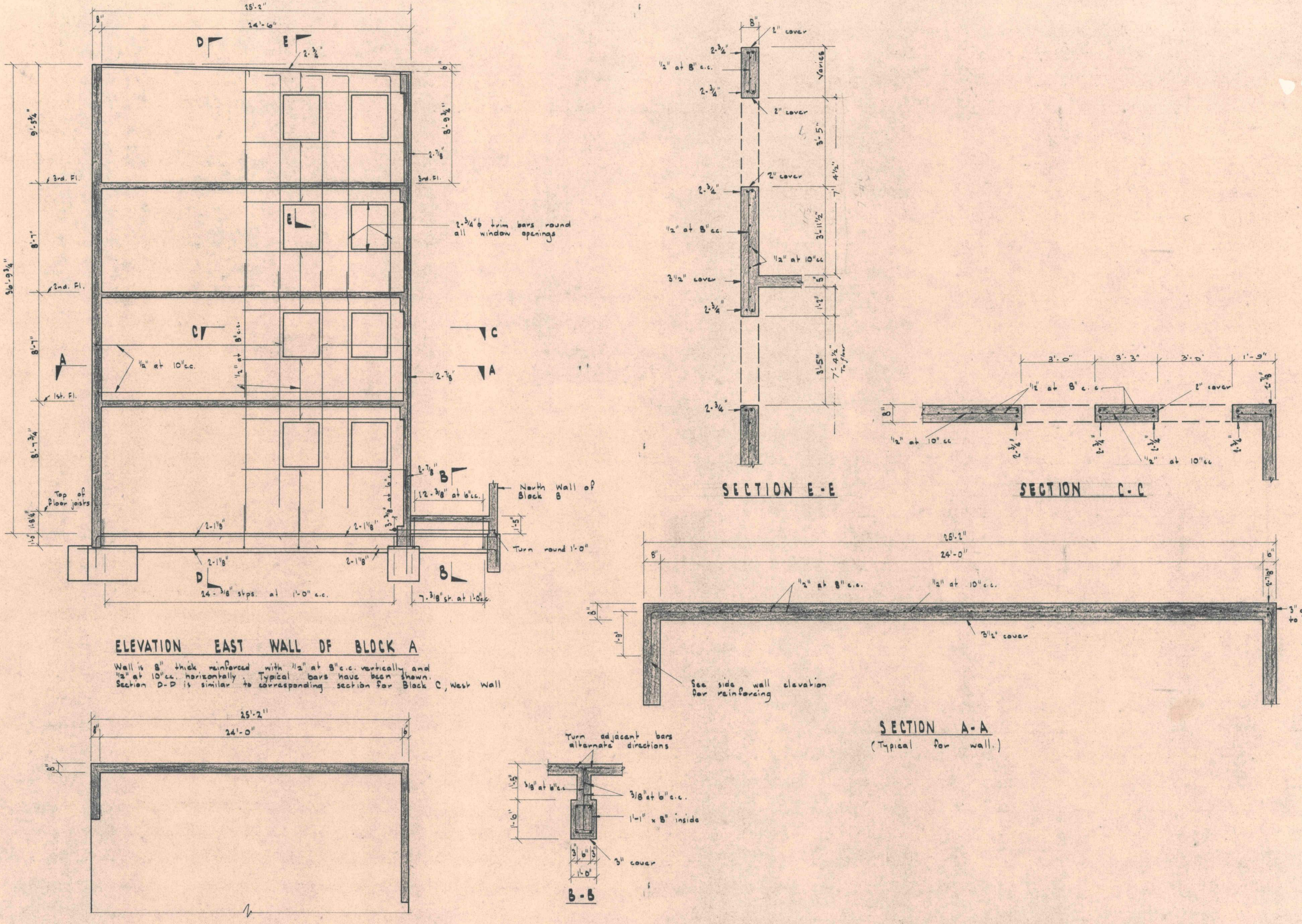
(To show 3/8" ties.)



4'-1" COLUMN SECTION

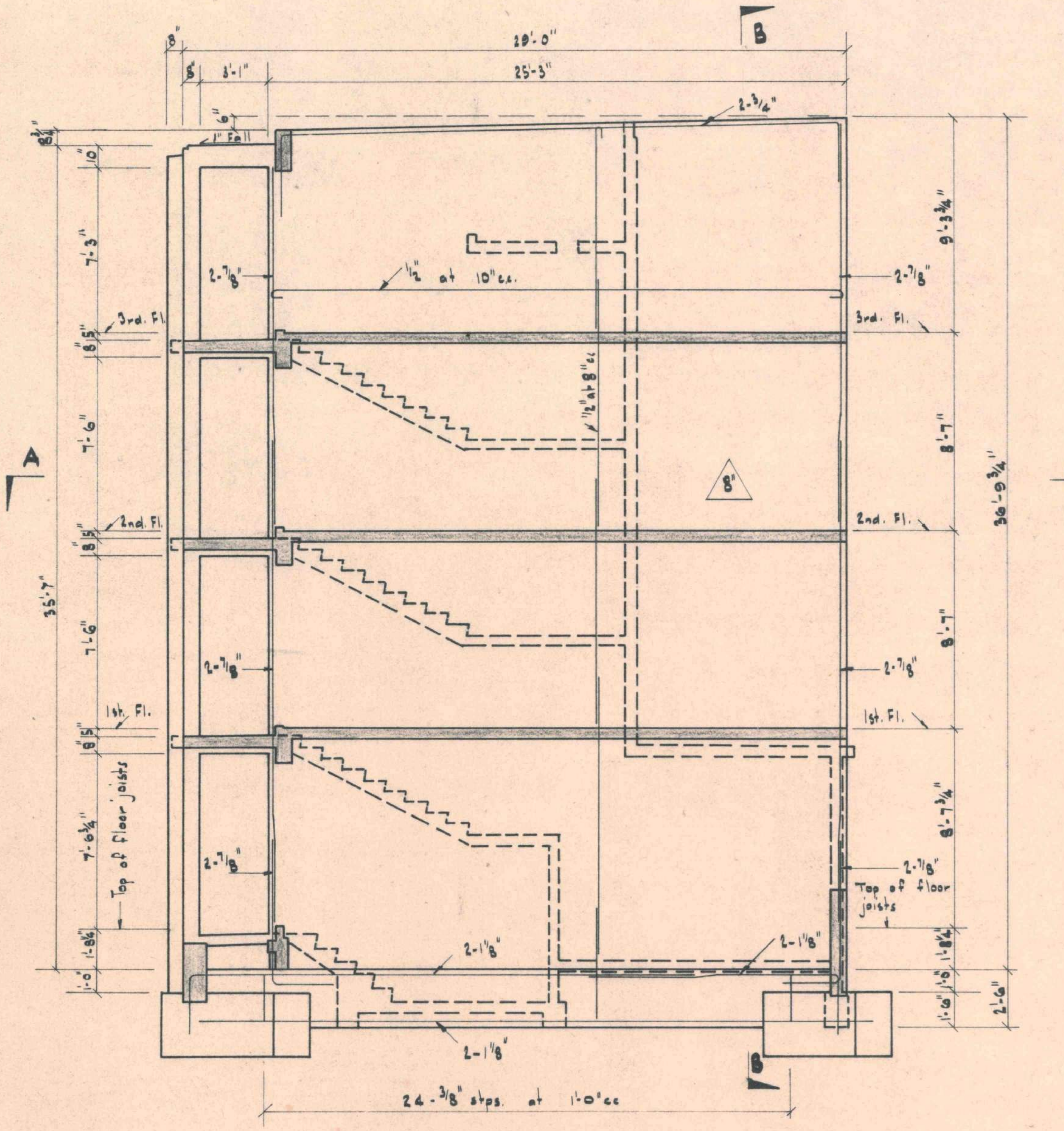
(To show 3/8" ties.)

KOTUKU FLATS - KEMP ST. - KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK A - NORTH WALL DRAWN: J.J.O. TRACED: C.B.S. CHECKED: DATE: 20-11-67 SCALES: 1/4" & 1/2" : 1'-0"	STEWART C. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON. PH. 46-321 WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	DWG. NO: 879/6 NO. OF SHEETS:



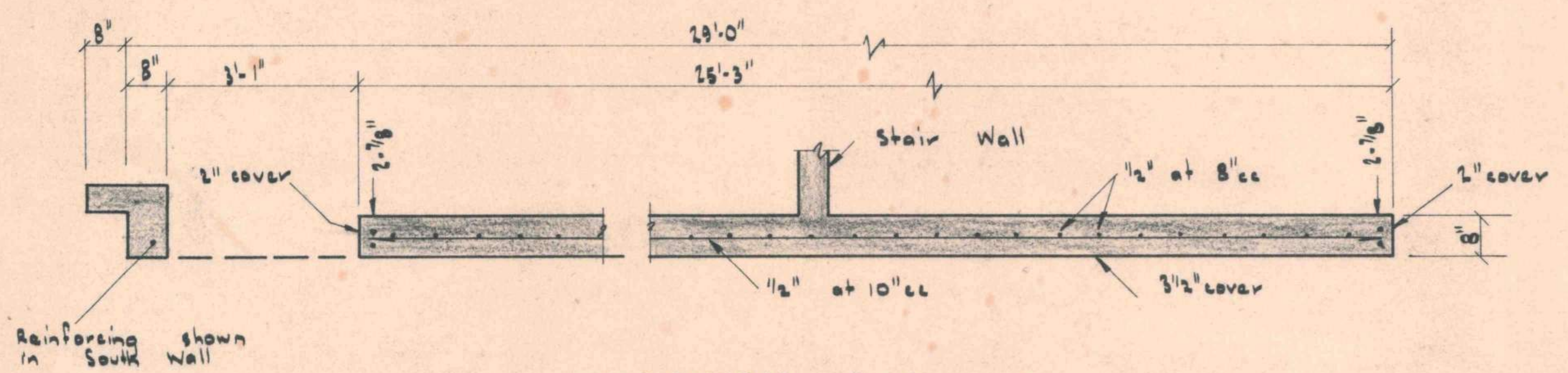
HORIZONTAL SECTION OF EAST WALL OF BLOCK A
AT 1ST., 2ND, & 3RD. FLOOR LEVELS

KOTUKU FLATS - KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK A - EAST WALL	STEWART C. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON. PH: 46321	DWG. NO: 879/7
	DRAWN: J.I.Q. TRACED: C.B.S. CHECKED:	WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	
	DATE: 25th. Oct. 1967 SCALES: 1/4" & 1/2" = 1'-0"		NO. OF SHEETS:

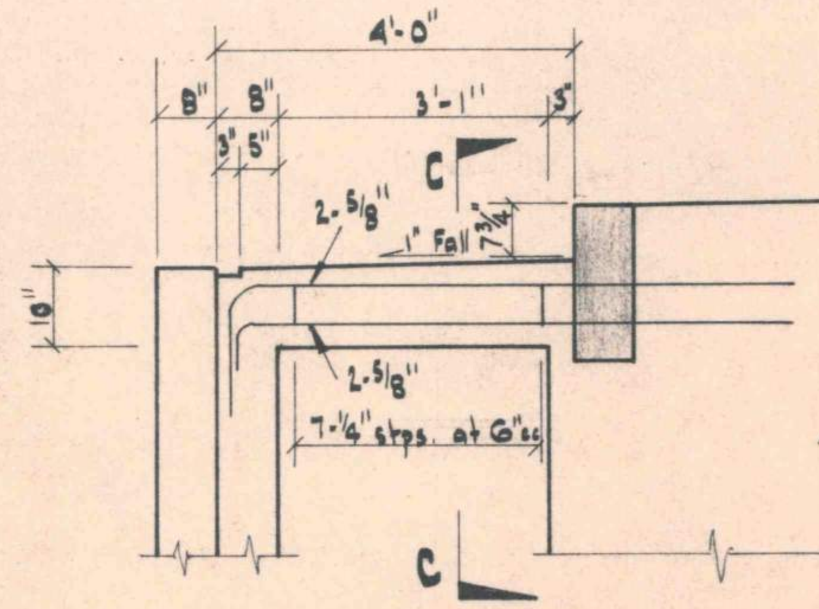


ELEVATION WEST WALL OF BLOCK A

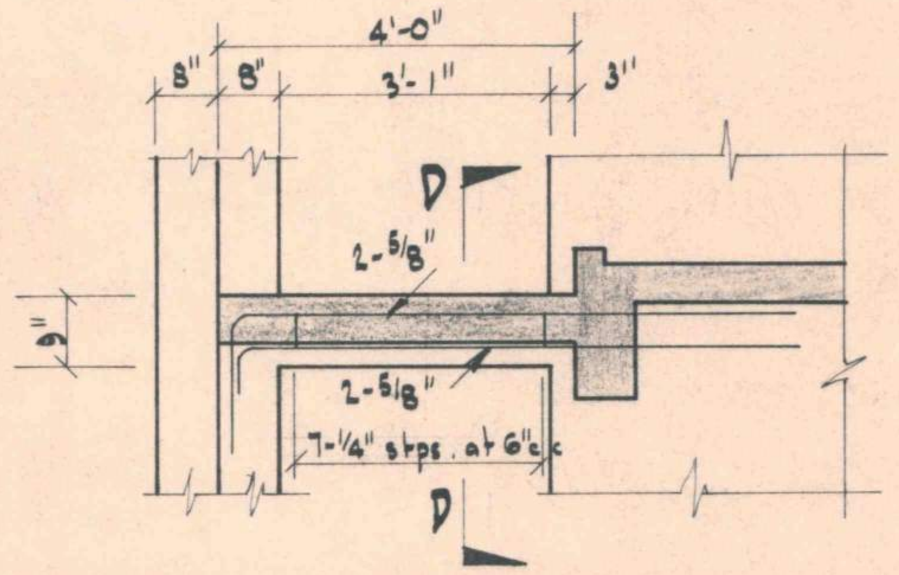
Wall is 8" thick reinforced with 1/2" at 8" cc vertically and 1/2" at 10" cc. horizontally. Typical bars only, have been shown.



SECTION A-A

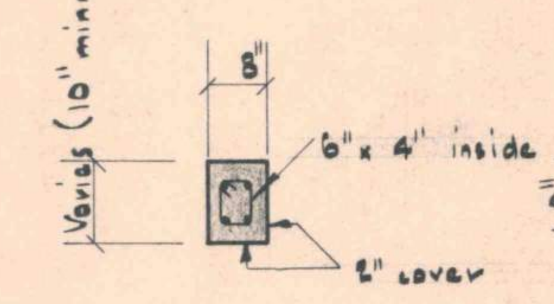


ELEVATION ROOF BEAM

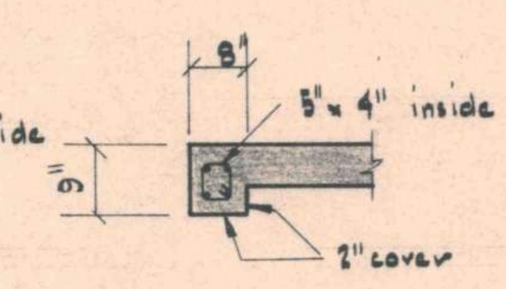


ELEVATION SLAB BEAM

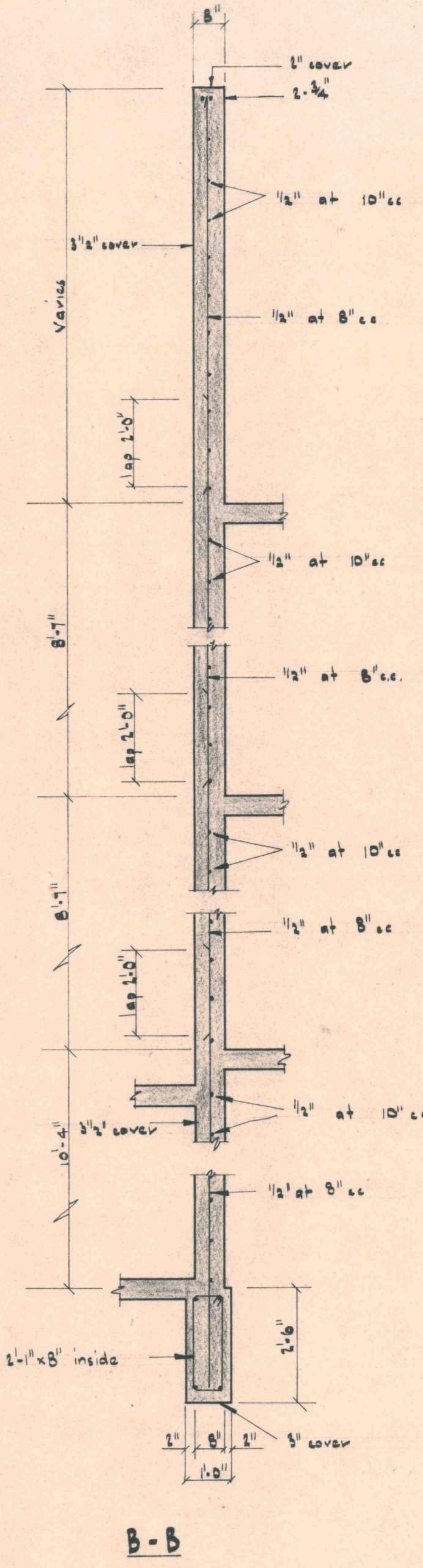
(Typical for 1st, 2nd. & 3rd. Floors.)



C-C



D-D



B-B

KOTUKU FLATS — KEMP ST. - KILBIRNIE FOR THE WELLINGTON CITY CORPORATION.	BLOCK A - WEST WALL	STEWART G. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON PH. 46-321	DWG NO: 879/8
	DRAWN: JJQ TRACED: CBS CHECKED: DATE: 19-3-68 SCALES: 1/4" & 1/2" = 1'-0"	WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	

KOTUKU FLATS -
KEMP STREET, KILBIRNIE FOR
THE WELLINGTON CITY
CORPORATION.

INTERIOR LONGITUDINAL WALL
AT EAST END OF BLOCK A

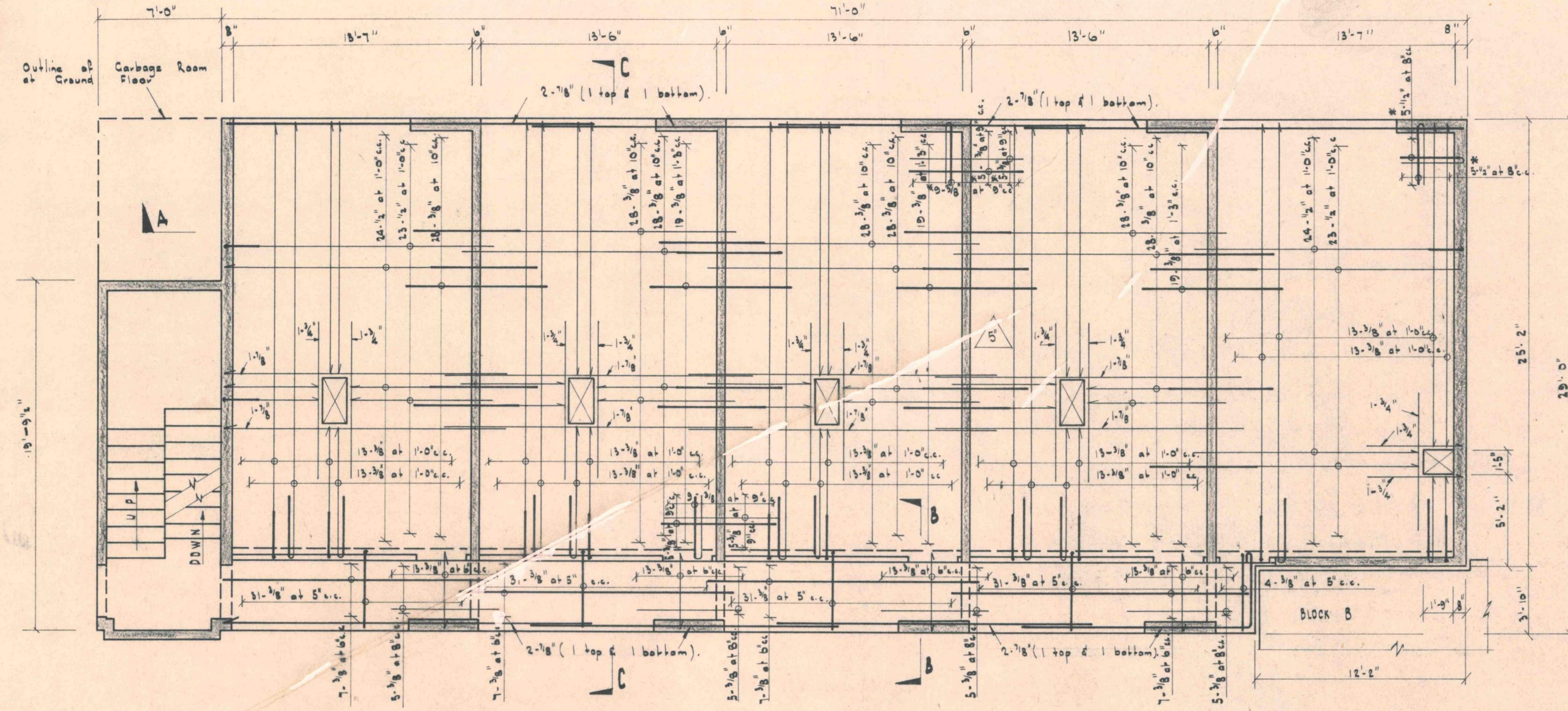
DRAWN: J.I.Q.	TRACED: C.B.S.	CHECKED:
SCALES: ¼", ½" = 1'-0"	DATE: 1-12-67	

STEWART C. REES & ASSOCIATES
CONSULTING CIVIL & STRUCTURAL ENGINEERS
21, EVERTON TERRACE, WELLINGTON. PH. 46-321

WELLINGTON CITY CORPORATION
ARCHITECTURAL DIVISION

DWG. NO. 879/9

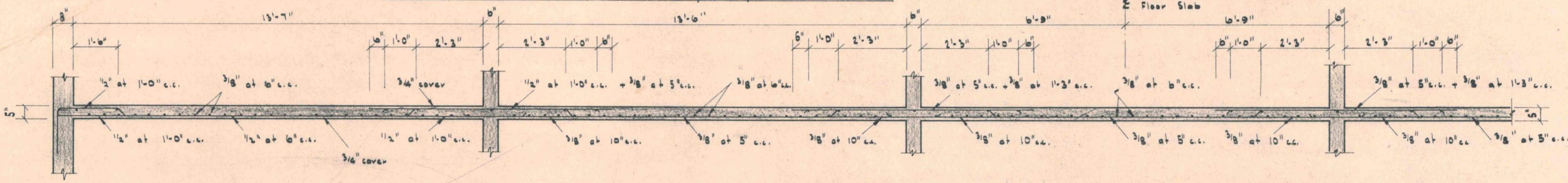
NO. OF SHEETS:



BLOCK A - SLAB PLAN FOR 1ST., 2ND., & 3RD. FLOORS

Bar Notation:
Bars in near face of slab have been shown thus ———
Bars in far face of slab have been shown thus ———

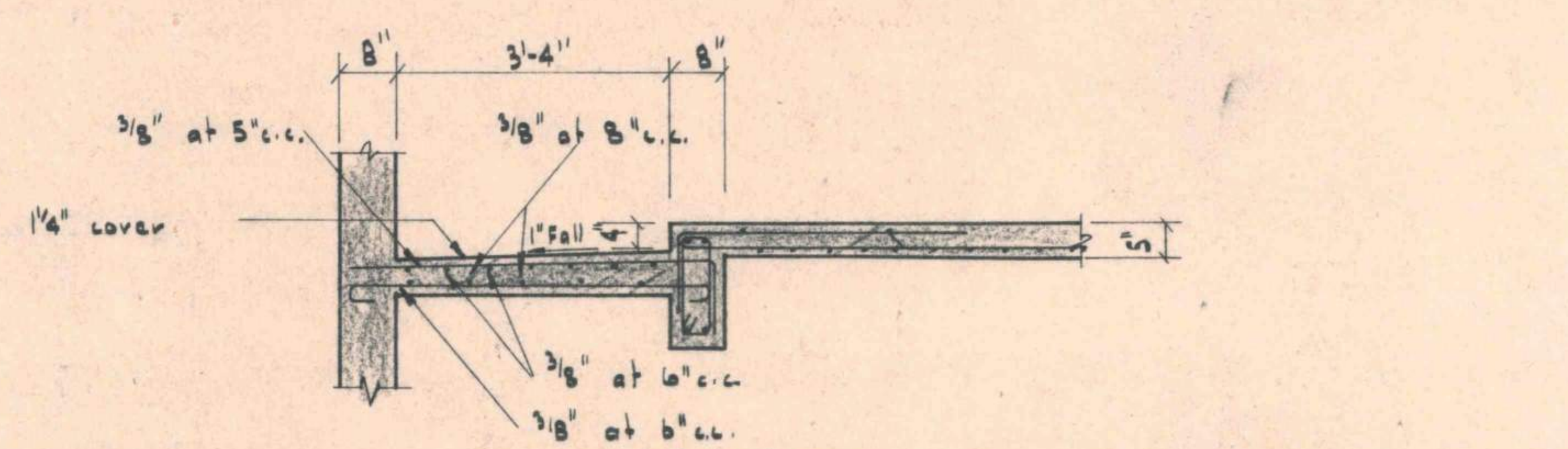
Torsion Steel:
Provide torsion reinforcement in slab at all corners and at each intersection of transverse walls and slab edges. Typical torsion reinforcement has been shown on slab plan and indicated by asterisks ✱



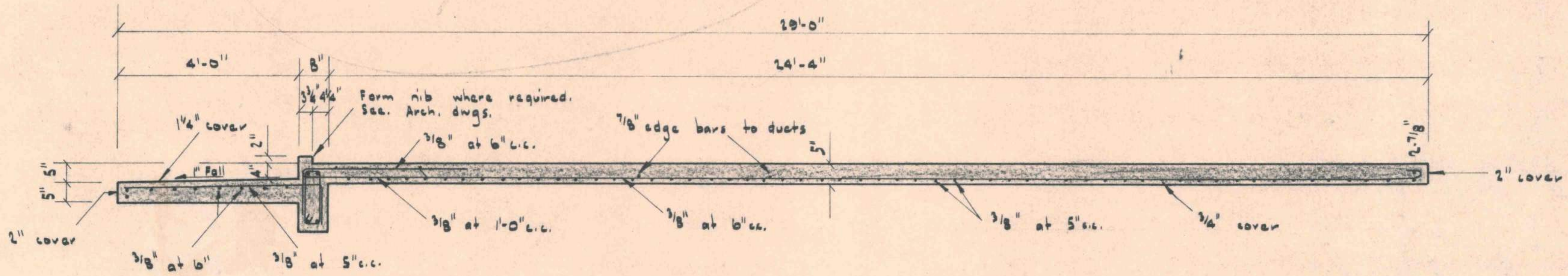
SECTION A-A

Reinforcing is symmetrical about ℄ Floor Slab.

Show distribution rods on plan

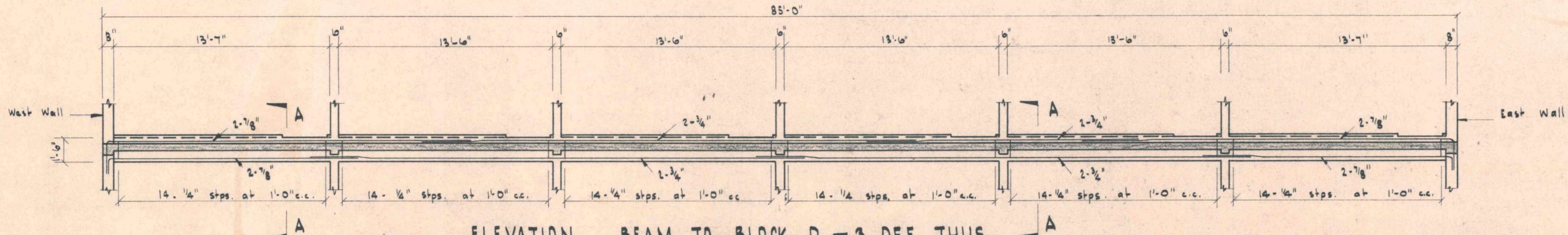


SECTION B-B

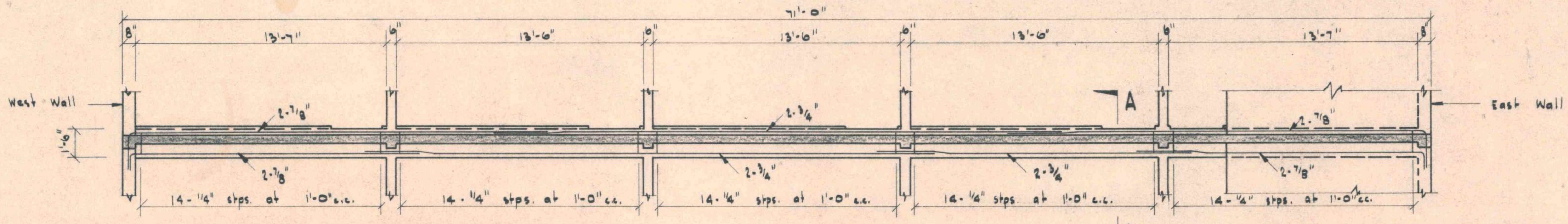


SECTION C-C

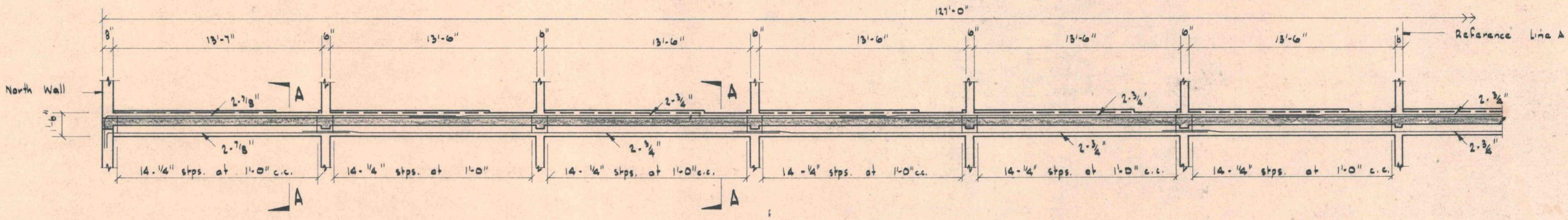
KOTUKU FLATS - KEMP ST., KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK A - SLAB PLAN & SECTIONS. DRAWN: J.J.Q. TRACED: CBS CHECKED: DATE: 30-10-67. SCALES: 1/4", 1/2" & 1'-0"	STEWART C. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON. PH. 46321 WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	DWG. NO: 879/10 NO. OF SHEETS:

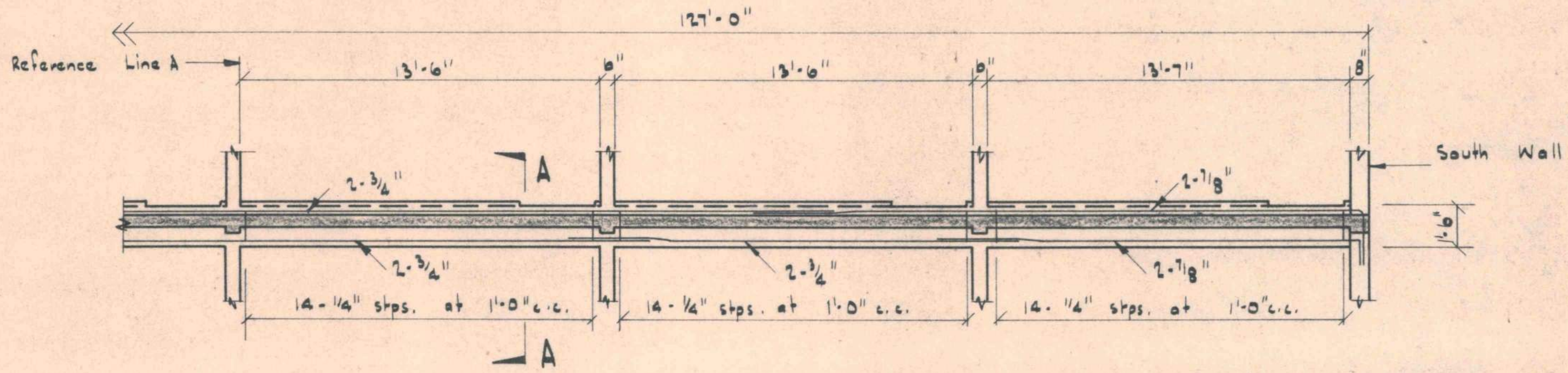


ELEVATION BEAM TO BLOCK D. – 3 OFF THUS.
ELEVATION BEAM TO BLOCK C. – 3 OFF THUS.

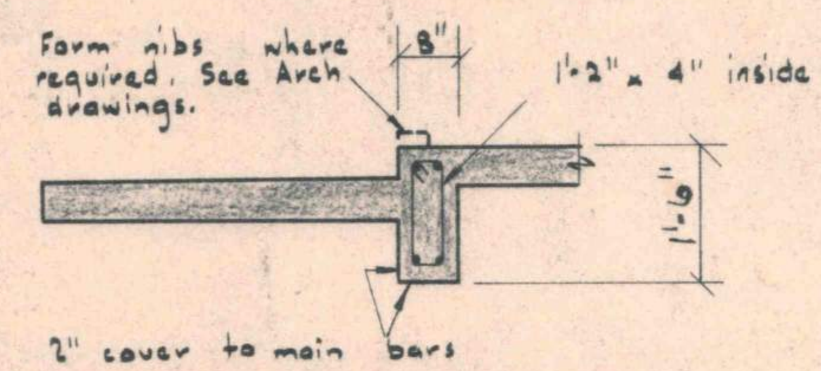


ELEVATION BEAM TO BLOCK A. – 3 OFF THUS



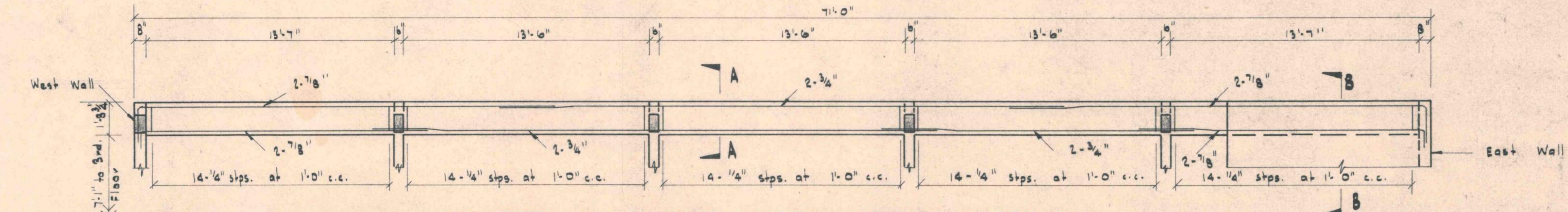


ELEVATION BEAM TO BLOCK B. – 3 OFF THUS.

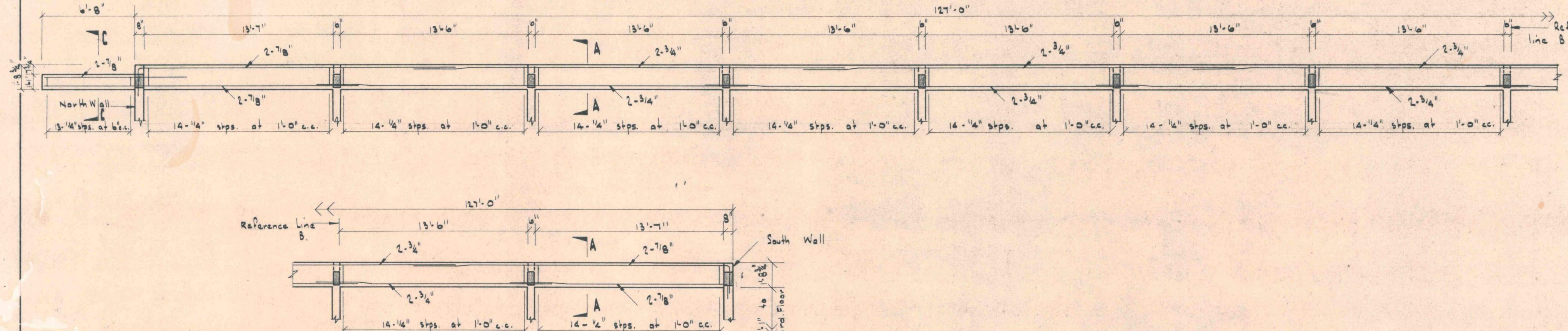


SECTION A-A
(Beam reinforcing only shown.)

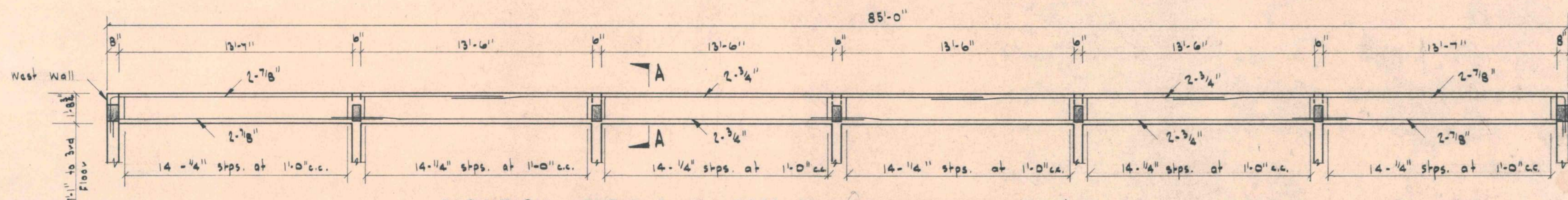
KOTUKU FLATS – KEMP ST., KILBIRNIE FOR THE WELLINGTON CITY CORPORATION.	INTERIOR LONGITUDINAL BEAMS AT 1ST, 2ND, & 3RD. FLOORS DRAWN: J.J.Q. TRACED: C.B.S. CHECKED: DATE: 27-10-67 SCALE: 1/4", 1/2" = 1'-0"	STEWART G. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON. PH. 46321 WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	DWG. NO: 879/11 NO. OF SHEETS:



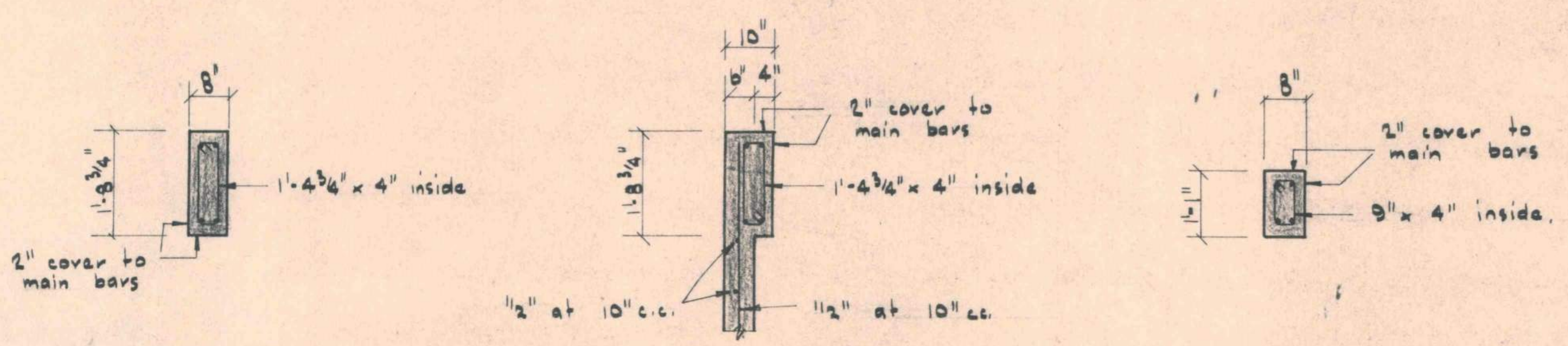
ELEVATION LONGITUDINAL ROOF BEAM TO BLOCK A



ELEVATION LONGITUDINAL ROOF BEAM TO BLOCK B

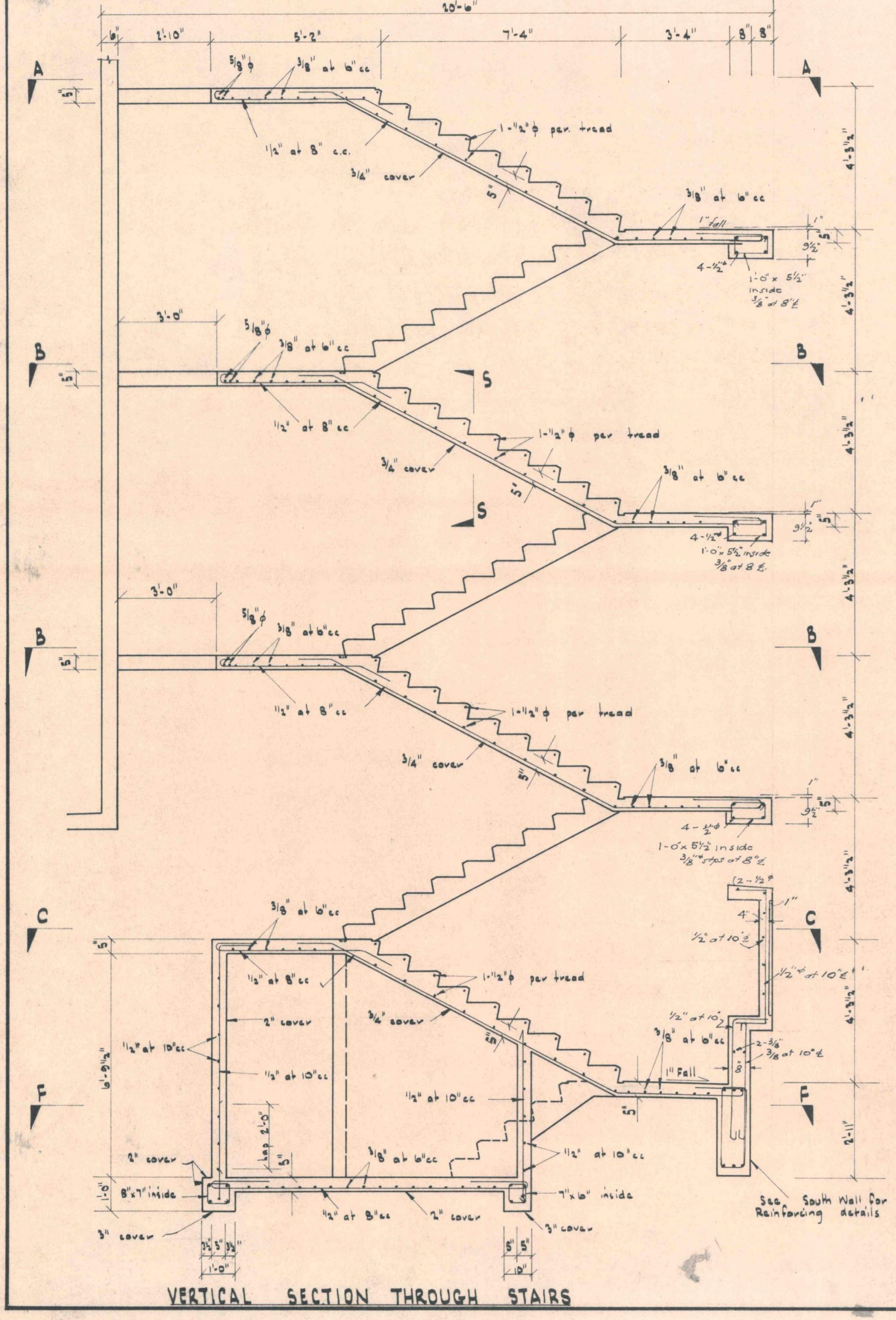


ELEVATION, LONGITUDINAL ROOF BEAMS TO BLOCKS C & D.

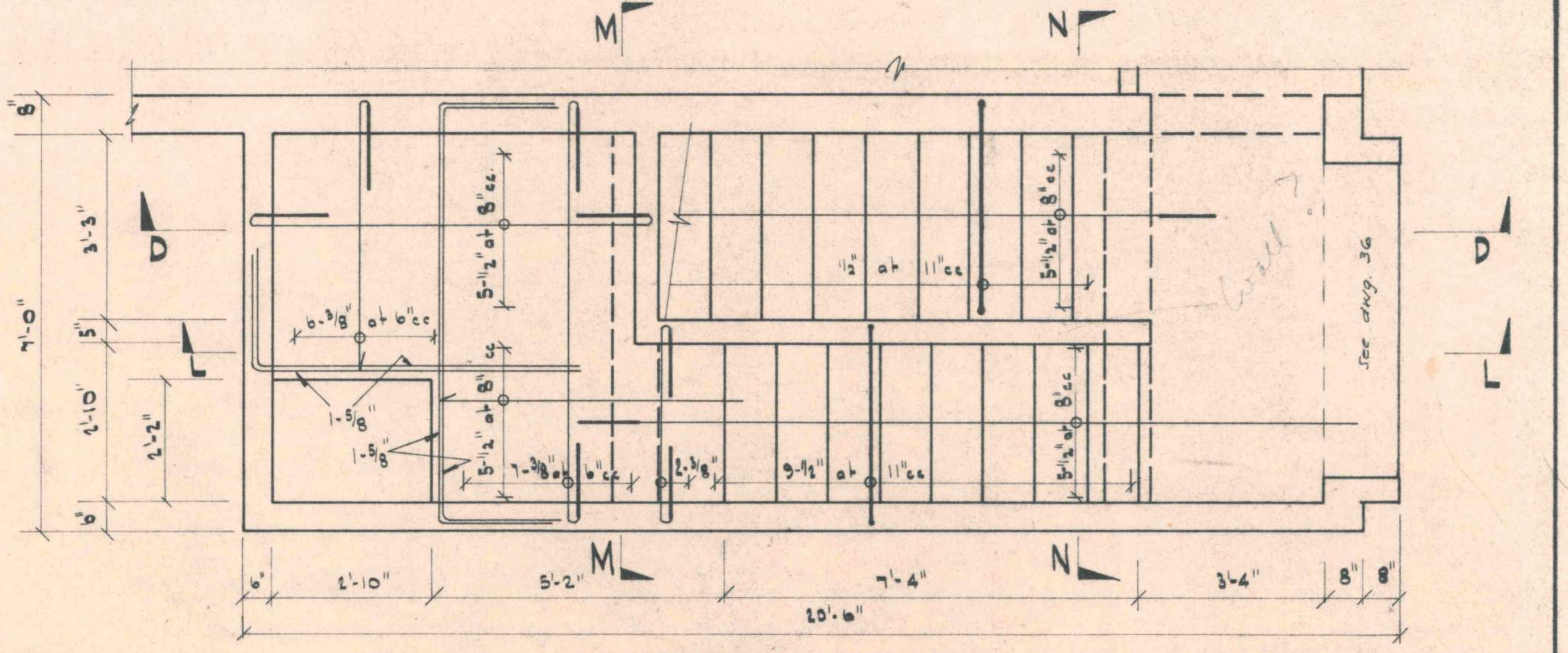


A-A B-B C-C

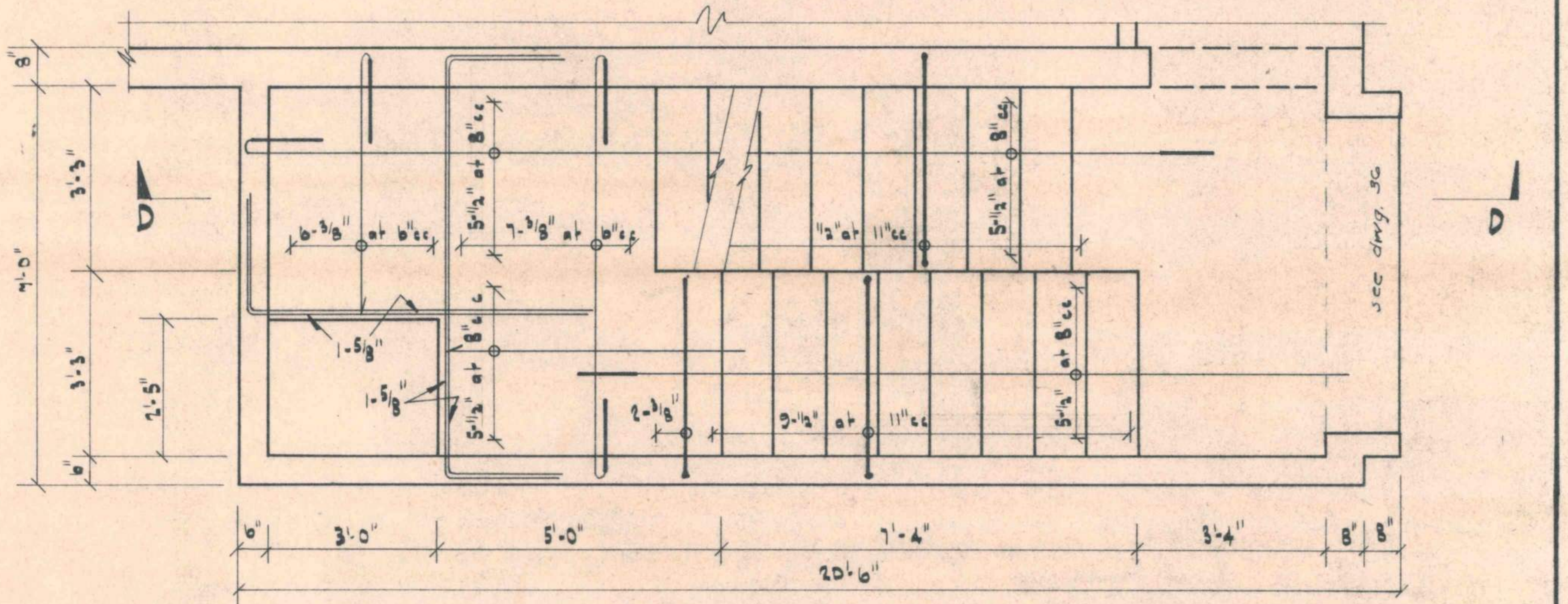
KOTUKU FLATS — KEMP ST., KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	LONGITUDINAL ROOF BEAMS TO BLOCKS A, B C & D	STEWART C. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE WELLINGTON PH. 46321 WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	DWG. NO. 879/12
	DRAWN: J.J.Q. TRACED: C.B.S. CHECKED: DATE: 22-11-67 SCALES: 1/4", 1/2" = 1'-0"		NO. OF SHEETS:



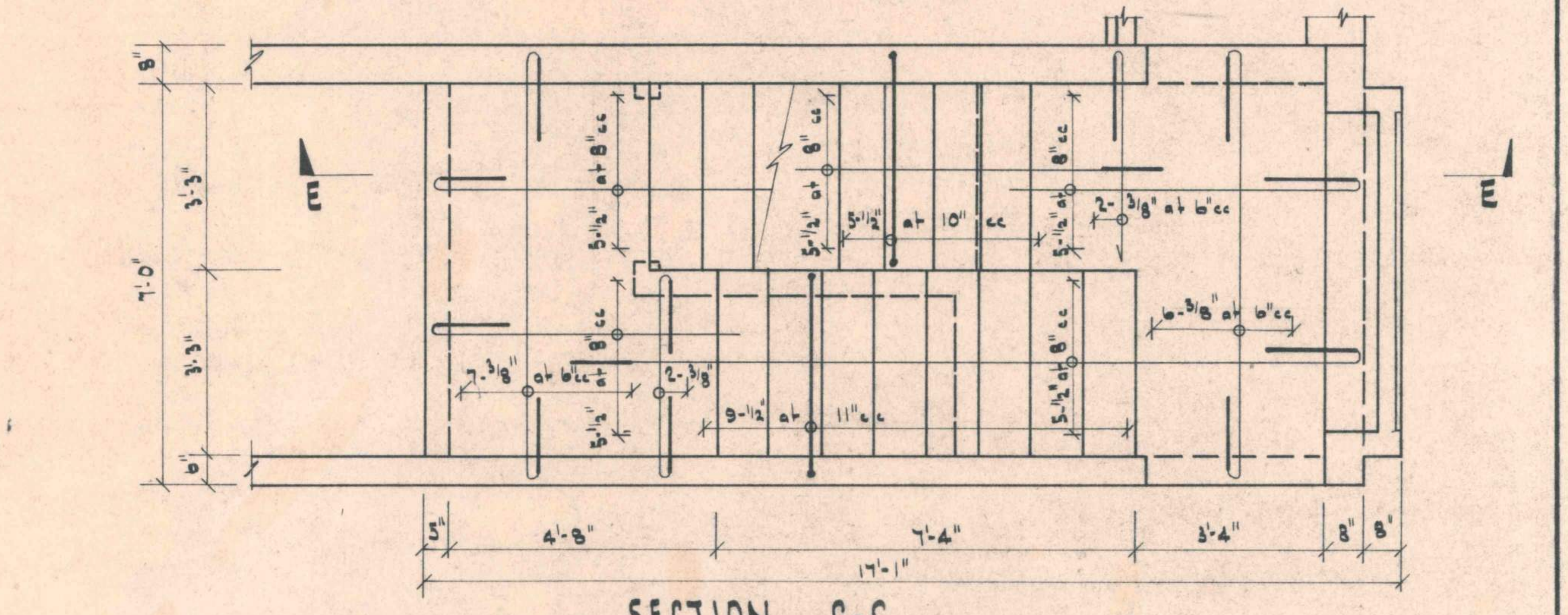
VERTICAL SECTION THROUGH STAIRS



SECTION A-A

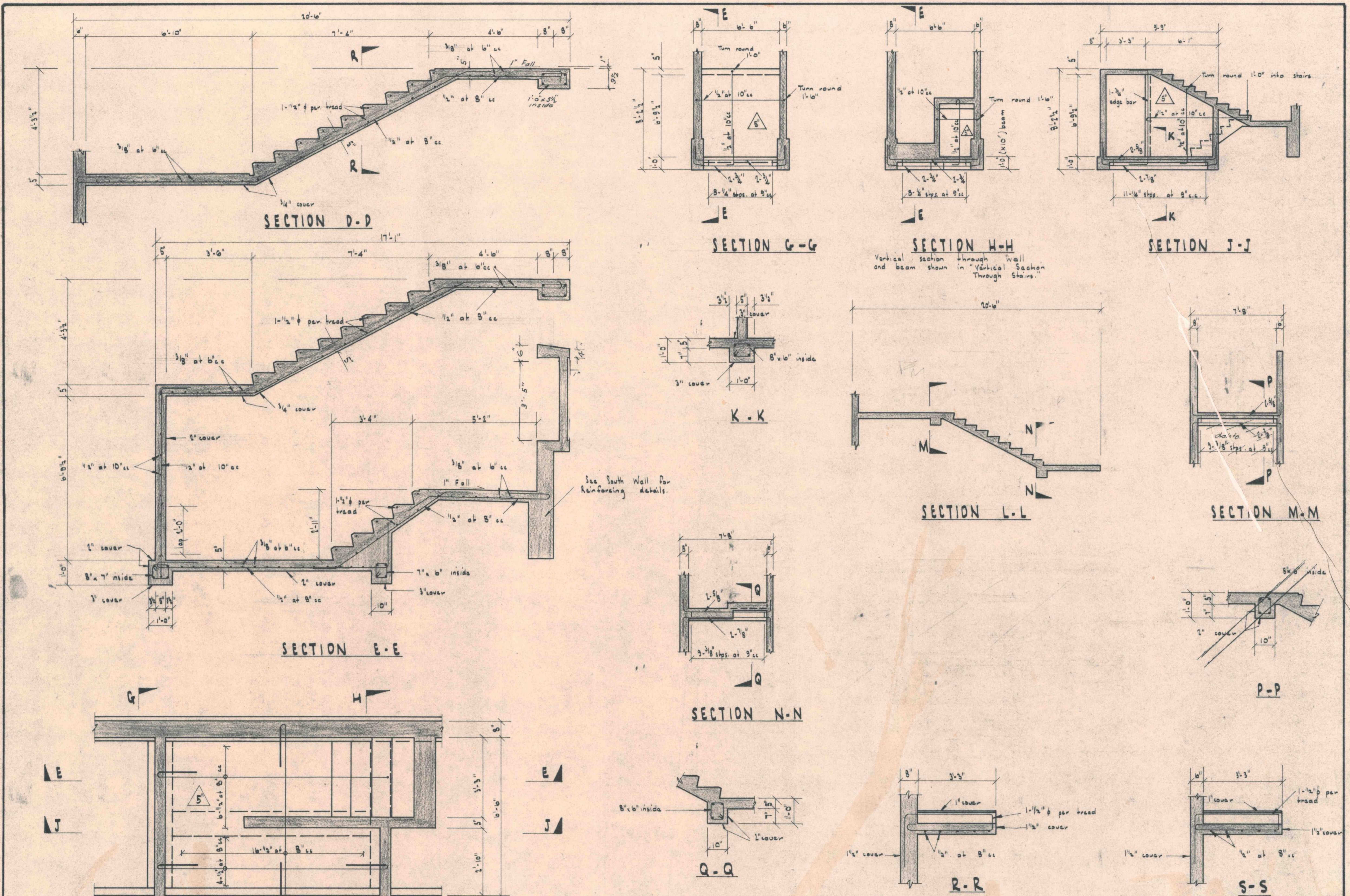


SECTION B-B



SECTION C-C

KOTUKU FLATS - KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK A - STAIRS AT WEST END DRAWN: JJQ / TRACED: CBS / CHECKED DATE: 1-2-68 / SCALES: 1/2" = 1'-0"	STEWART G. REES & ASSOC. CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON. PH. 46 321 WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	DWG NO: 879/13



KOTUKU FLATS - KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION

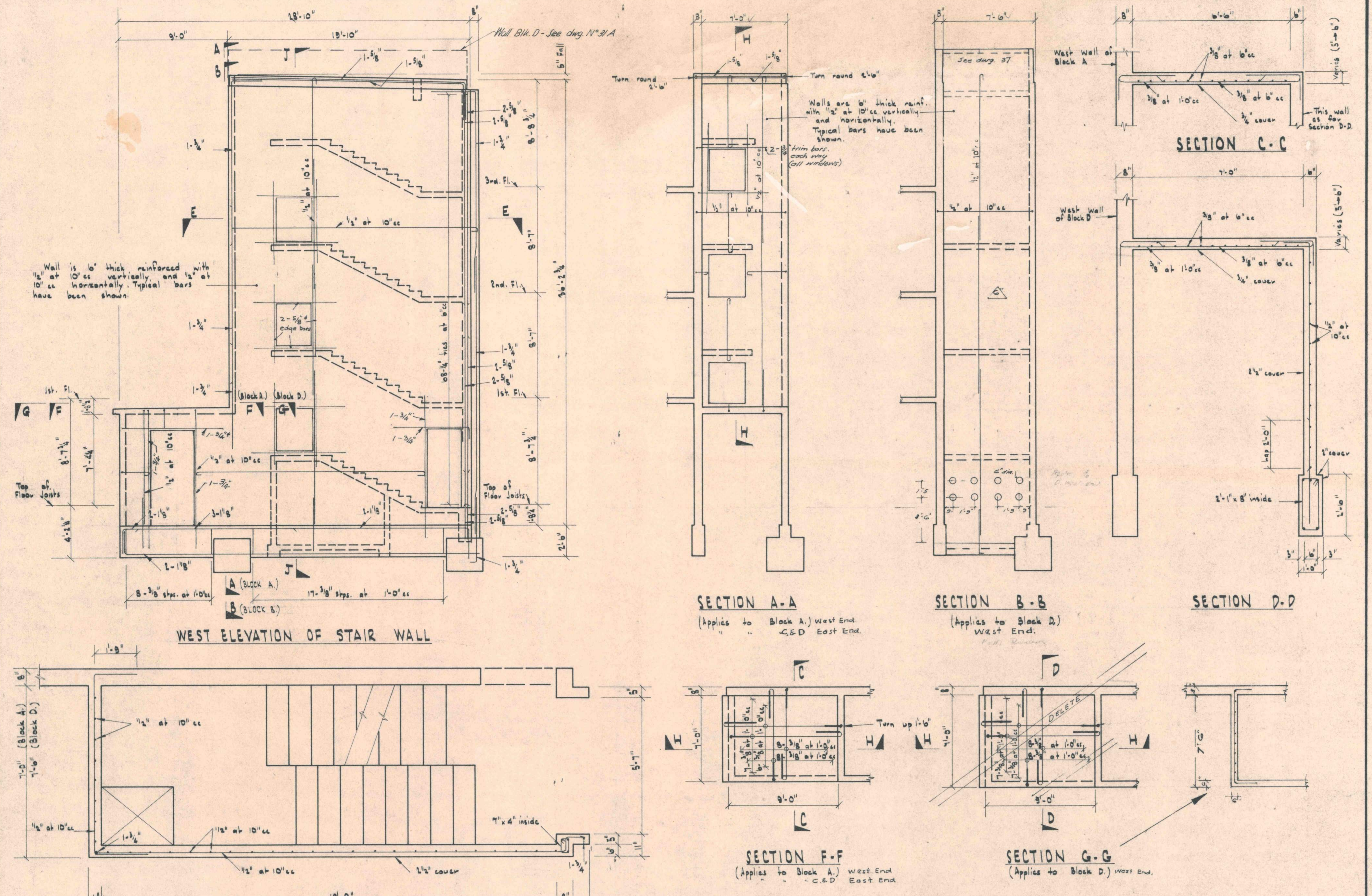
BLOCK A - STAIRS AT WEST END

STEWART G. REES & ASSOCIATES
CONSULTING CIVIL & STRUCTURAL ENGINEERS
11, EVERTON TERRACE, WELLINGTON PH. 46-321

WELLINGTON CITY CORPORATION
ARCHITECTURAL DIVISION

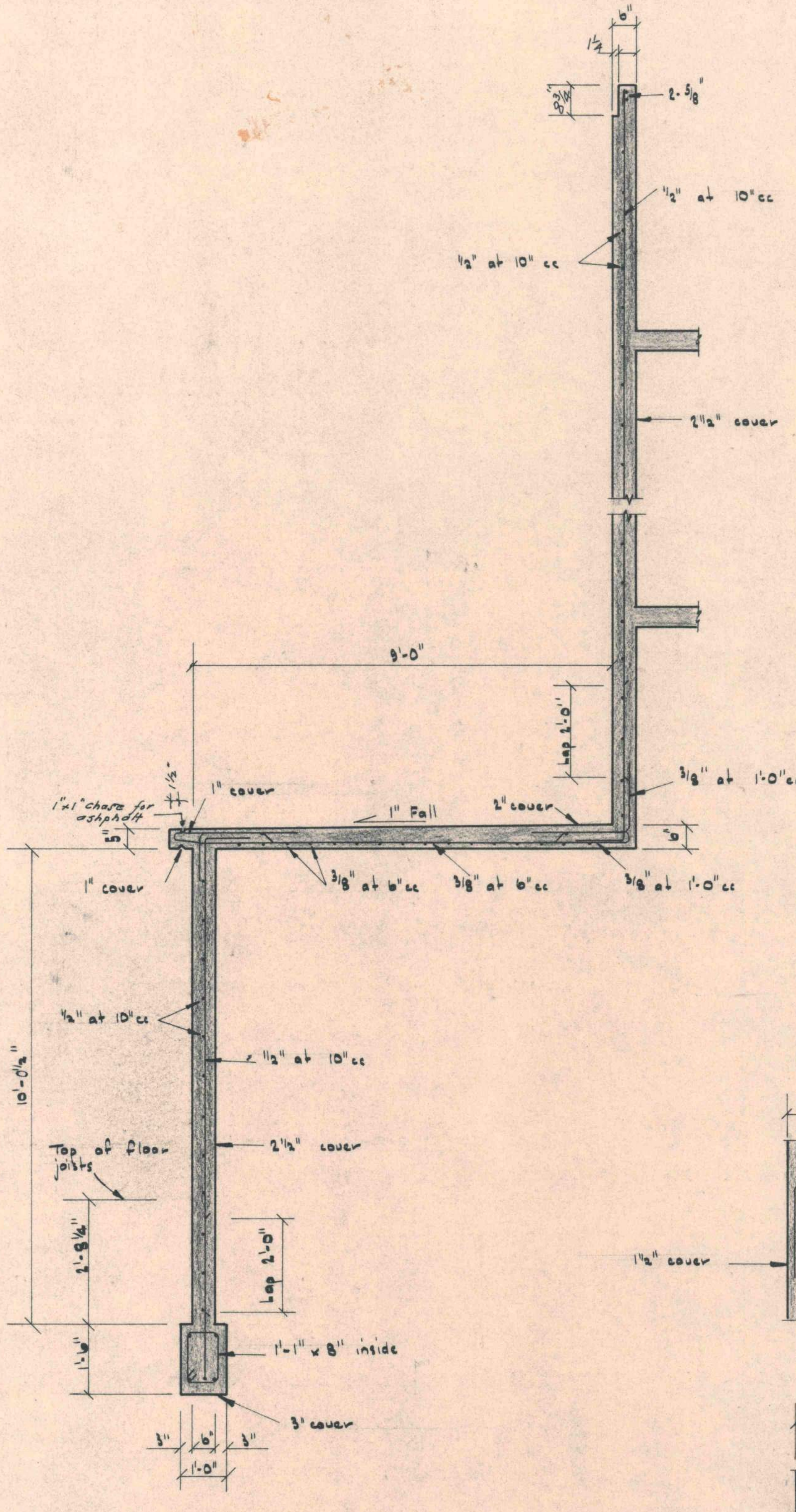
DRAWN: J.I.O.	TRACED: CBS	CHECKED:
DATE: 7-1-68	SCALES: ¼ & ½" = 1'-0"	

DWG. NO: 879/14

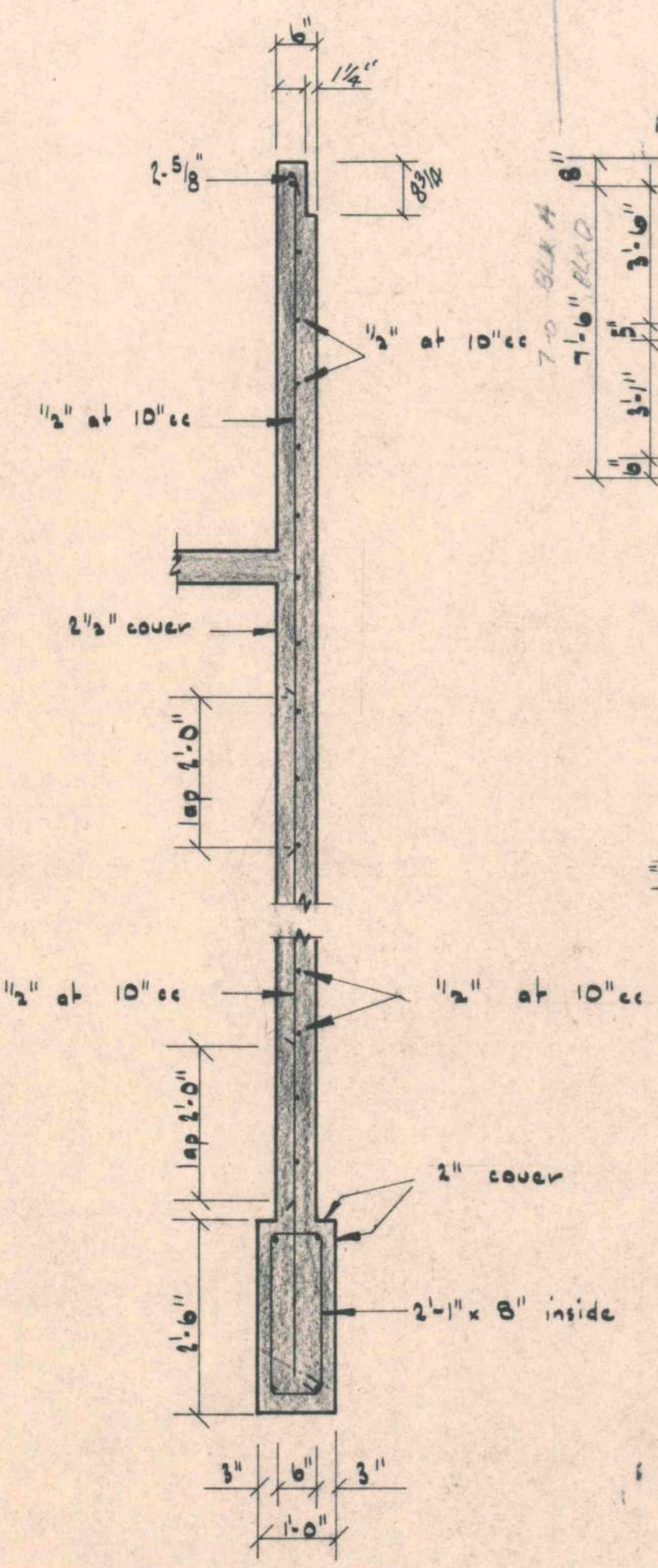


SECTION E-E

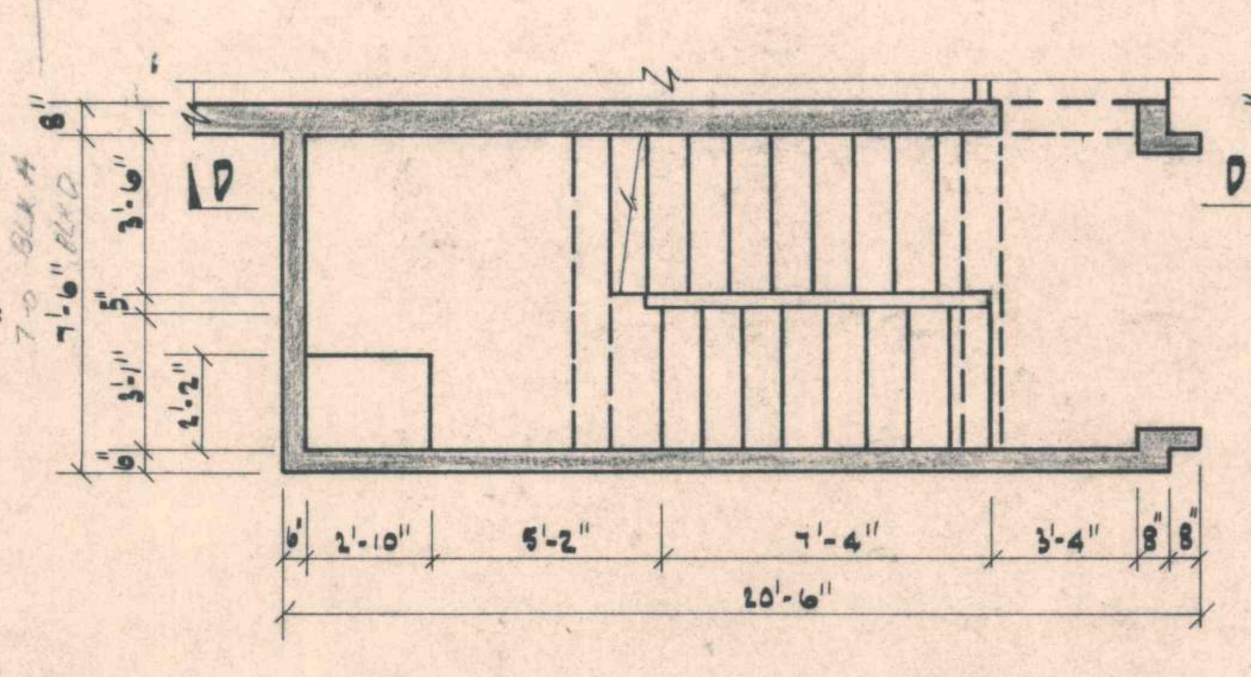
KOTUKU FLATS - KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	STAIR WALLS BLOCK A WEST END BLOCKS C & D EAST END	STEWART G. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON. PH. 46321	DWG NO: 879/15
	DRAWN: JJO TRACED: CBS CHECKED:	WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION.	
	DATE: 7-2-68 SCALES: ¼" ½" = 1'-0"		



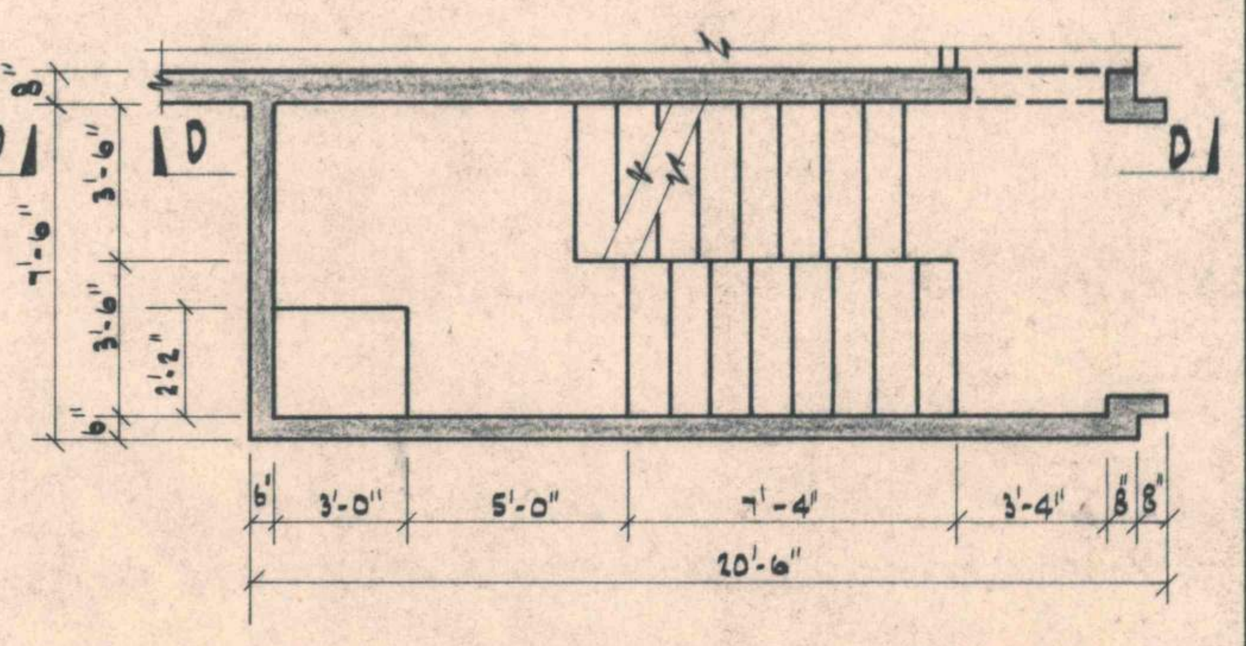
SECTION H-H



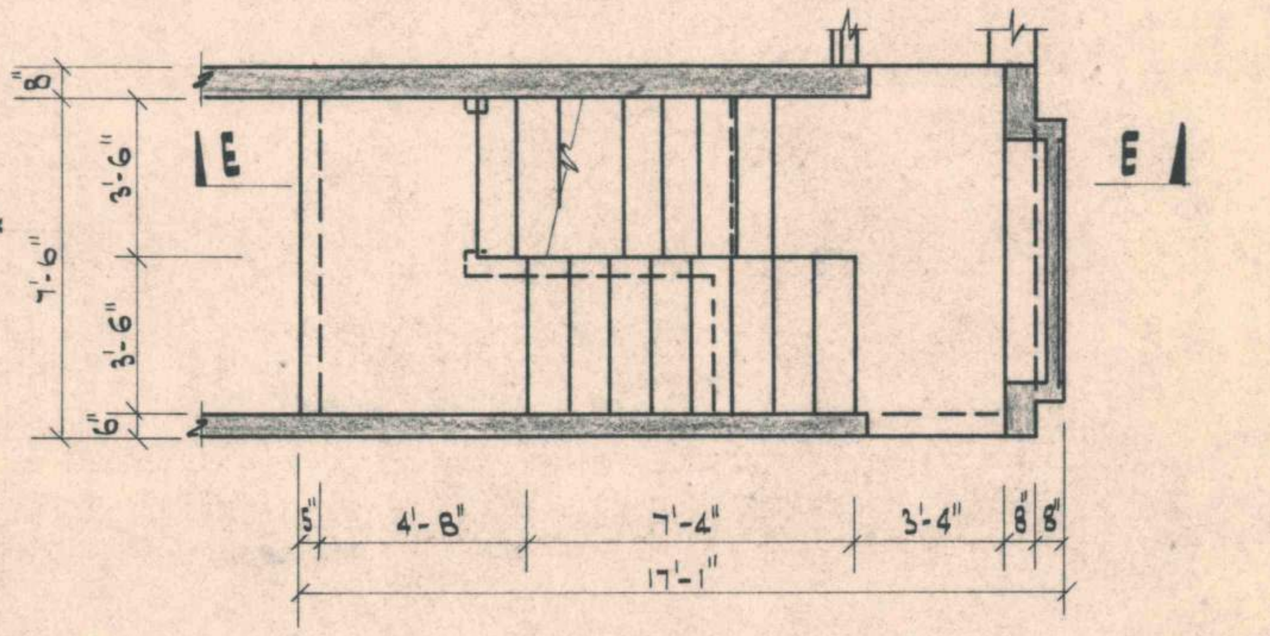
SECTION J-J



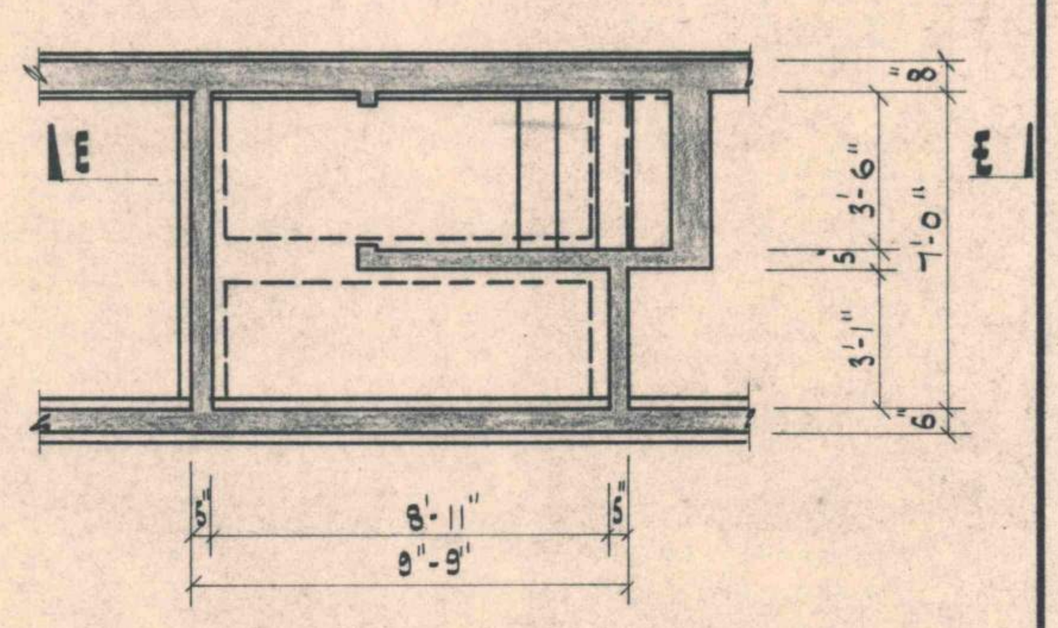
SECTION A1-A1



SECTION B1-B1



SECTION C1-C1

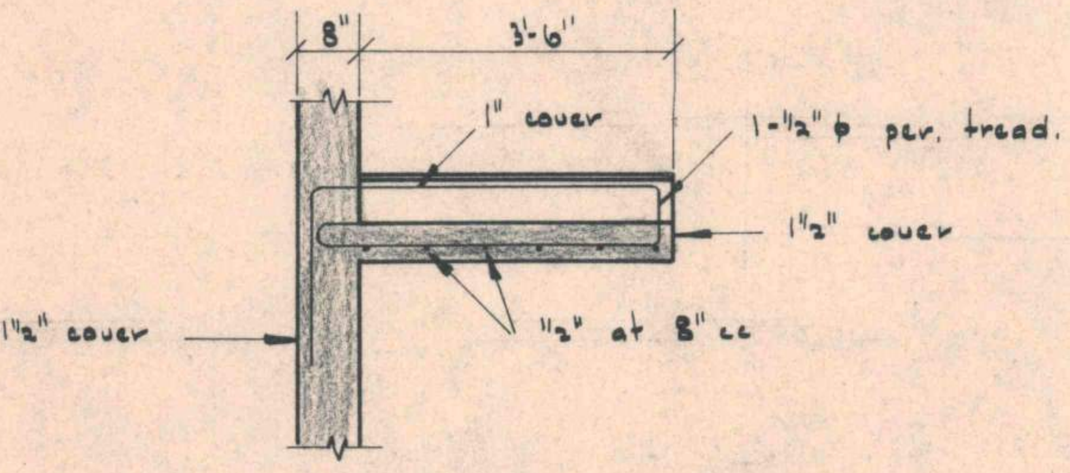


SECTION F1-F1

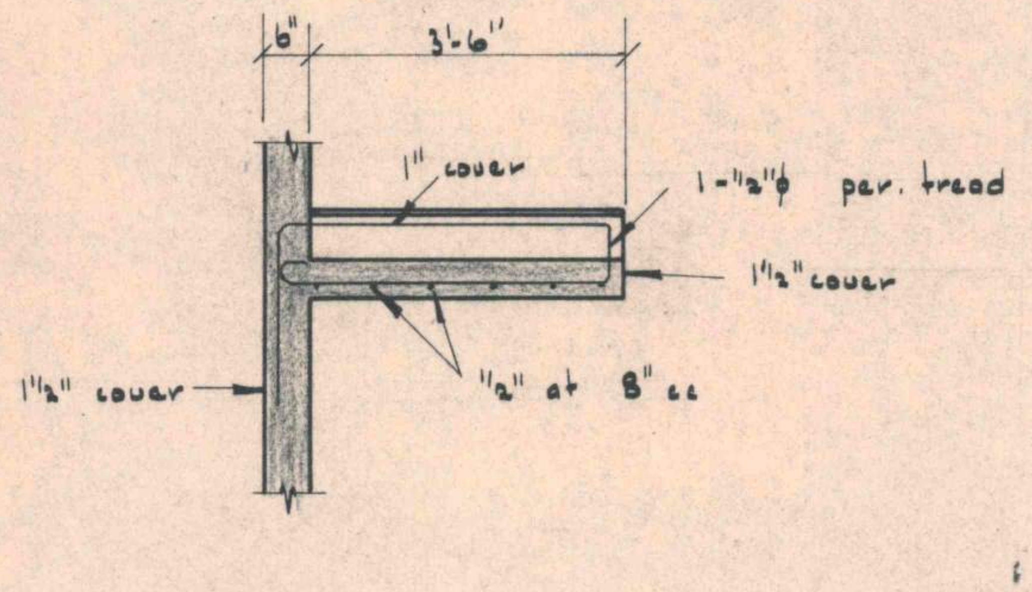
BLOCK D – STAIRS AT WEST END.

Stairs are similar to those at West end of Block A except that inside width of stair tower is 7'-0" instead of 6'-6" for Block A. This has been shown in Sections A1-A1, B1-B1, C1-C1, and F1-F1 which correspond to Sections A-A, B-B, C-C and F-F for Block A.

One extra reinforcing bar per stair flight is required and this has been shown in R1-R1 and S1-S1 corresponding to R-R and S-S for Block A.



SECTION R1-R1



SECTION S1-S1

KOTUKU FLATS – KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION

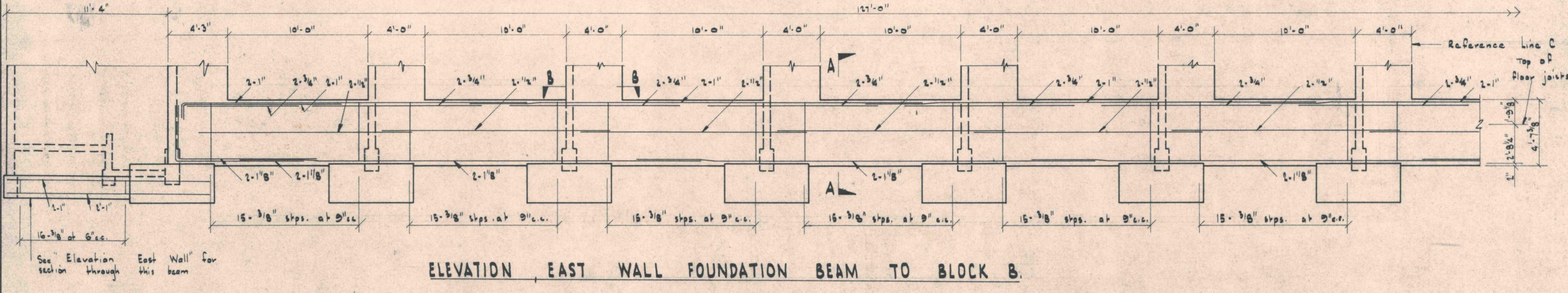
SECTIONS TO STAIR WALLS AT WEST END OF BLOCKS A & D

DRAWN: JJO	TRACED: CGS	CHECKED:
DATE: 1-2-68	SCALES: 1½" = 1'-0"	

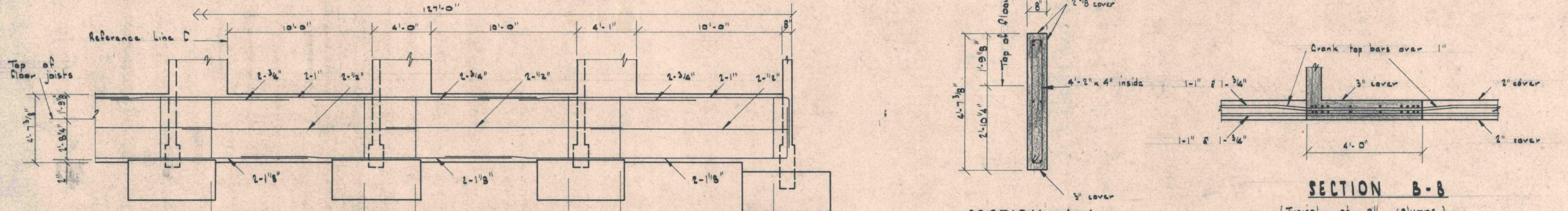
STEWART G. REES & ASSOCIATES
CONSULTING CIVIL & STRUCTURAL ENGINEERS
21, EVERTON TERRACE, WELLINGTON. PH. 46321

WELLINGTON CITY CORPORATION
ARCHITECTURAL DIVISION.

DWG. NO. 879/16

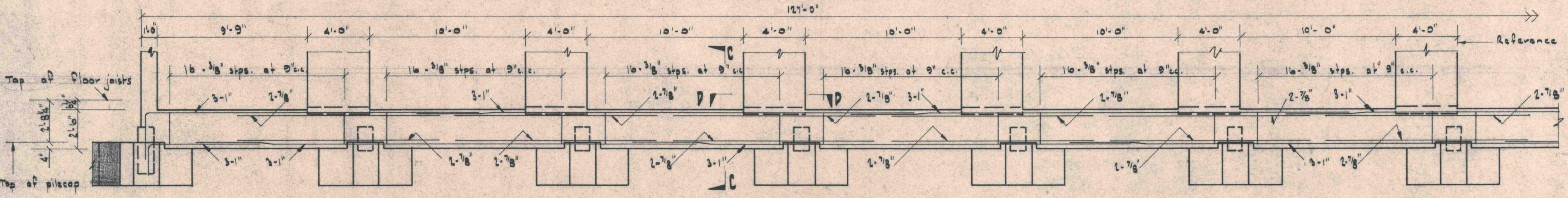


ELEVATION, EAST WALL FOUNDATION BEAM TO BLOCK B.

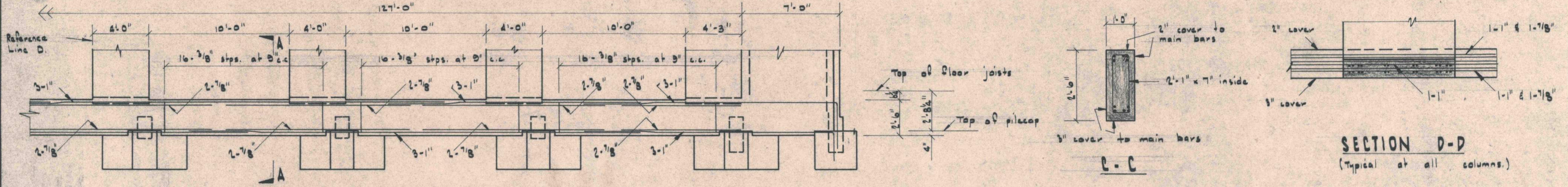


SECTION A-A

SECTION B-B
(Typical at all columns.)



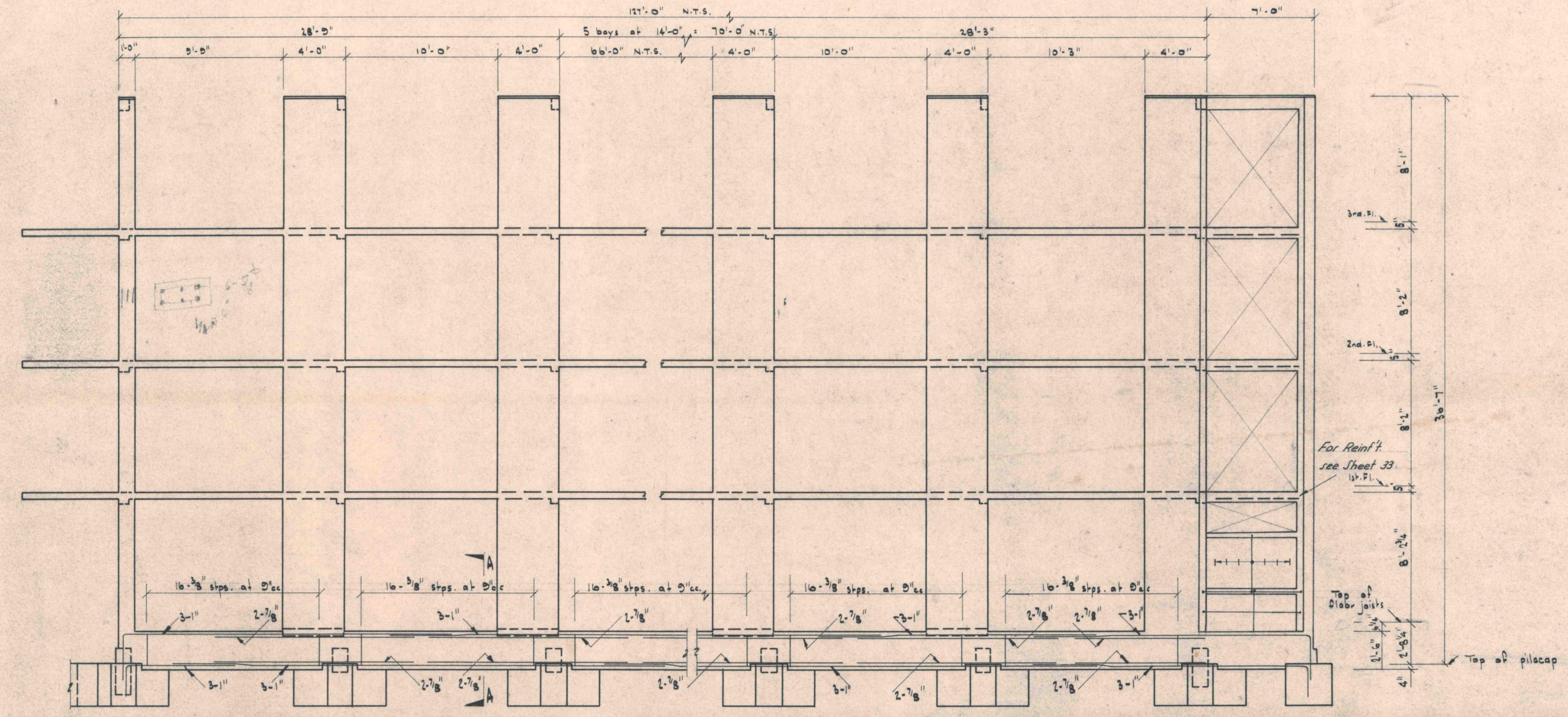
ELEVATION WEST WALL FOUNDATION BEAM TO BLOCK B.



C - C

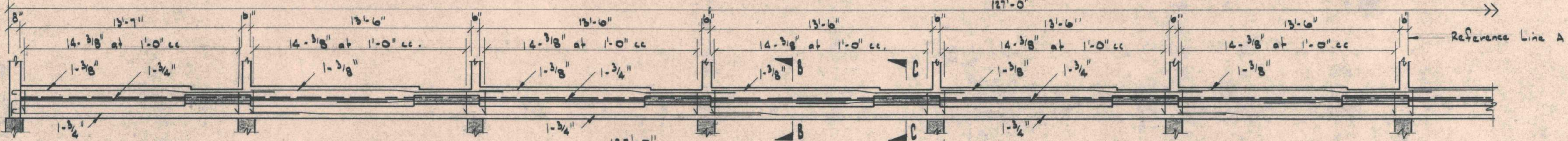
SECTION D-D
(Typical at all columns.)

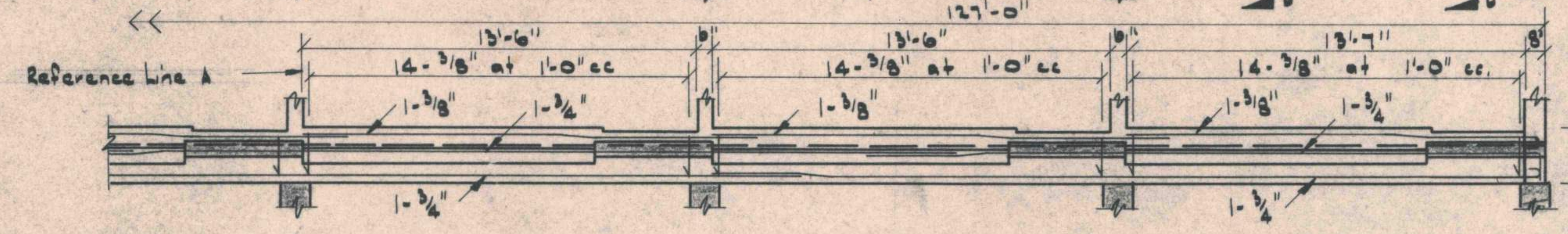
KOTUKU FLATS - KEMP ST., KILBIRNIE FOR THE WELLINGTON CITY CORPORATION.	BLOCK B - EAST & WEST WALL FOUNDATION BEAMS	STEWART Q. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON PH. 46-321	DWG. NO. 879/17
	DRAWN: J.J.Q. TRACED: C.B.S. CHECKED: DATE: 21-11-67 SCALES: 1/4", 1/2" = 1'-0"	WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	NO. OF SHEETS:



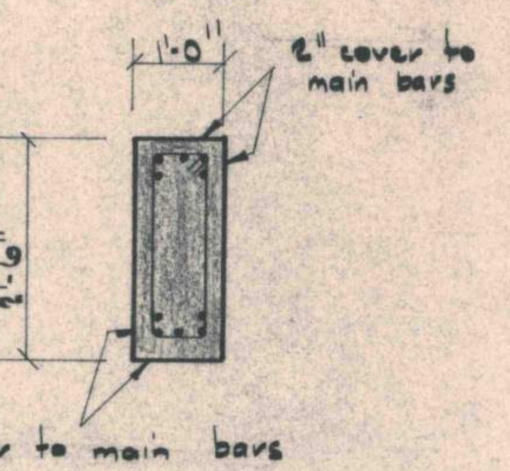
ELEVATION WEST WALL BLOCK B.

Column reinforcing is similar to that for columns in South Wall of Block A.

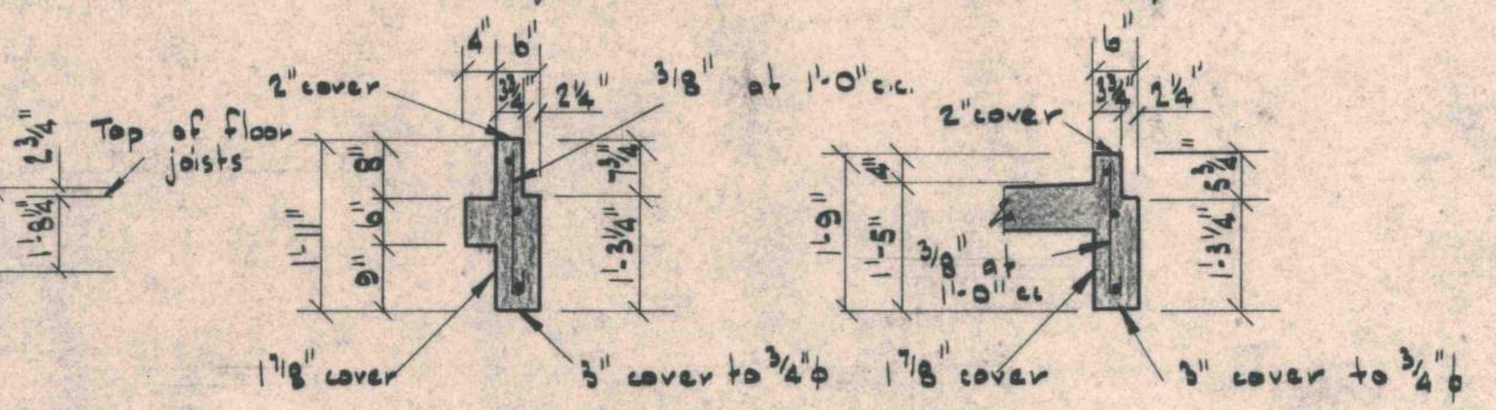




ELEVATION INTERIOR LONGITUDINAL BEAM



A-A

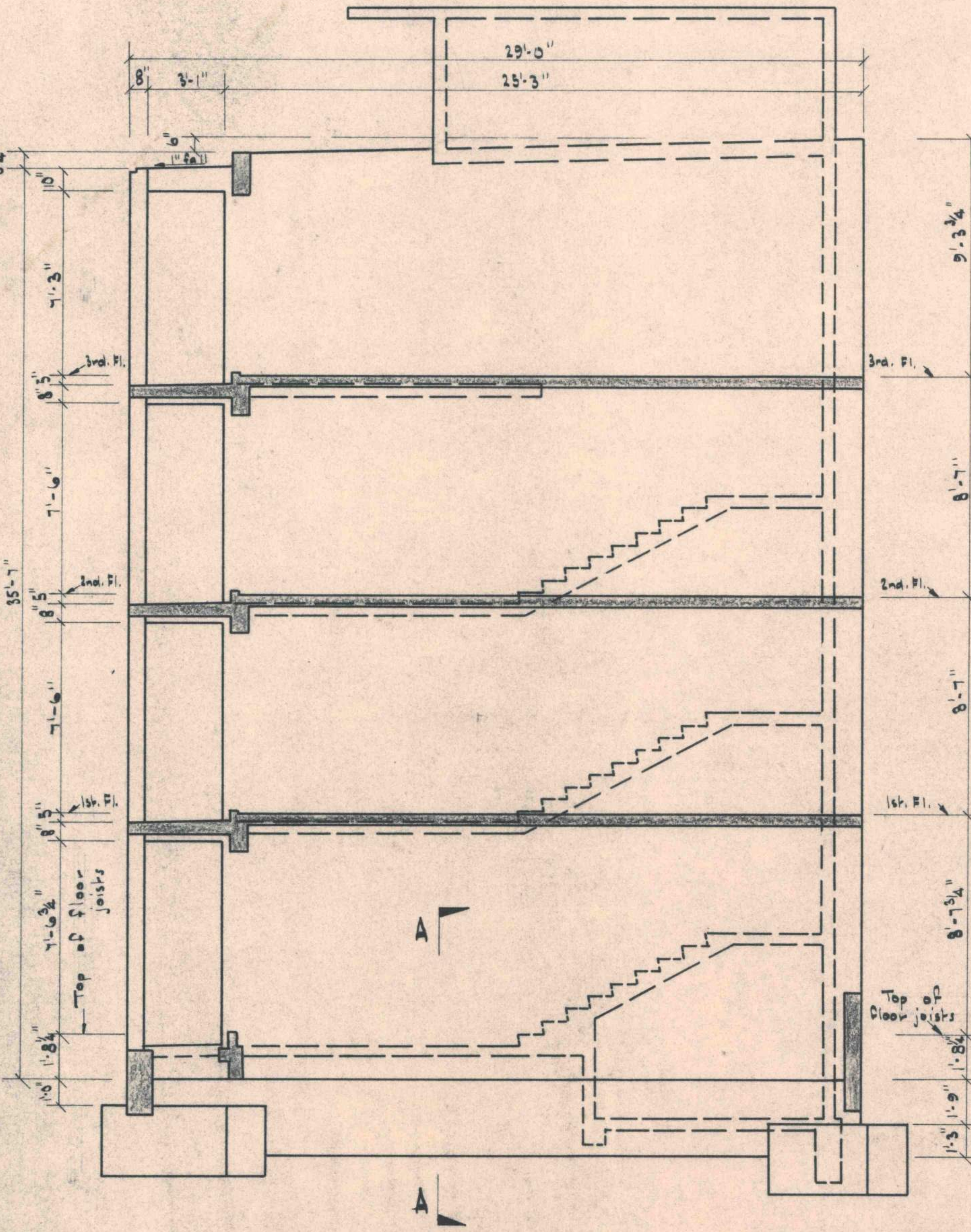


B-B

C-C

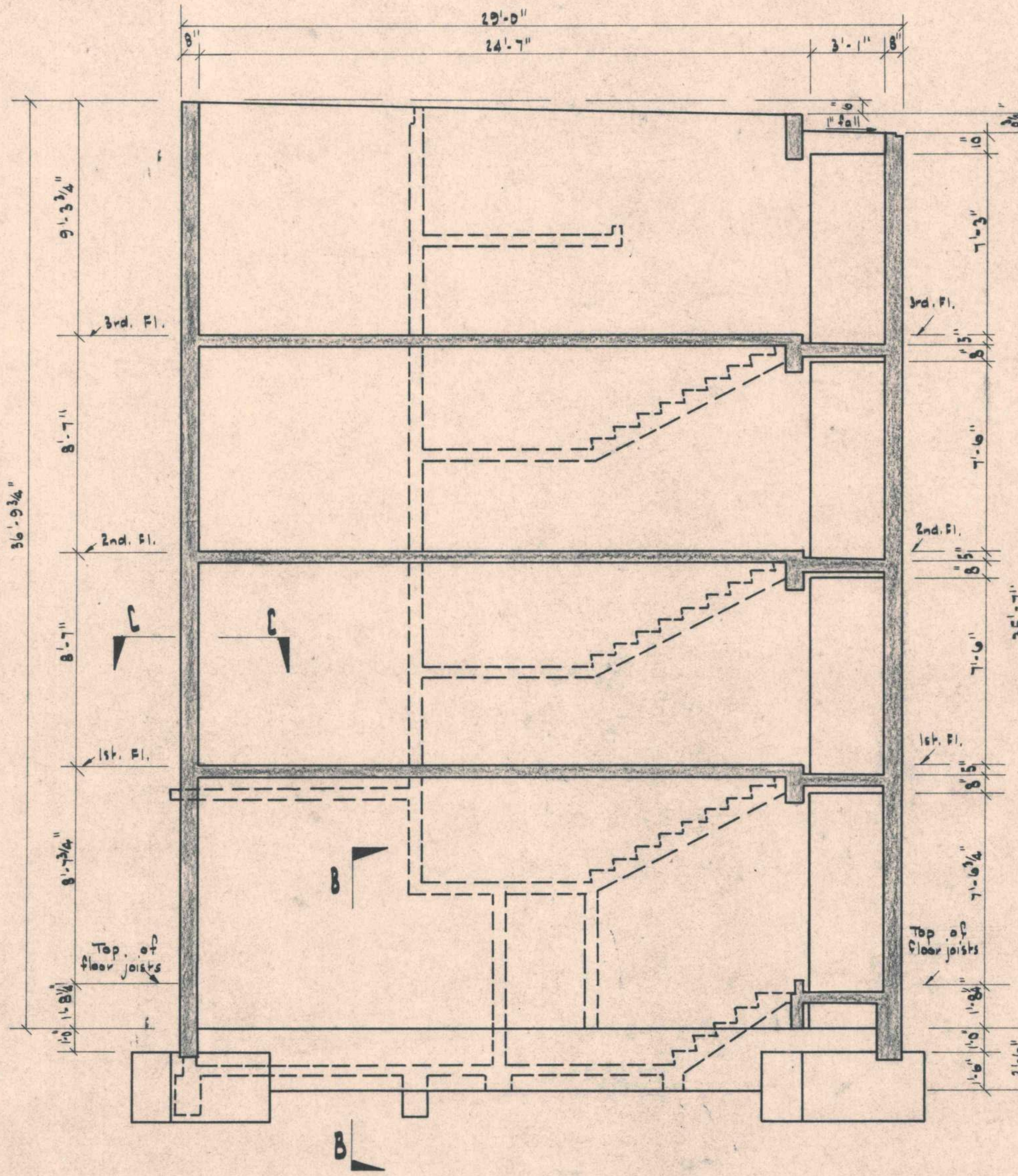
KOTUKU FLATS – KEMP ST., KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK B – WEST WALL	STEWART C. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON. PH. 46321	DWG. NO: 879/18
	DRAWN: J.J.O. TRACED: C.B.S. CHECKED:	WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	
	DATE: 26-10-67 SCALES: 1/4", 1/2" = 1'-0"		NO. OF SHEETS:

KOTUKU FLATS - KEMP ST., KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK B - EAST WALL	STEWART C. REES & ASSOCIATES CONSULTING, CIVIL & STRUCTURAL ENGINEERS 2, EVERTON TERRACE, WELLINGTON. PH. 46321	DWG. NO. 879/19
DRAWN: J.J.Q. TRACED: C.B.S. CHECKED:		WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	NO. OF SHEETS:
DATE: 25.10.67 SCALES: 1/4", 1/2" = 1'-0"			



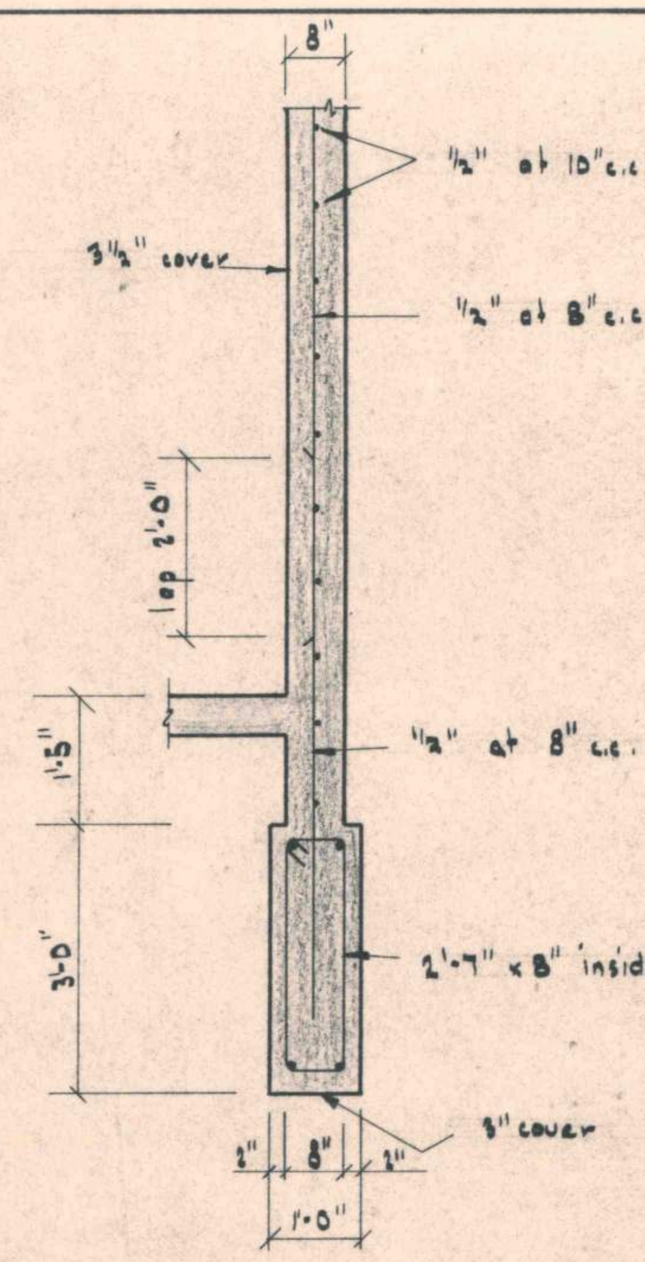
ELEVATION NORTH WALL OF BLOCK B

Wall is 8" thick. Reinforcing above Grd. Fl. level is similar to corresponding reinforcing in West Wall of Block C, except for Water Tank.

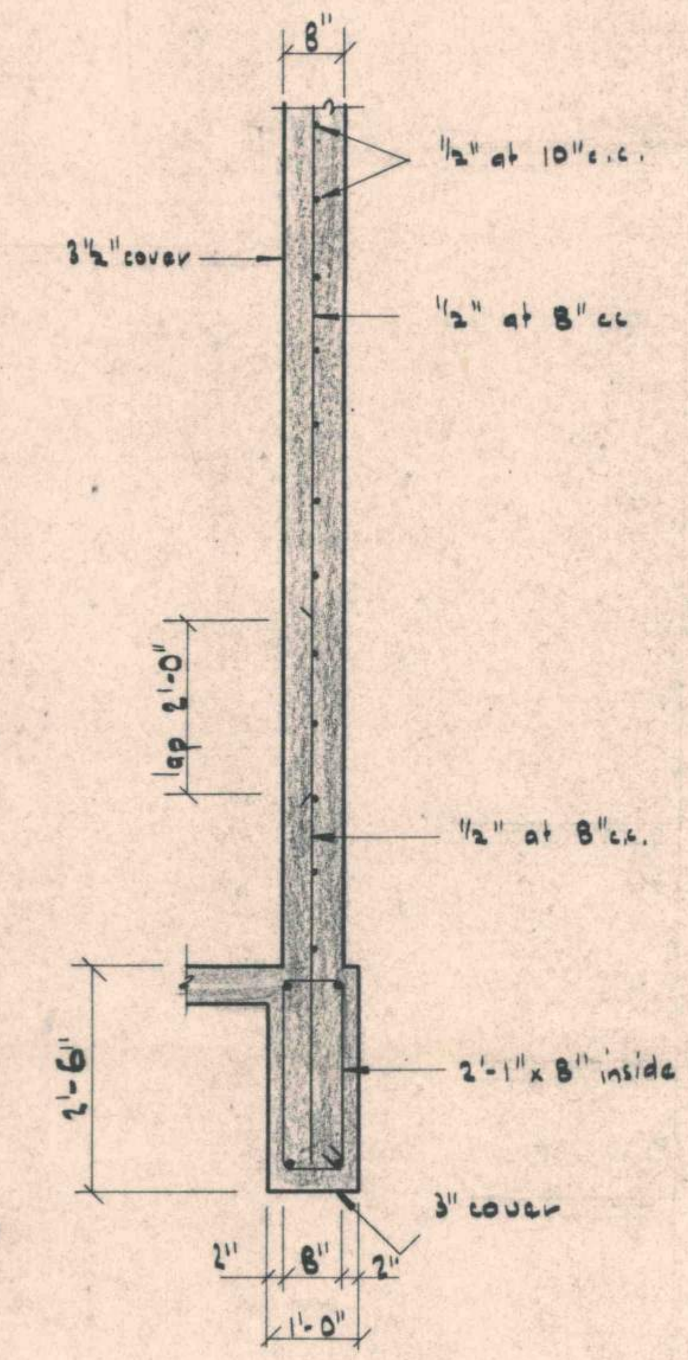


ELEVATION SOUTH WALL OF BLOCK B.

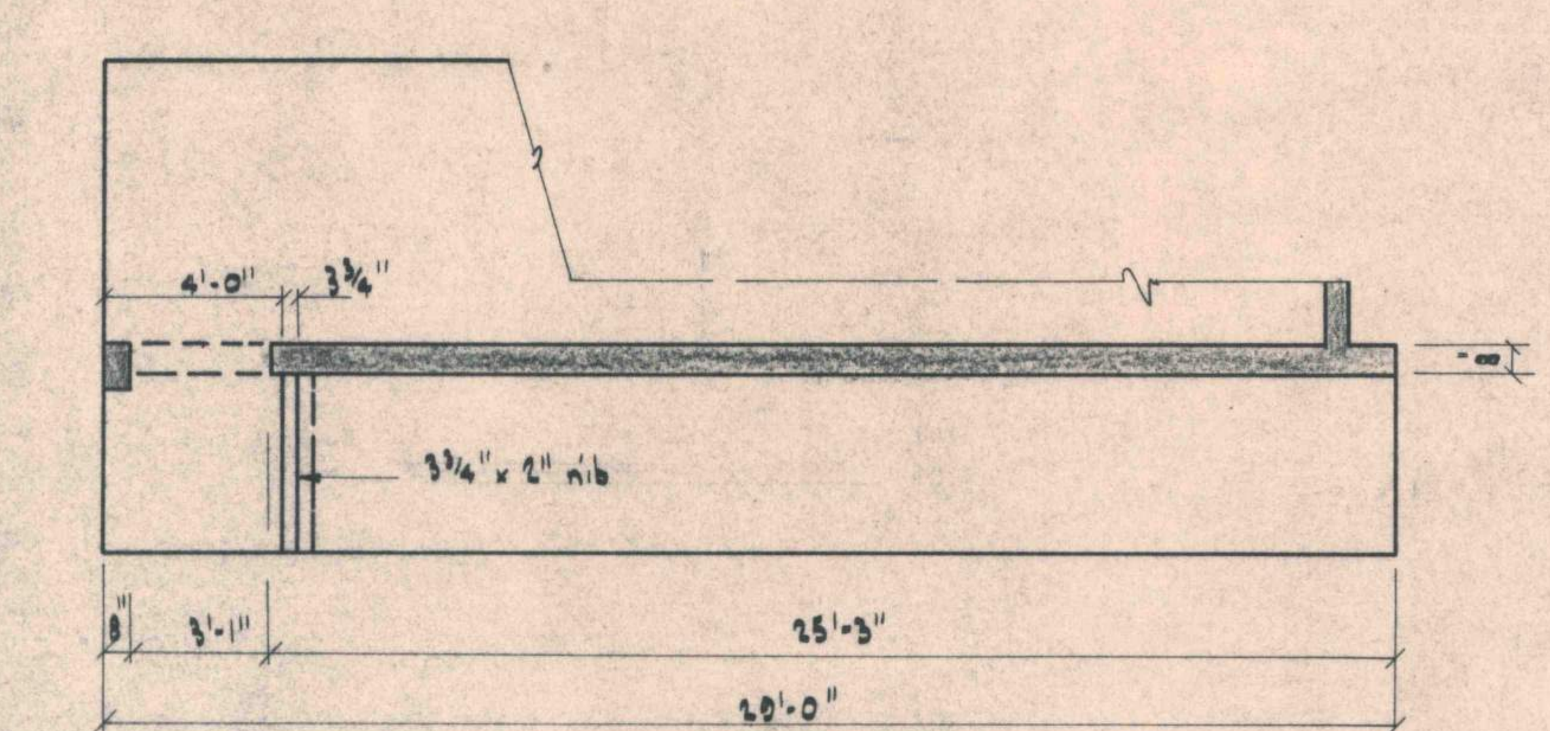
Wall is 8" thick. Reinforcing above Grd. Fl. level is similar to corresponding reinforcing in West Wall of Block C except that horizontal bars (½" at 10" c.c.) turn round 1'-9" into East Wall. (See C-C.)



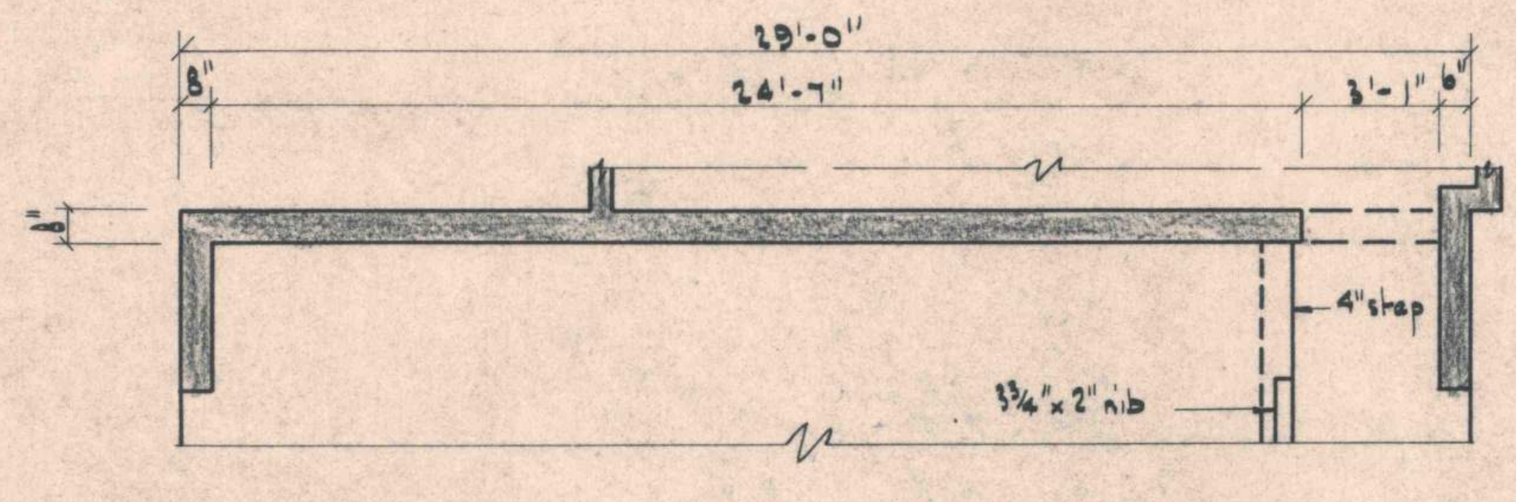
A-A



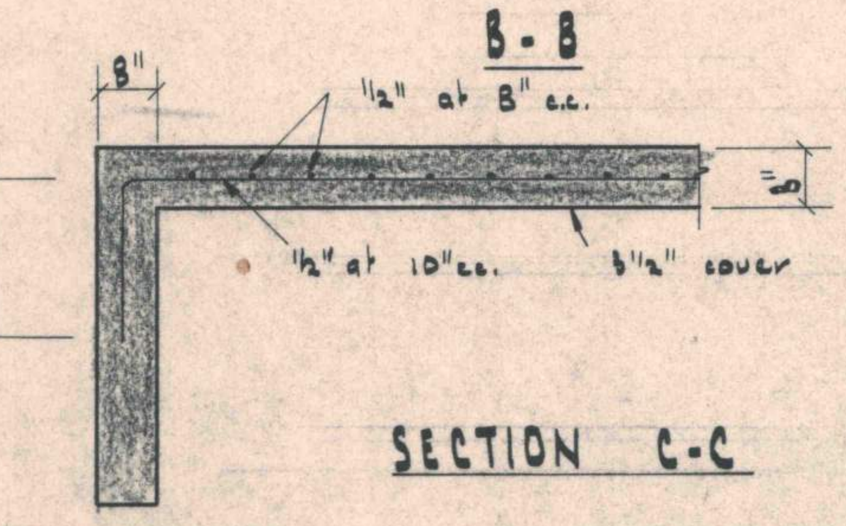
B-B



HORIZONTAL SECTION OF NORTH WALL AT 1ST. 2ND. & 3RD. FLOOR LEVELS.

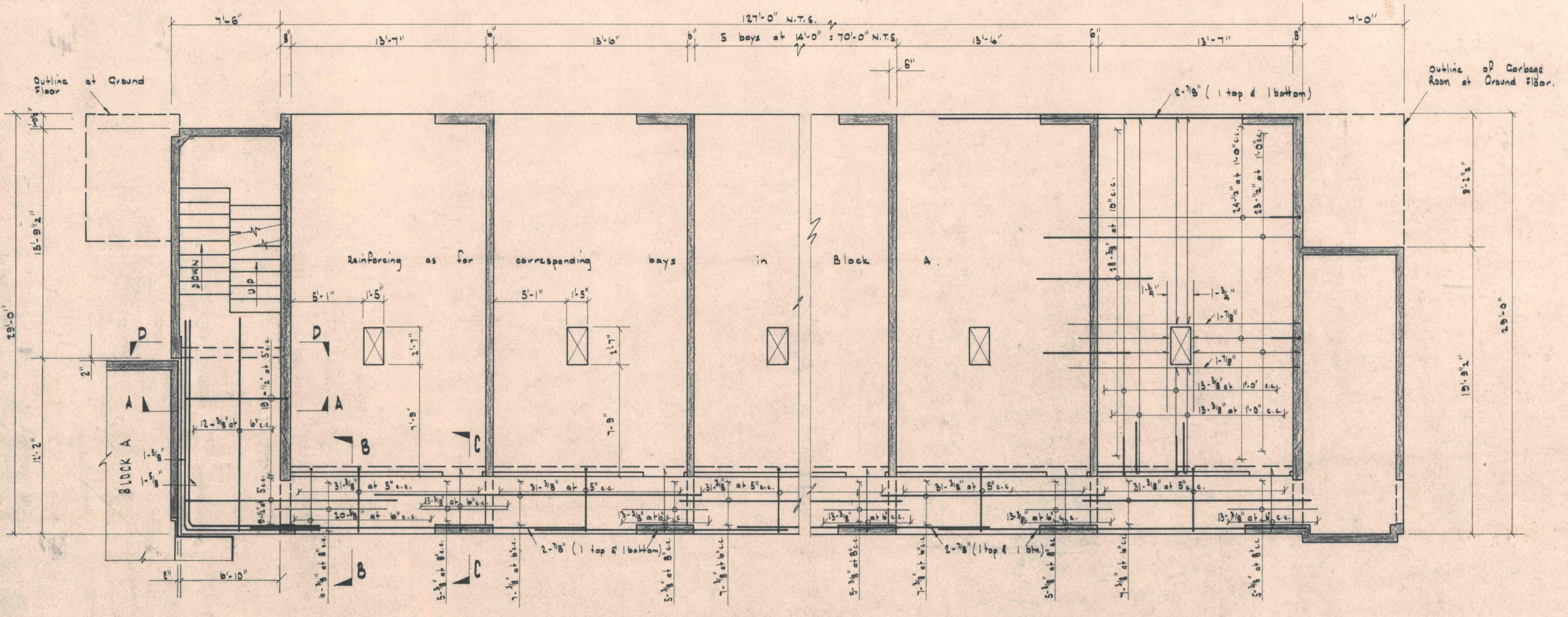


HORIZONTAL SECTION OF SOUTH WALL AT 1ST., 2ND., & 3RD. FLOOR LEVELS.

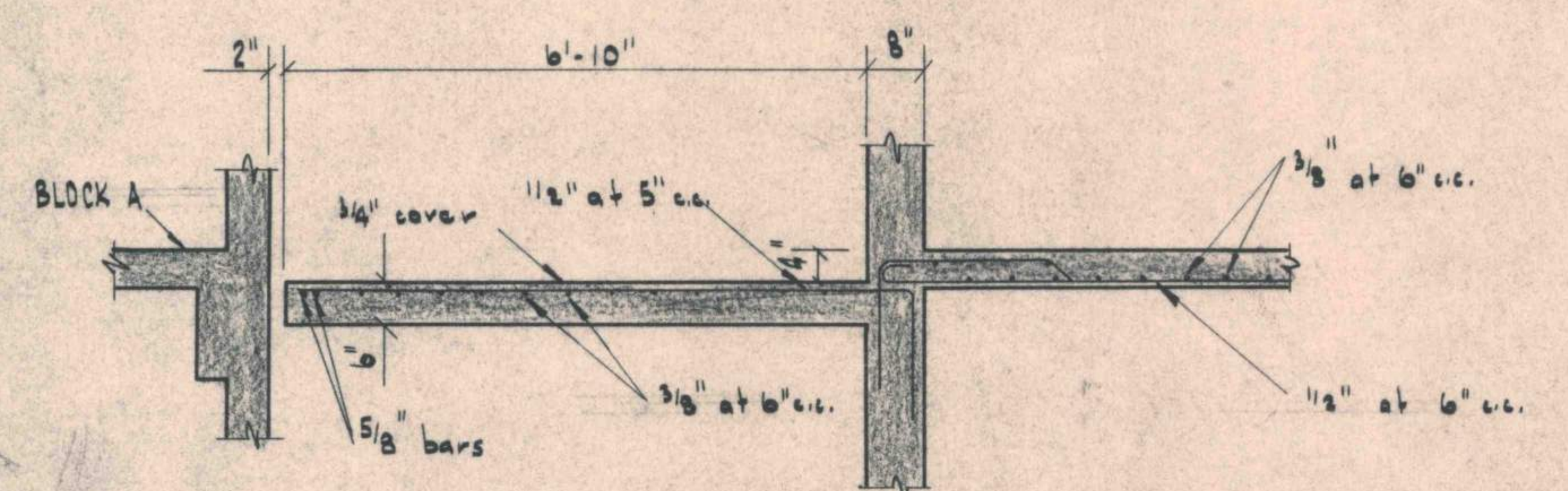


SECTION C-C

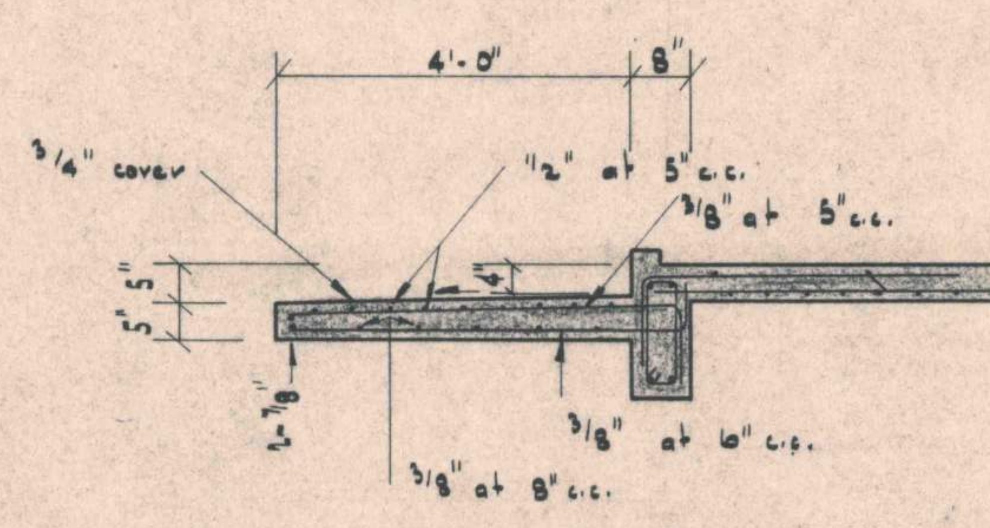
KOTUKU FLATS - KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK B - NORTH & SOUTH WALLS	STEWART C. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON. PH. 46-321	DWG. NO: 879/20
	DRAWN: J.L.Q. TRACED: CBS CHECKED:	WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	
	DATE: 23-10-67 SCALES: ¼", ½" = 1'-0"		NO. OF SHEETS:



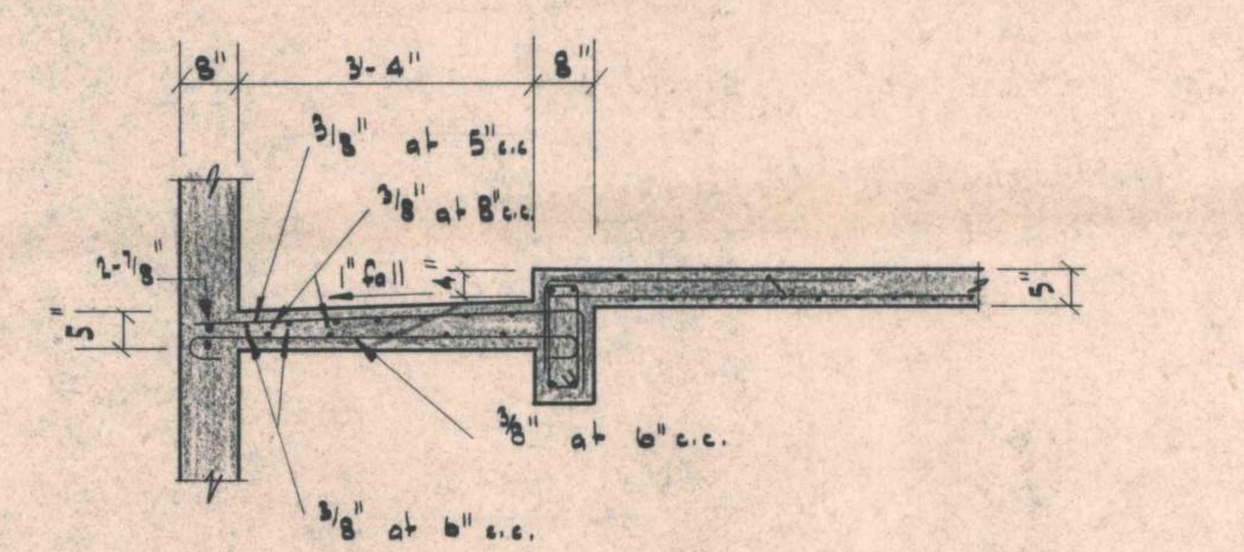
BLOCK B - SLAB PLAN FOR 1ST., 2ND. & 3RD. FLOORS.



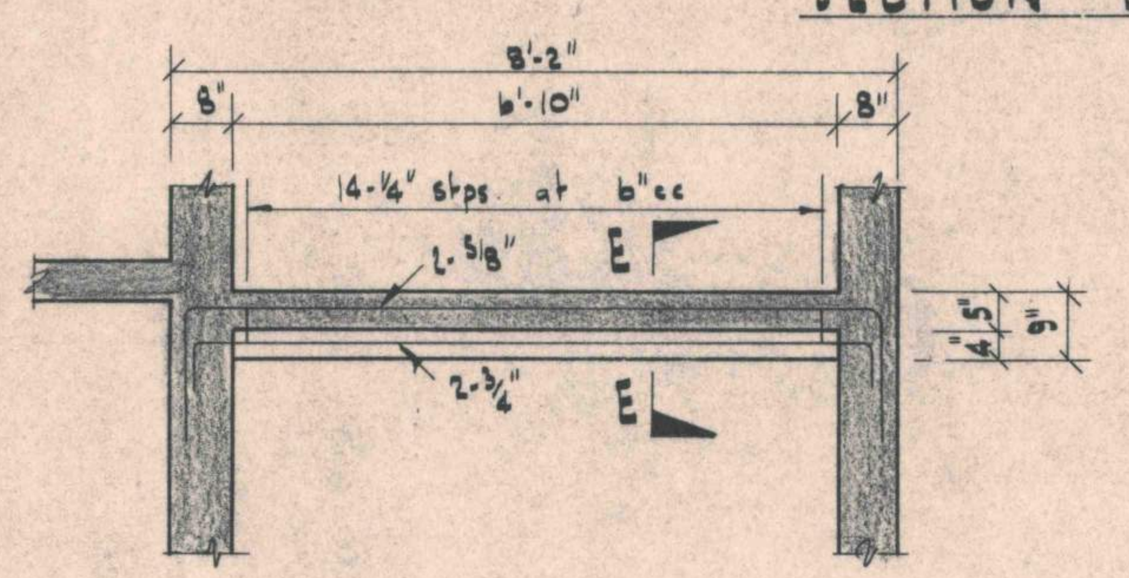
SECTION A-A



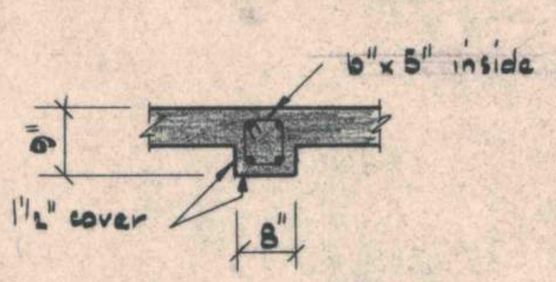
SECTION B-B



SECTION C-C



SECTION D-D



SECTION E-E

Bar Notation:

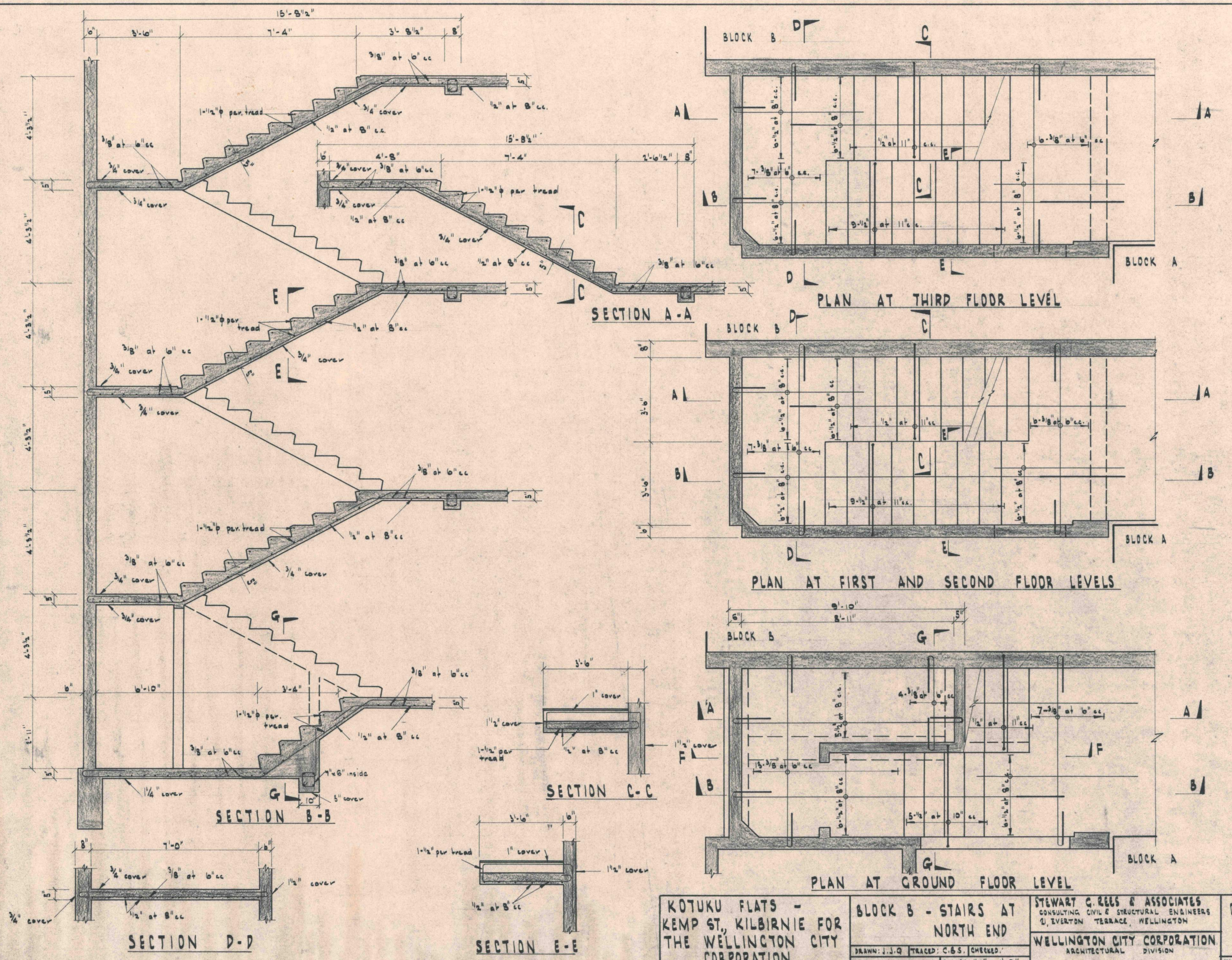
Bars in near face of slab have been shown thus ———

Bars in far face of slab have been shown thus ———

Torsion Steel:

Provide torsion reinforcement in slab at all corners and at each intersection of transverse walls and slab edges. Torsion reinforcement shall be as for Block A.

KOTUKU FLATS - KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK B - SLAB PLAN & SECTIONS DRAWN: I.I.Q. TRACED: CBS CHECKED: DATE: 1-11-67 SCALES: 1/4", 1/2" = 1'-0"	STEWART G. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON. PH. 46321 WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	DWG. NO: 879/21 NO OF SHEETS:



KOTUKU FLATS - KEMP ST., KILBIRNIE FOR THE WELLINGTON CITY CORPORATION

BLOCK B - STAIRS AT NORTH END

DRAWN: J.J.Q TRACED: C.B.S. CHECKED:

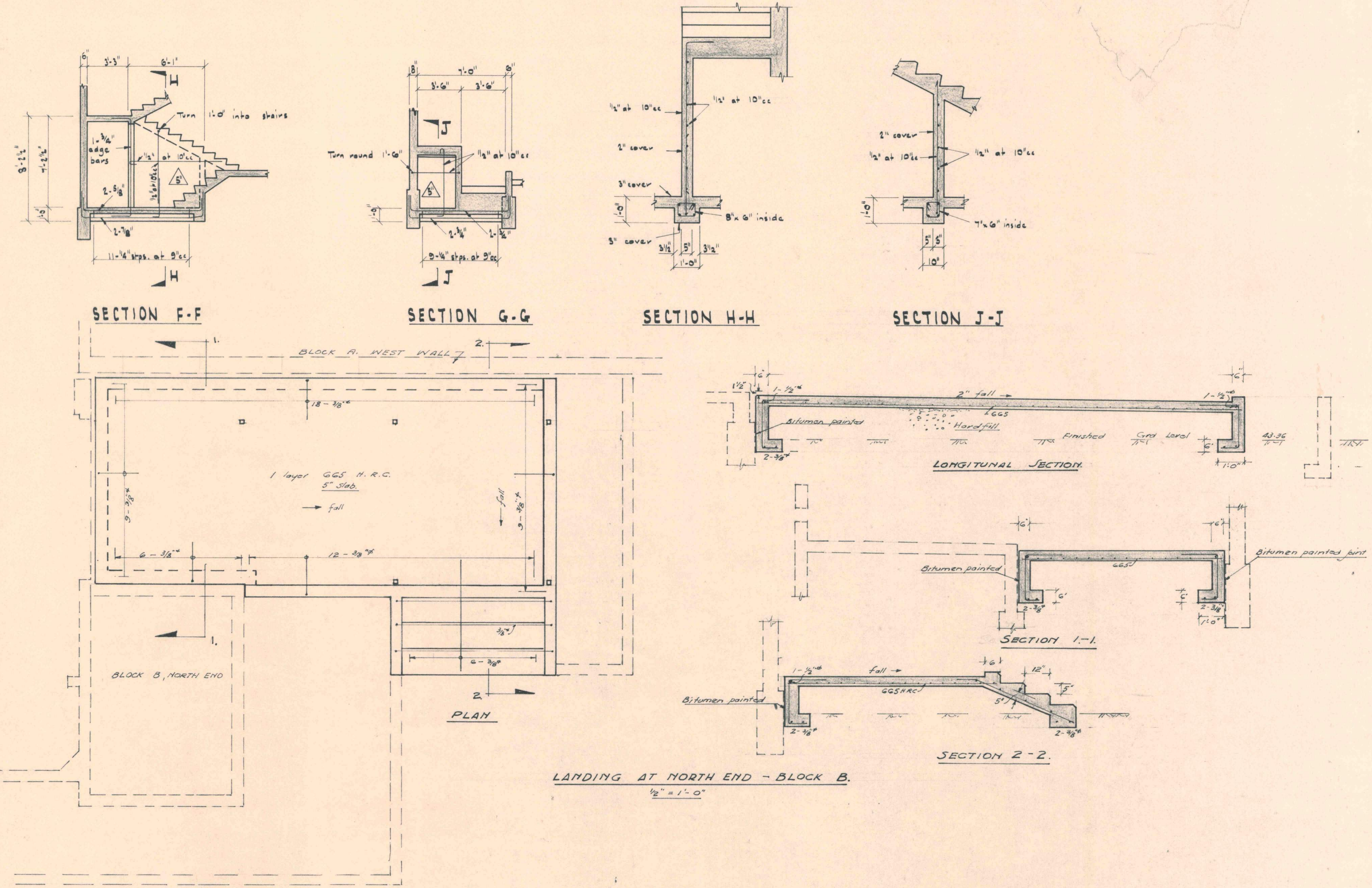
DATE: 11-12-67 SCALES: 1/2" = 1'-0"

STEWART C. REES & ASSOCIATES
CONSULTING CIVIL & STRUCTURAL ENGINEERS
2, EVERTON TERRACE, WELLINGTON

WELLINGTON CITY CORPORATION
ARCHITECTURAL DIVISION

DWG. NO: 879/22

NO. OF SHEETS:



KOTUKU FLATS - KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION

BLOCK B - STAIRS AT NORTH END

DRAWN: JJQ | TRACED: CBS | CHECKED: 8-10-68
DATE: 22-3-68 | SCALES

STEWART C. REES & ASSOCIATES
CONSULTING CIVIL & STRUCTURAL ENGINEERS
11, EVERTON TERRACE, WELLINGTON

WELLINGTON CITY CORPORATION
ARCHITECTURAL DIVISION

DWG. NO. 879/23

KOTUKU FLATS - KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION.

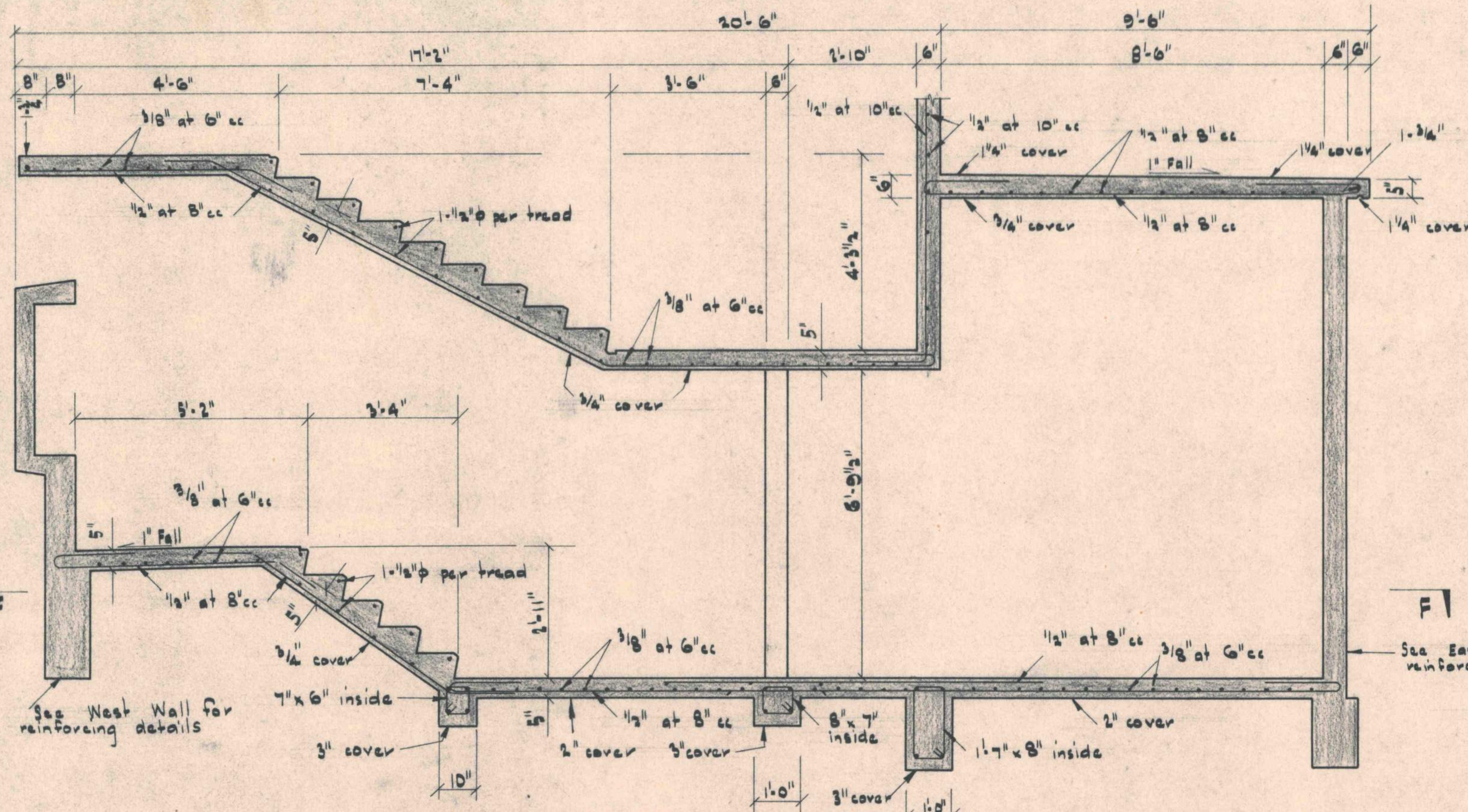
BLOCK B. - STAIR WALLS AT SOUTH END

DRAWN: JJG	TRACED: CBS	CHECKED:
DATE: 20-3-68	SCALES: ⅛", ½" = 1'-0"	

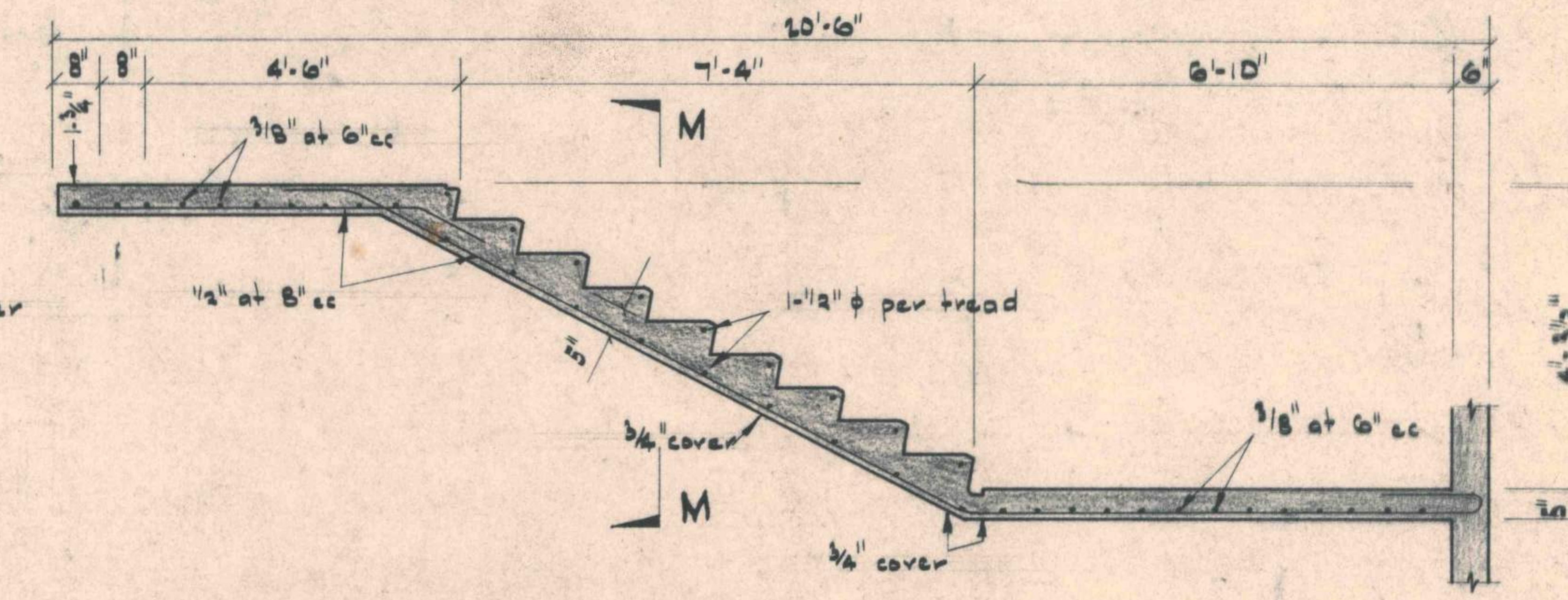
STEWART C. REES & ASSOCIATES
CONSULTING CIVIL & STRUCTURAL ENGINEERS
21, EVERTON TERRACE, WELLINGTON

WELLINGTON CITY CORPORATION
ARCHITECTURAL DIVISION

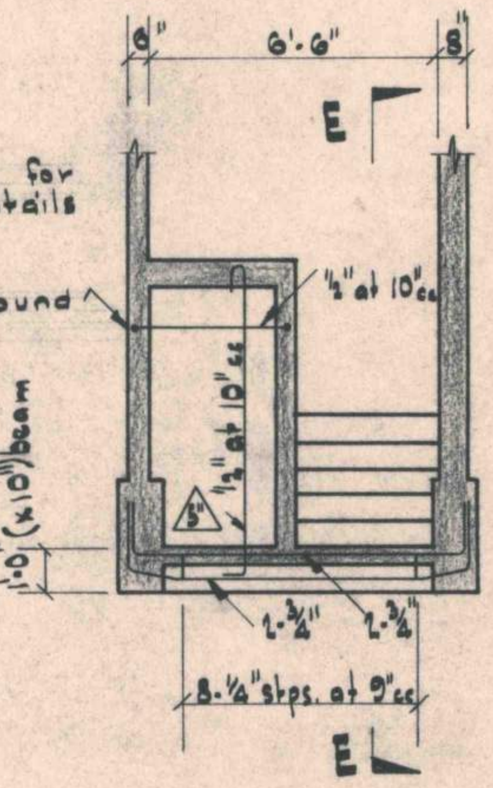
DWG. NO. 879/25

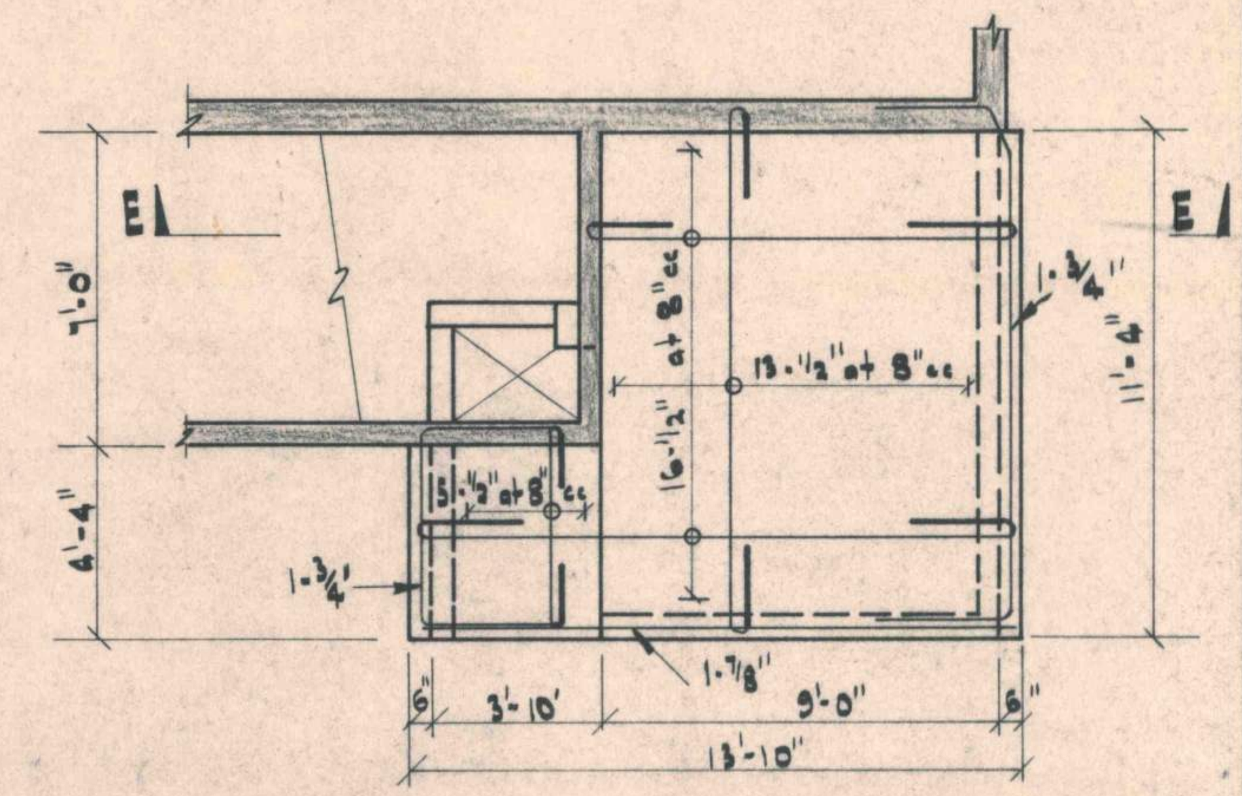


SECTION E-E



SECTION D-D

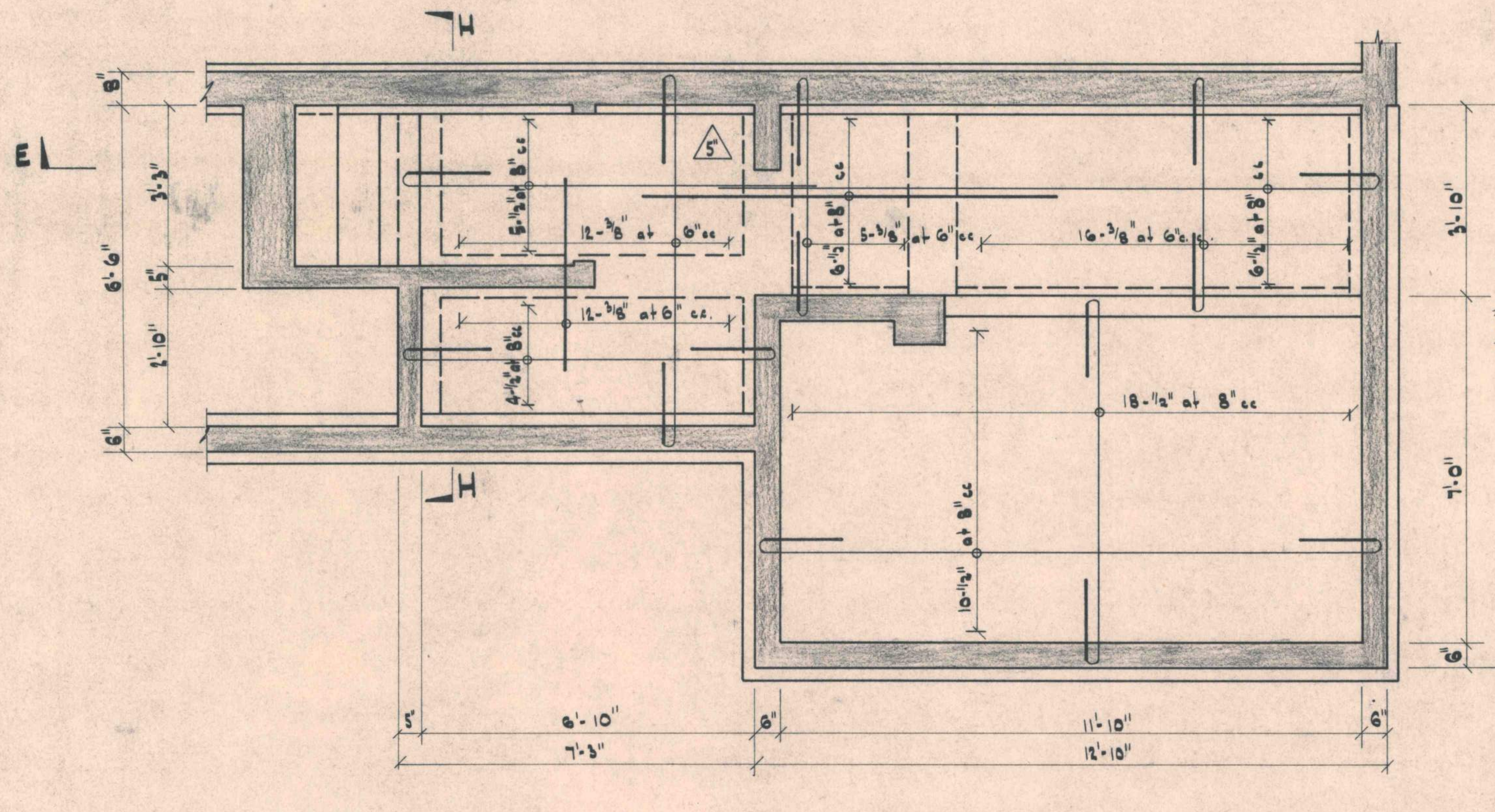




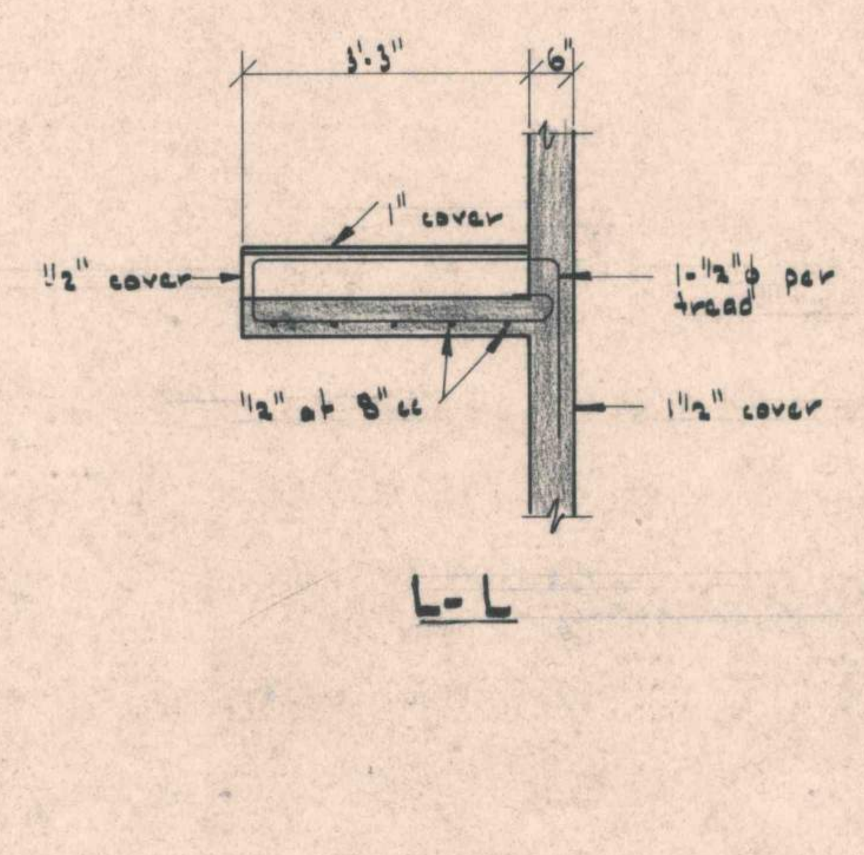
SECTION H-H

PLAN OF ROOF SLAB TO GARBAGE & METER ROOMS

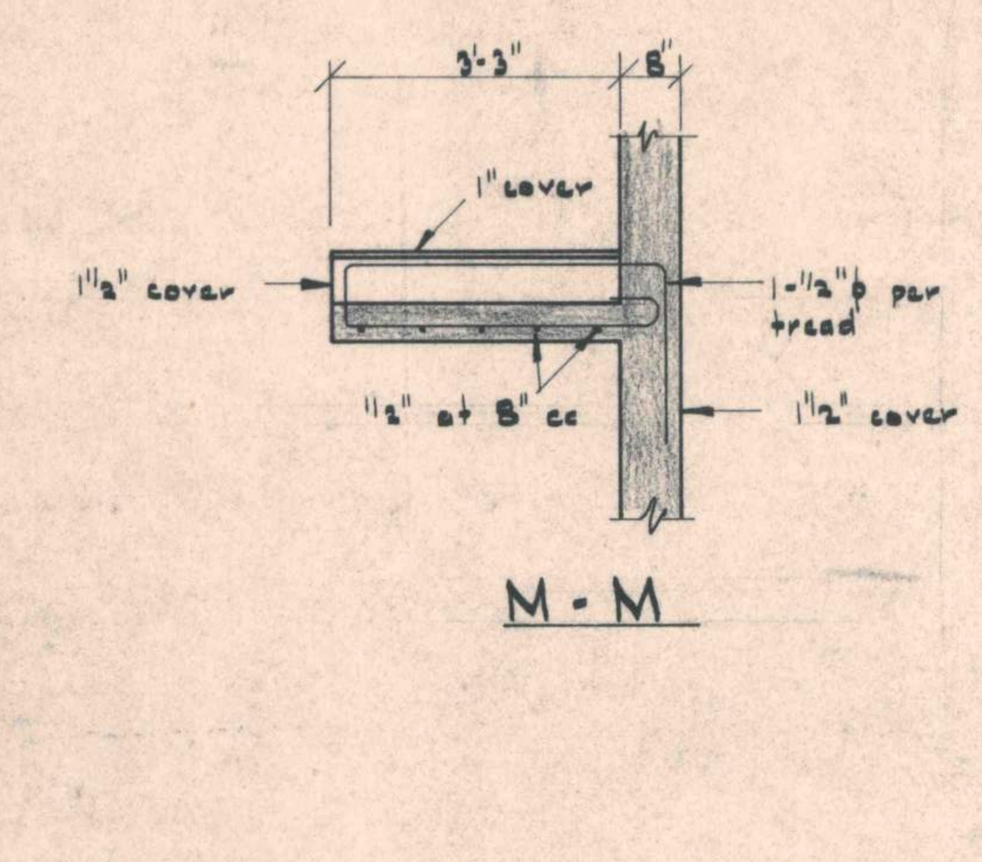
Vertical section through wall and beam shown in "Vertical Section Through Stairs."



SECTION F-F

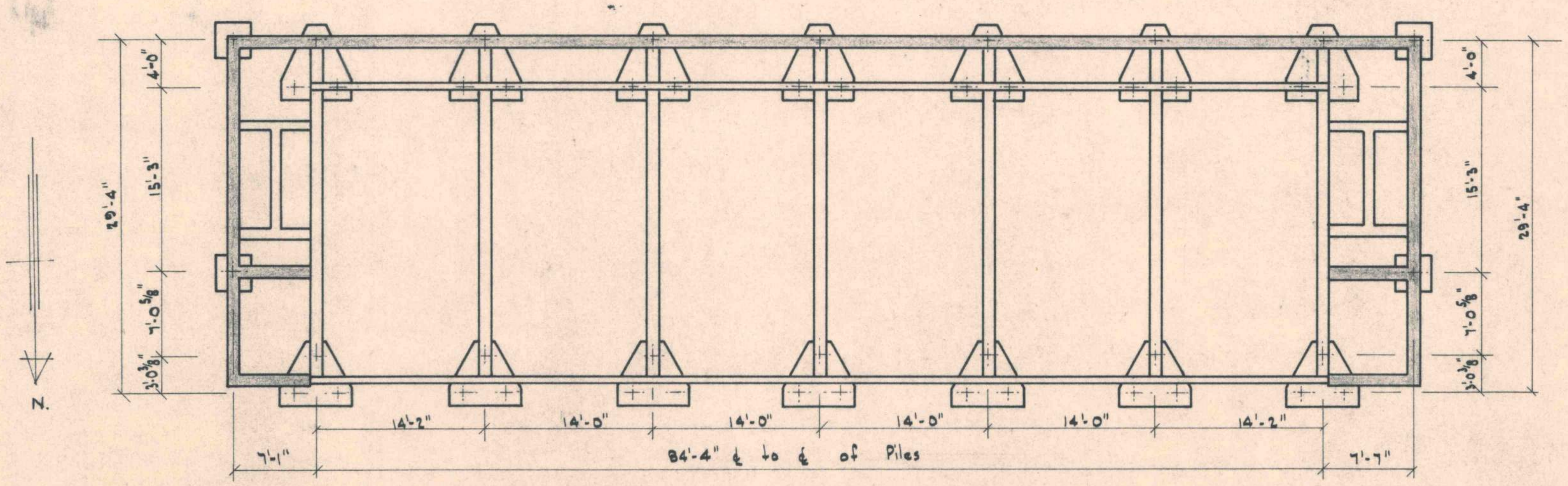


L-L



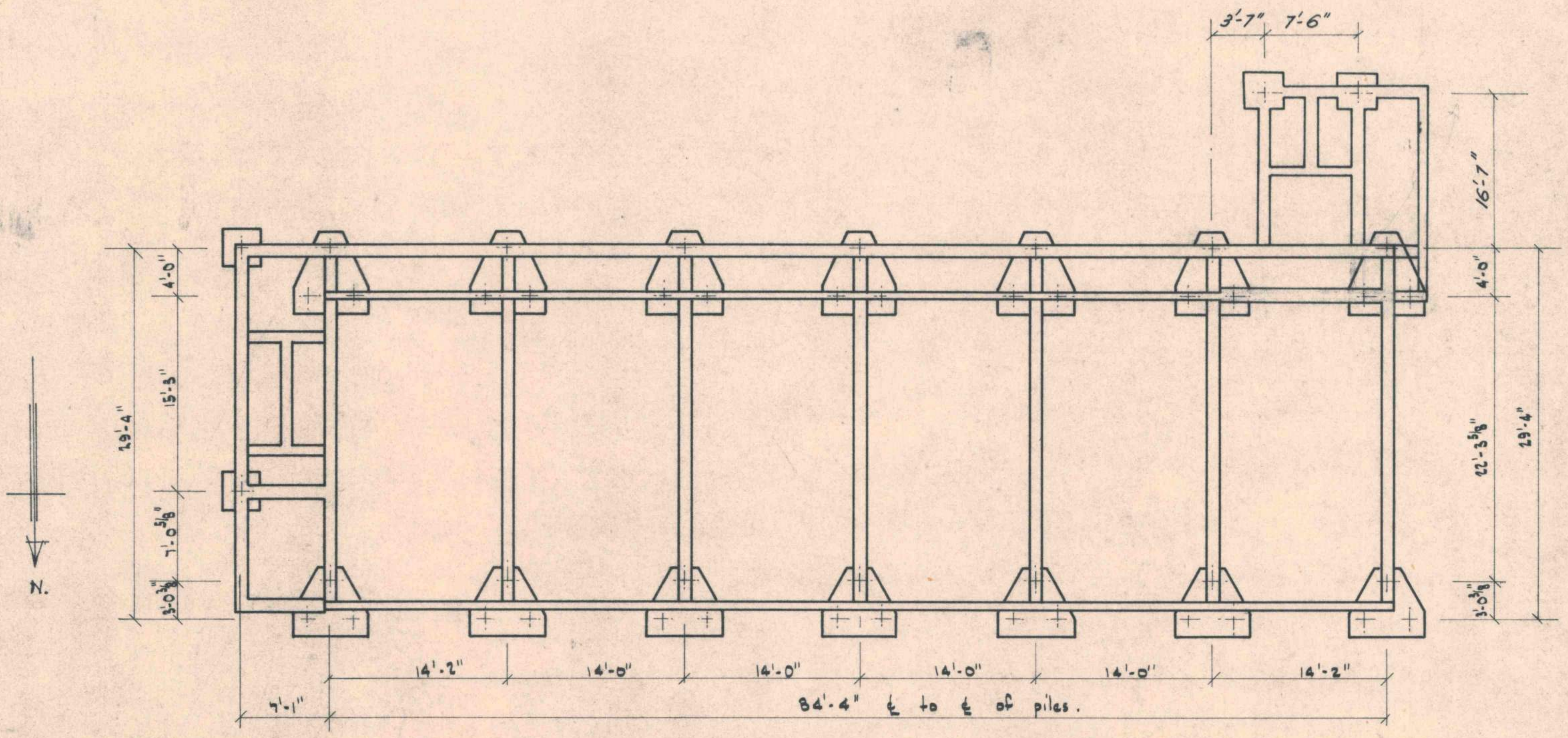
M-M

KOTUKU FLATS - KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK B - STAIRS AT SOUTH END DRAWN: JJQ / TRACED: CBS / CHECKED: DATE: 20-5-68 / SCALES: 1/4", 1/2" : 1'-0"	STEWART G. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	DWG. NO. 879/26



FOUNDATION PLAN - BLOCK D

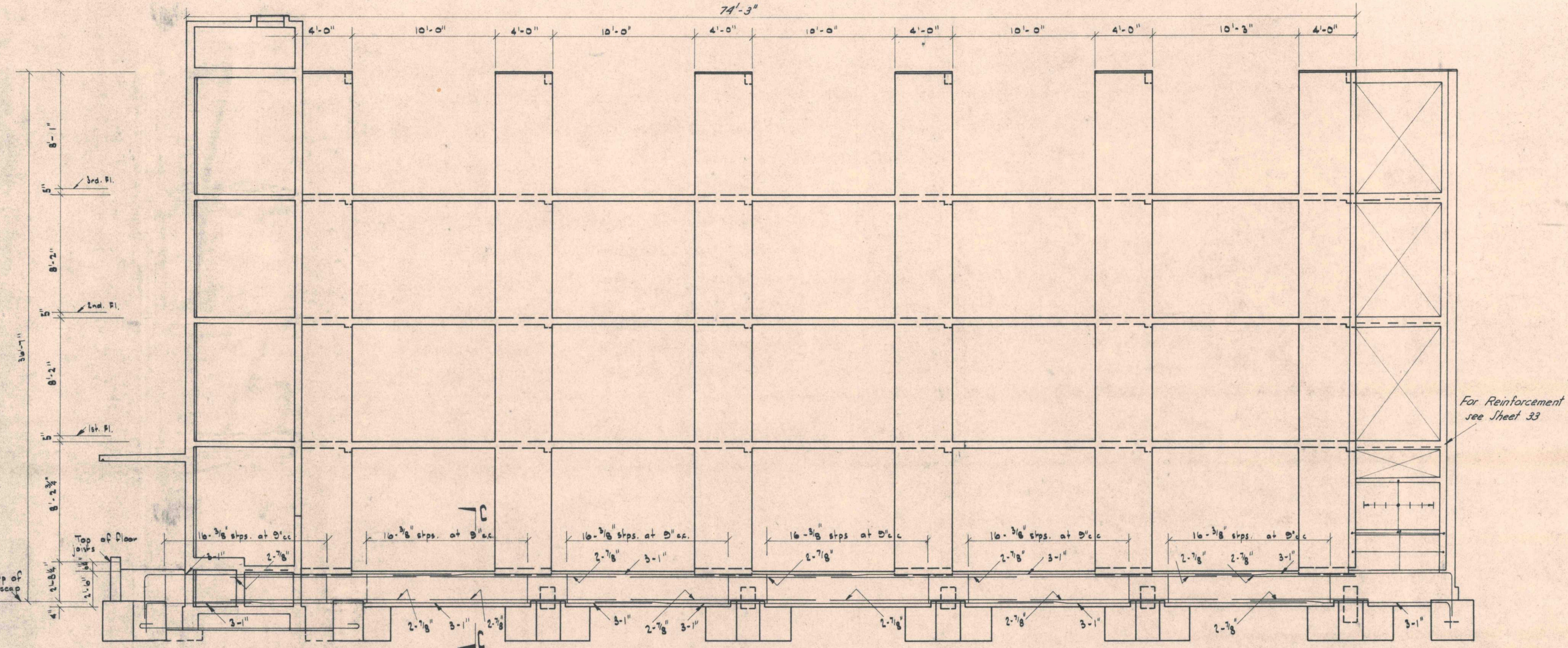
Scale: 1/8" = 1'-0"



FOUNDATION PLAN - BLOCK C

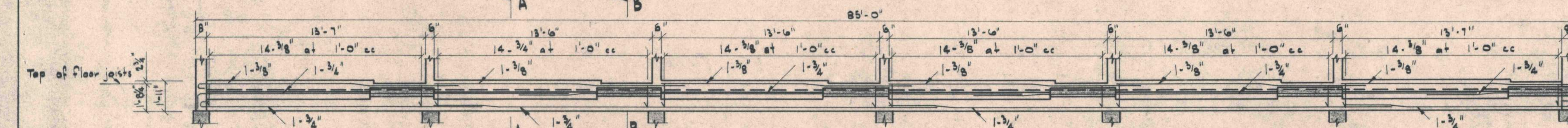
Scale : 1/8" = 1'-0"

KOTUKU FLATS - KEMP STREET KILBIRNIE FOR THE WELLINGTON CITY CORPORATION.	BLOCKS C & D - FOUNDATION PLAN DRAWN: TRACED: CHECKED: DATE: SCALES:	STEWART G. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON. PH. 46-321 WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	DWG. NO: 879/27

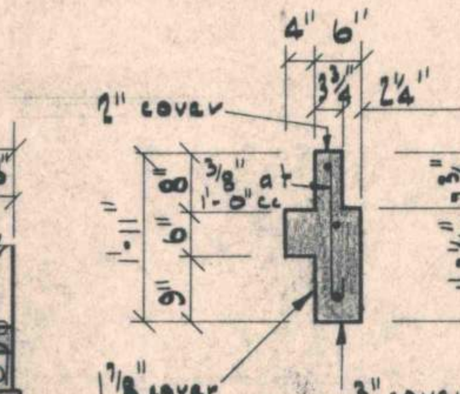


ELEVATION SOUTH WALL - BLOCK C

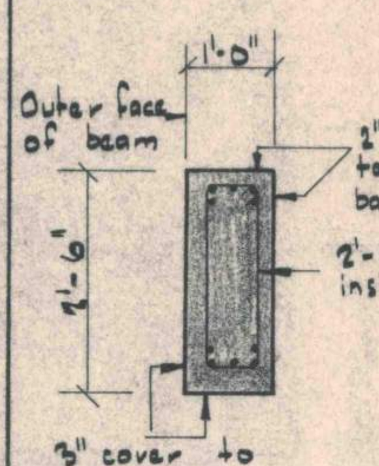
Column reinforcing is similar to that for columns in South Wall of Block A.



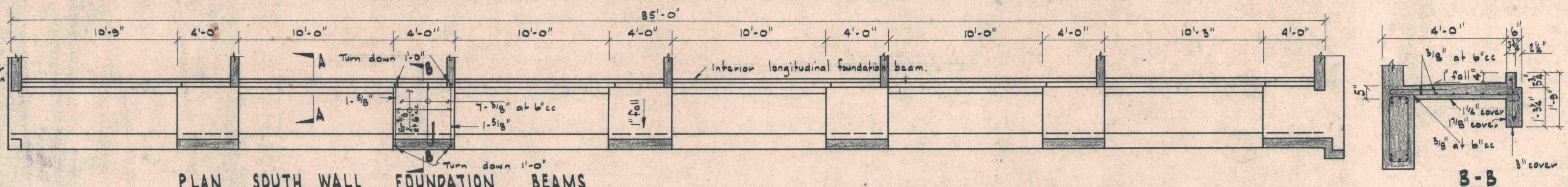
ELEVATION INTERIOR LONGITUDINAL FOUNDATION BEAM.



A - A



C - C

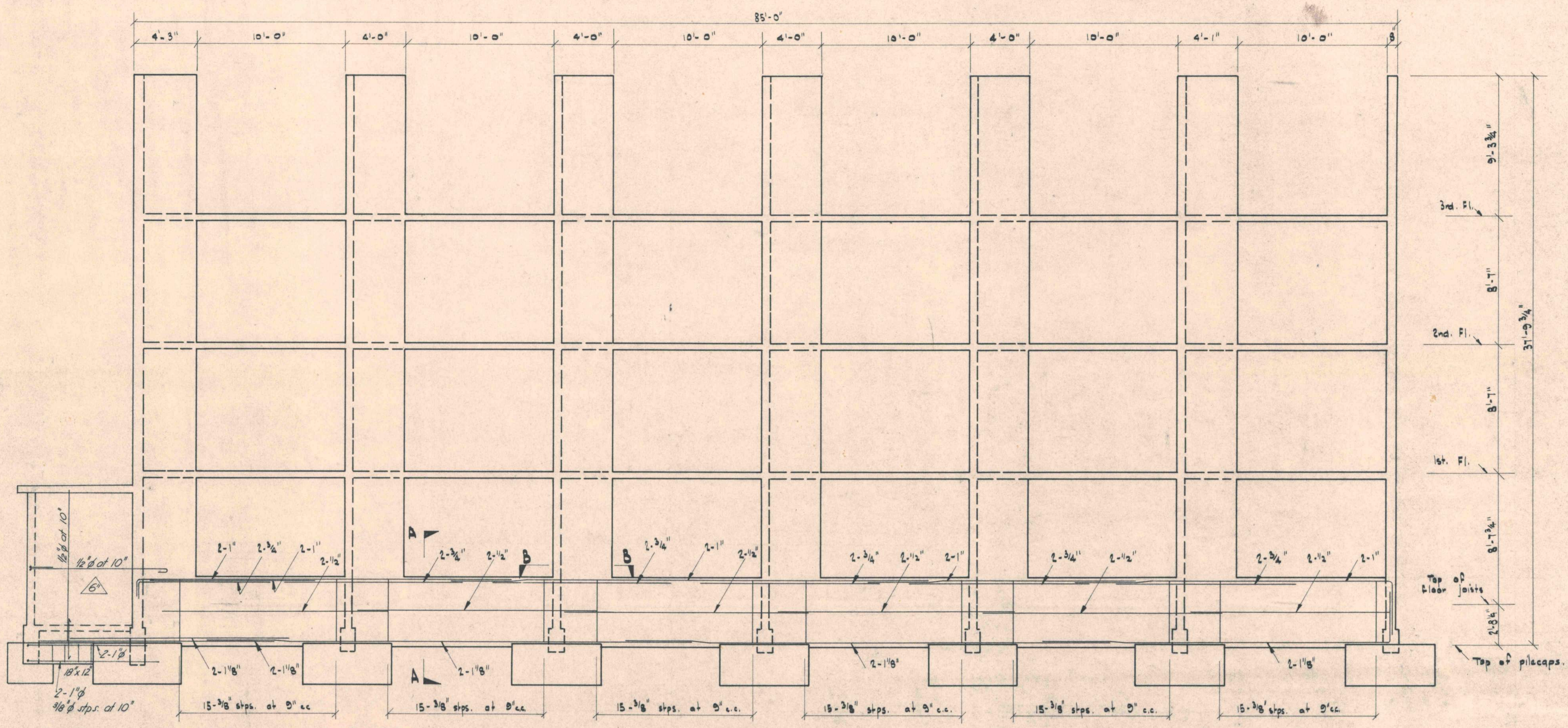


PLAN SOUTH WALL FOUNDATION BEAMS

Balcony slab reinforcing has been shown for one bay only. Other balcony slabs are reinforced similarly.

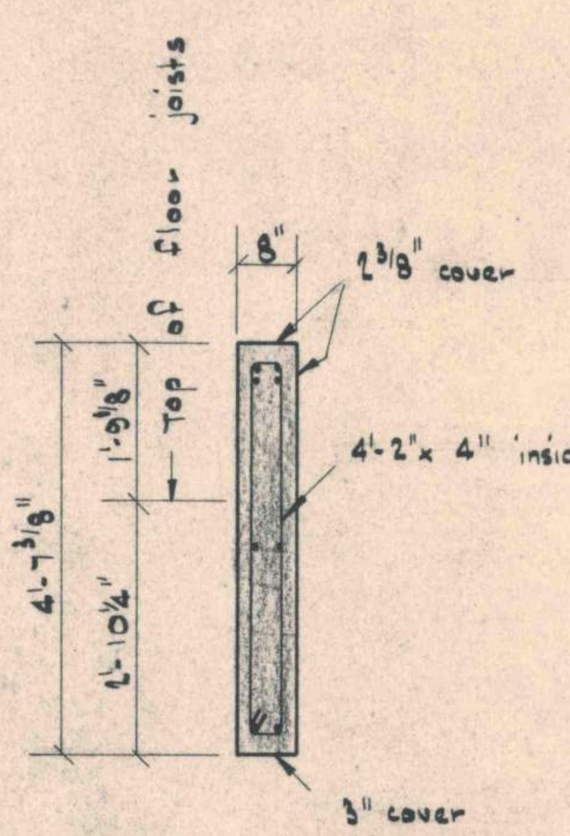
B - B

KOTUKU FLATS — KEMP ST., KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK C - SOUTH WALL	STEWART C. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 2, EVERTON TERRACE, WELLINGTON. PH. 46321	DWG. NO: 879/28
	DRAWN: J.J.O. TRACED: C.B.S. CHECKED:	WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	
	DATE: 26-10-67 SCALES:		NO. OF SHEETS:

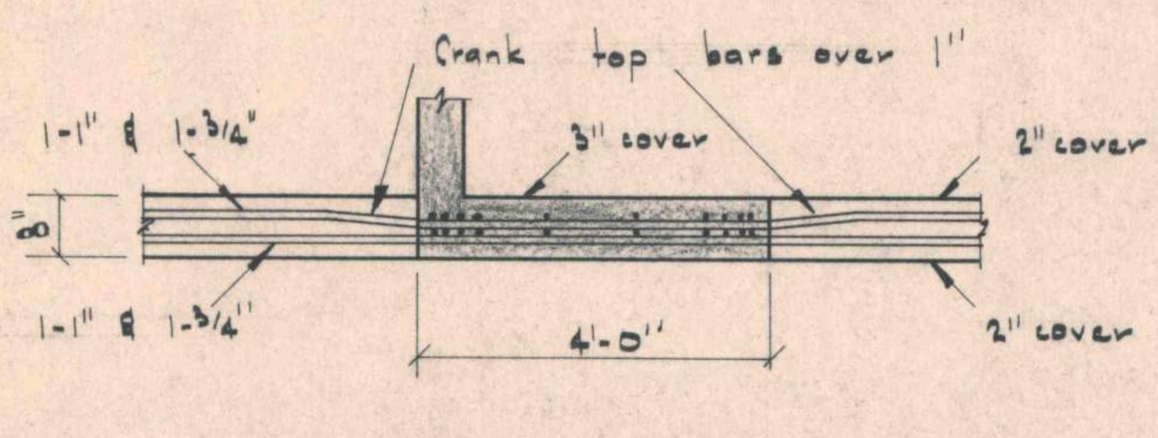


ELEVATION NORTH WALL BLOCKS C & D.

Column reinforcing is similar to that for corresponding columns in North Wall of Block A.

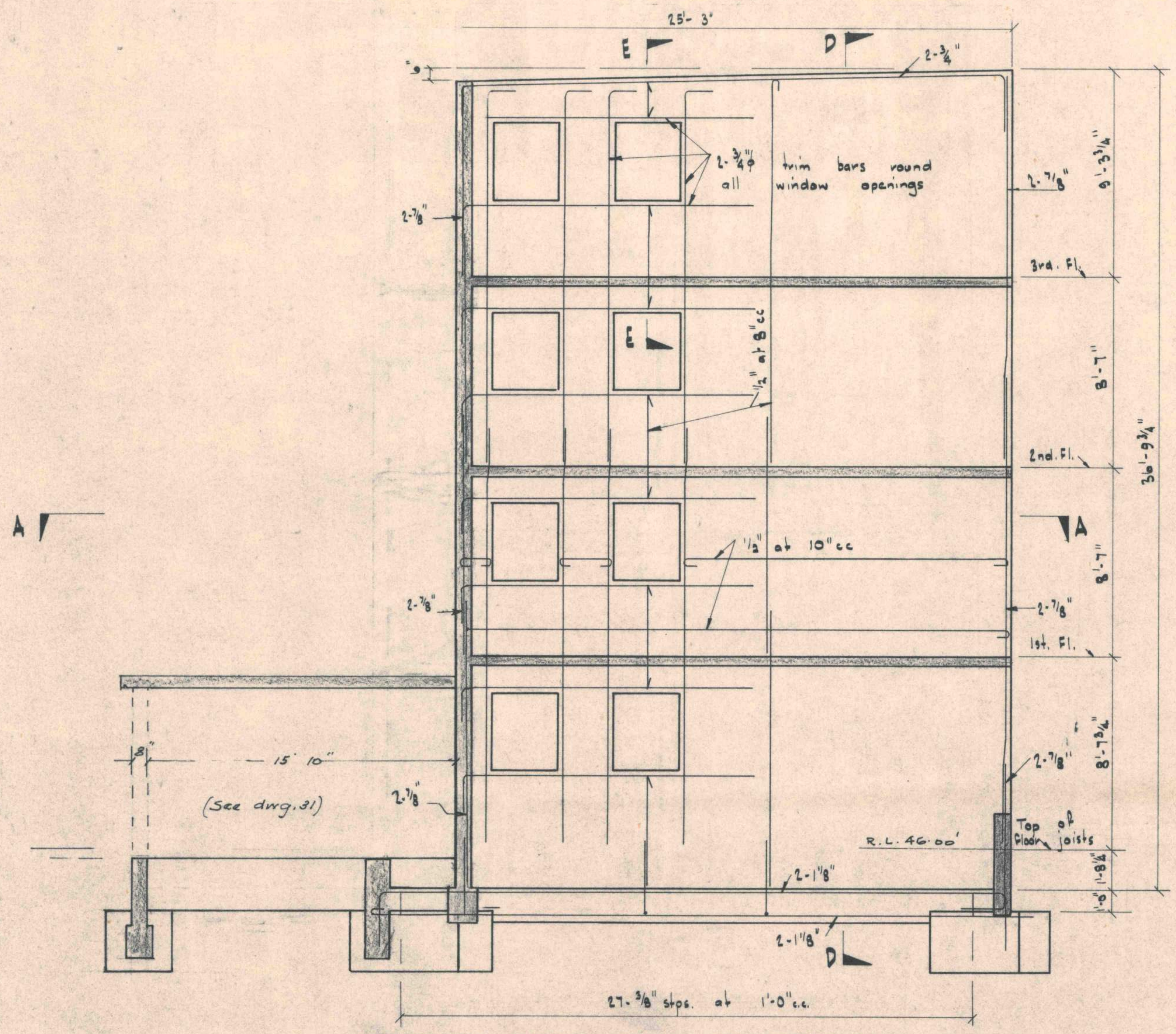


SECTION A-A



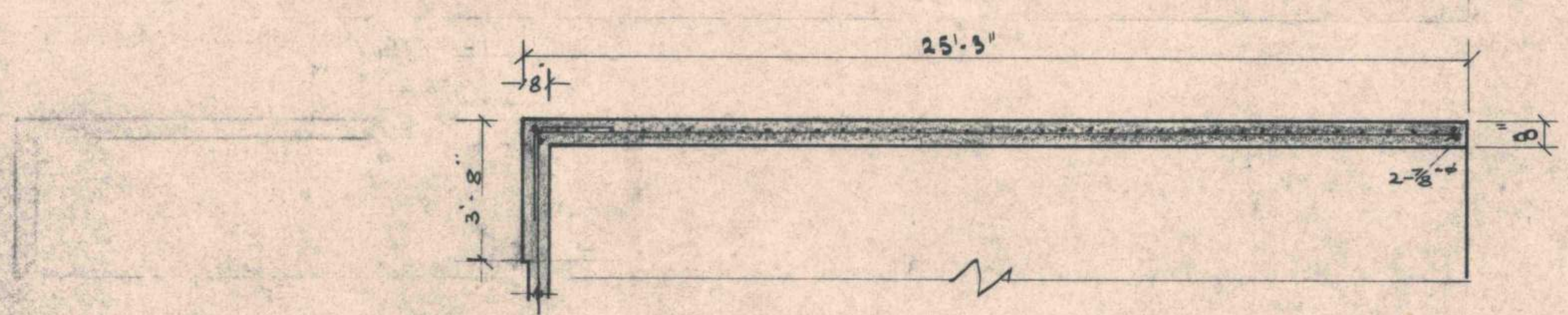
SECTION B-B
(Typical at all columns.)

KOTUKU FLATS – KEMP ST., KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCKS C & D. – NORTH WALL	STEWART C. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON. PH.46530	DWG. NO. 879/29
	DRAWN: J.J.Q. TRACED: CBS CHECKED:	WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	
	DATE: 27-10-67 SCALES: ¼", ½" = 1'-0"		NO. OF SHEETS:

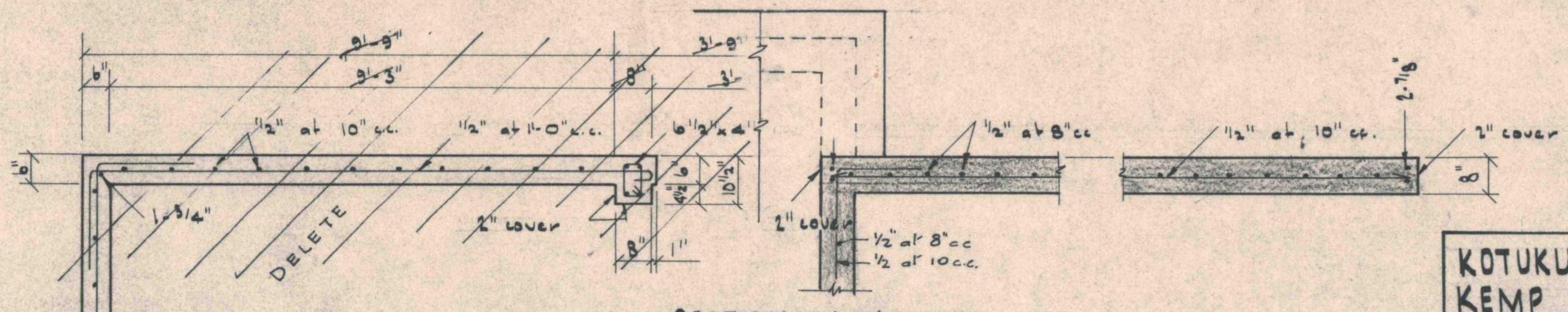


ELEVATION WEST WALL OF BLOCK C.

Wall is 8" thick reinforced with 1/2"φ at 8" c.c. vertically and 1/2"φ at 10"c.c. horizontally. Typical bars have been shown. Section E-E is similar to E-E for Block A, East Wall.

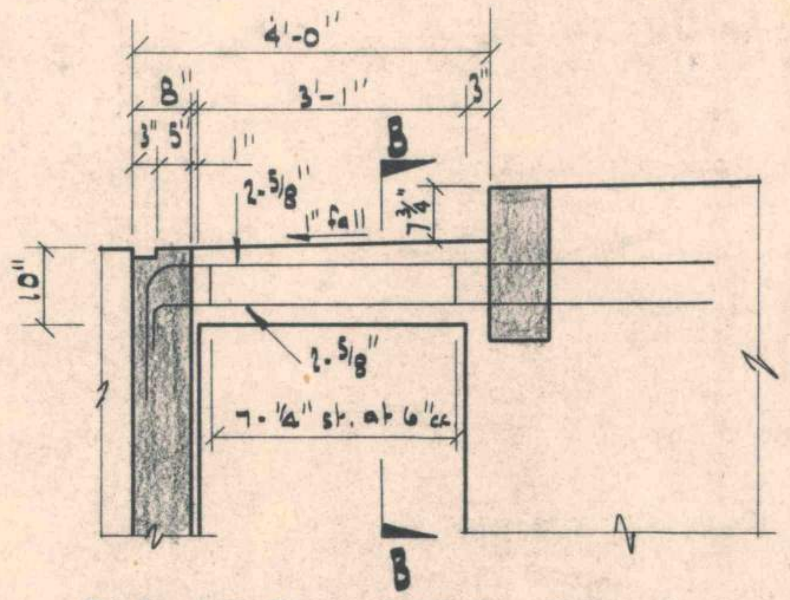


HORIZONTAL SECTION WEST OF BLOCK C AT 1ST., 2ND., & 3RD. FLOOR LEVELS.

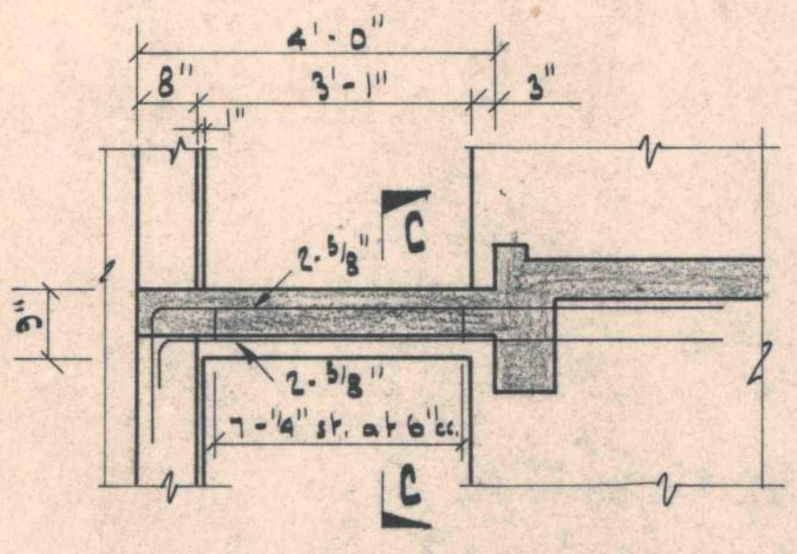


SECTION A-A

(Typical for wall)

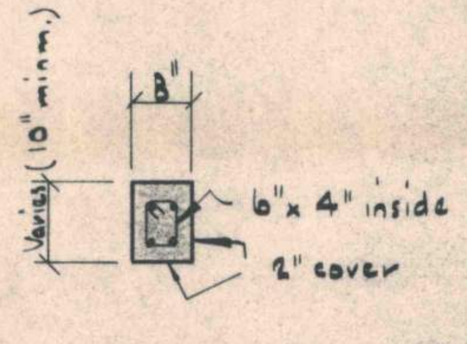


ELEVATION ROOF BEAM

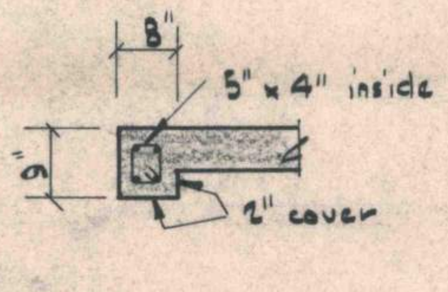


ELEVATION SLAB BEAM

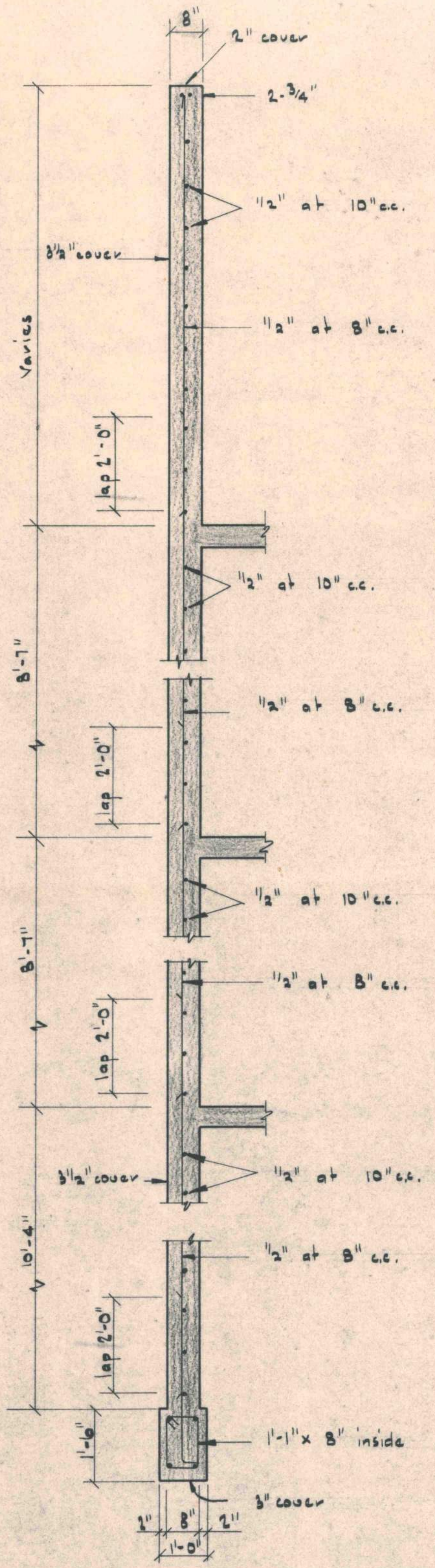
(Typical for 1st, 2nd, & 3rd. floors.)



B-B



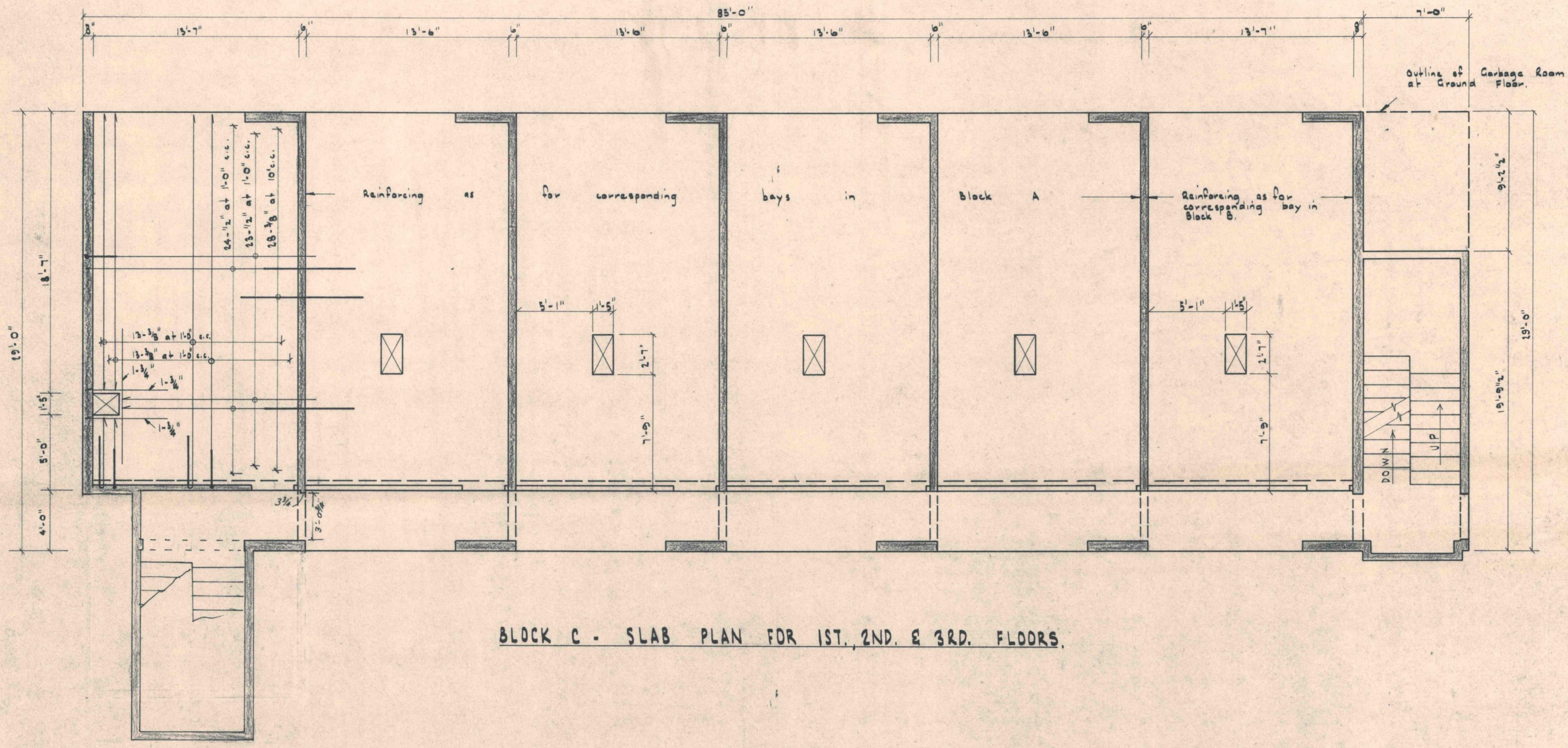
C-C



SECTION D-D

KOTUKU FLATS - KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK C - WEST WALL	STEWART C. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21 EVERTON TERRACE, WELLINGTON. PH. 46-321 WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	Amended 23.8.68 DWG. NO: 879/30
	DRAWN: J.J.O. TRACED: C.B.S. CHECKED: SGR DATE: 20th. DCT. 1967 SCALES: 1/8", 1/2" = 1'-0"		NO. OF SHEETS.


SECTION A-A
Refers to dwg. No 16A
SECTION B-B
ELEVATION - WEST WALL OF BLOCK C STAIRS - WEST END
See Dwg. 879/37
For Stair Reinf't see dwg. 879/22
D-D
(INTERIOR OF East Elev.)
C-C
Top of Joists
SECTION E-E.
WEST BLOCK WALL FOUND'N.
SOUTH BLOCK WALL FOUND'N.
PLAN- SLAB.
KOTUKU FLATS - KEMP ST, KILBIRNIE FOR THE WELLINGTON CITY CORPORATION
WALLS - STAIRWAYS WEST END - BLOCK C
STEWART G. REES & ASSOCIATES
CONSULTING CIVIL & STRUCTURAL ENGINEERS
21 EVERTON TERRACE, WELLINGTON. PH. 46-321
WELLINGTON CITY CORPORATION
ARCHITECTURAL DIVISION
DRAWN: S.G.R.
TRACED: M.F.
CHECKED:
DATE: 23-8-68.
SCALES: 1/4" = 1'
DWG. NO: 879/31
NO: OF SHEETS:



BLOCK C - SLAB PLAN FOR 1ST., 2ND. & 3RD. FLOORS.

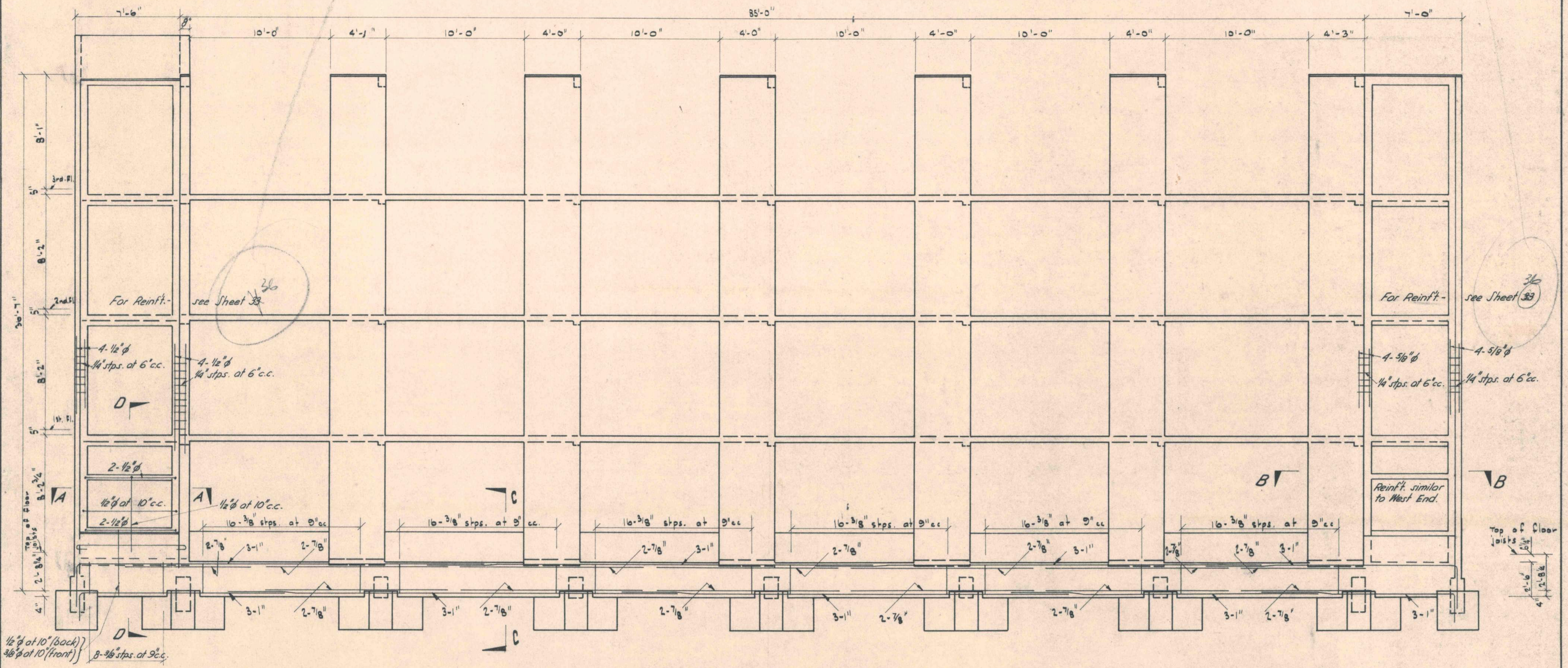
Bar Notation

Bars in near face of slab have been shown thus ———
Bars in far face of slab have been shown thus - - - -

Torsion Steel

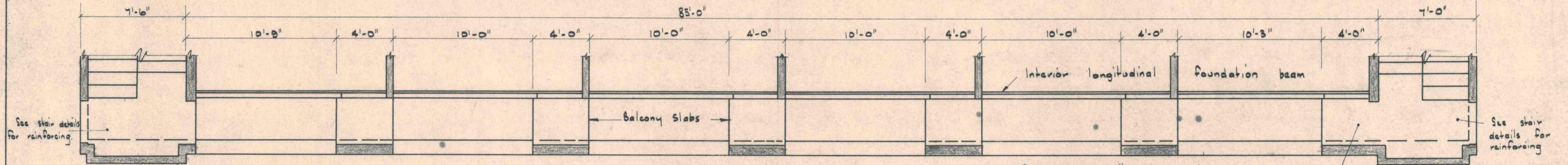
Provide torsion reinforcement in slab at all corners and at each intersection of transverse walls and slab edges. Torsion reinforcement shall be as for Block A.

KOTUKU FLATS — KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK C - SLAB PLAN	STEWART G. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON. PH. 46321	DWG. NO: 879/32
	DRAWN: J.J.D. TRACED: CBS CHECKED:	WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	
	DATE: 31-10-67 SCALES ¼", ½" = 1'-0"		NO. OF SHEETS:



ELEVATION SOUTH WALL - BLOCK D.

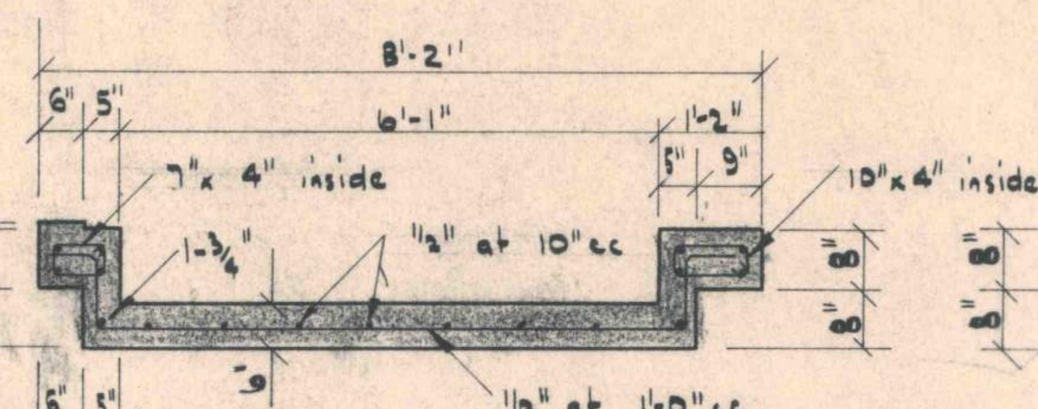
Column reinforcing is similar to that for columns in South Wall of Block A.



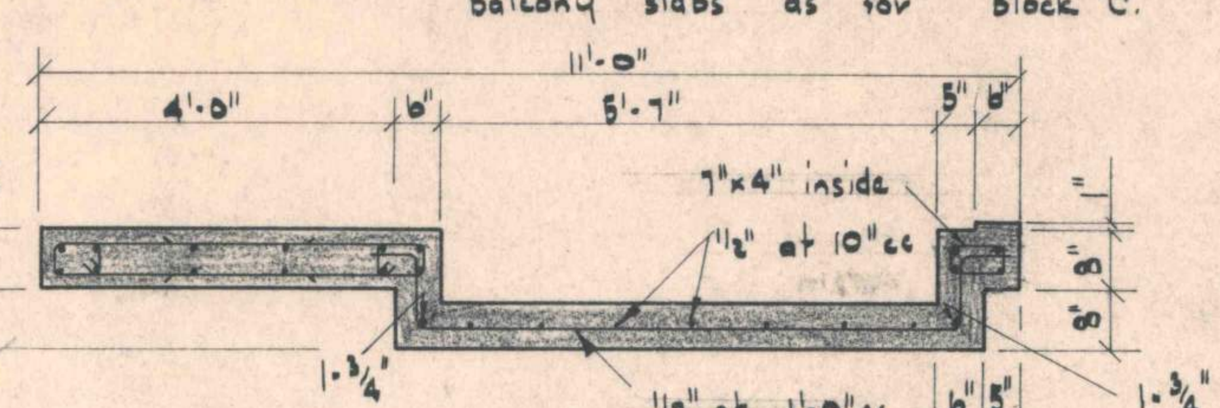
PLAN, SOUTH WALL FOUNDATION BEAMS

Interior longitudinal foundation beam as for Block C.
Balcony slabs as for Block C.

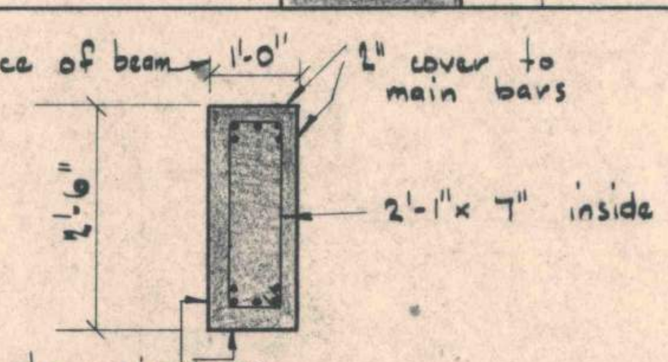
As corresponding slab for Block B.



SECTION A-A

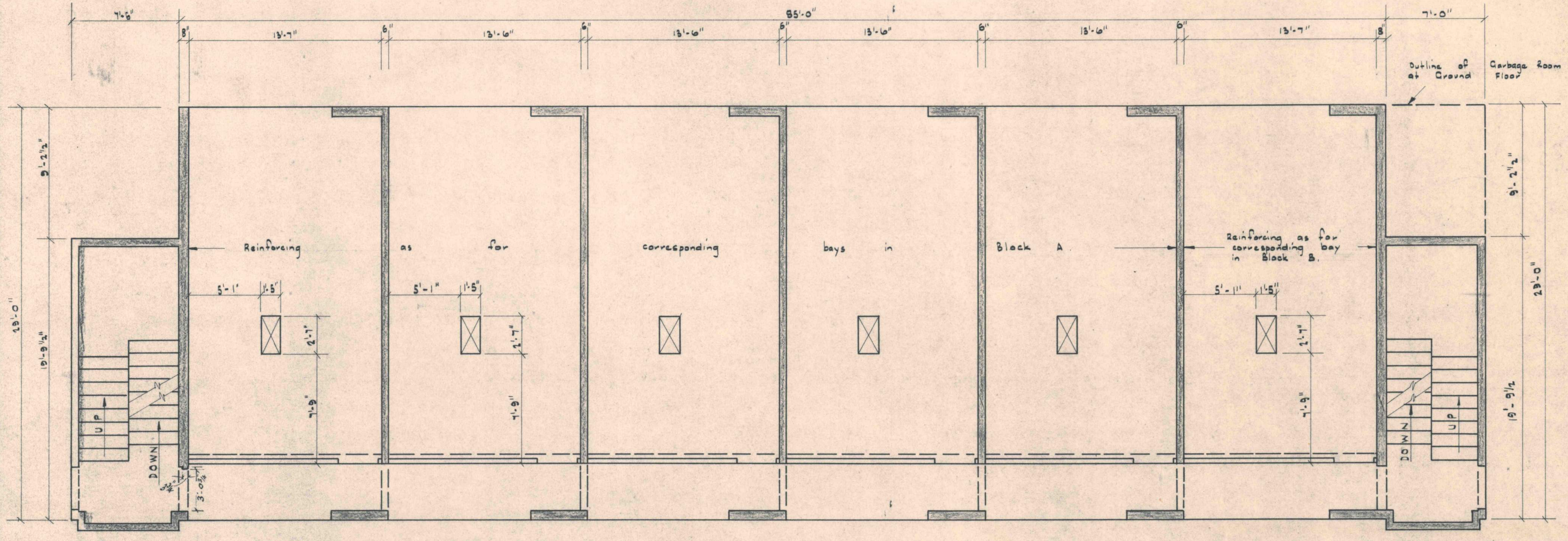


SECTION B-B



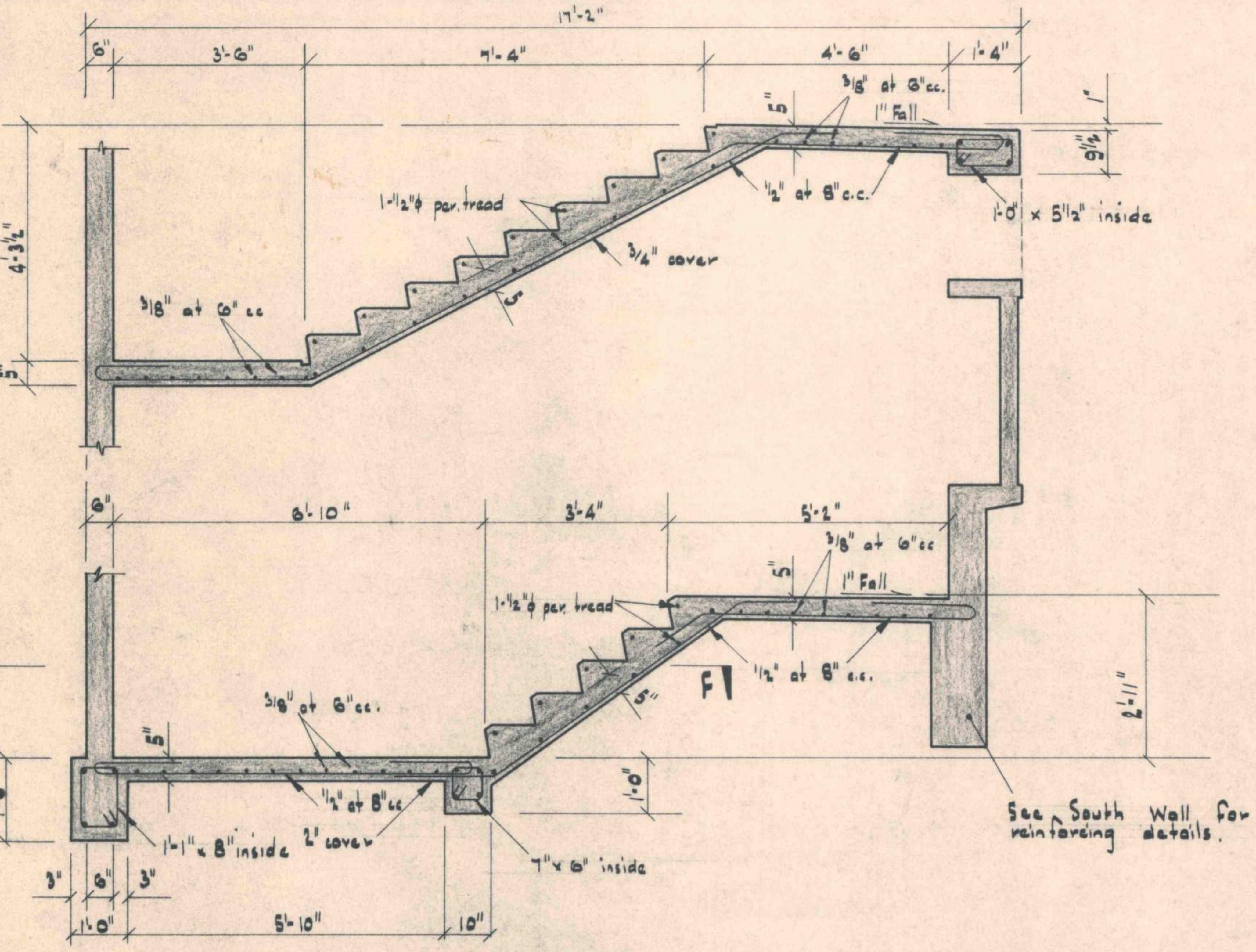
C-C

KOTUKU FLATS - KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK D - SOUTH WALL DRAWN: J.J.O. TRACED: C.B.S. CHECKED: DATE: SCALES: 1/4", 1/2" = 1'-0"	STEWART G. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 2, EVERTON TERRACE, WELLINGTON. PH. 40321 WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	DWG. NO: 879/33 NO. OF SHEETS:

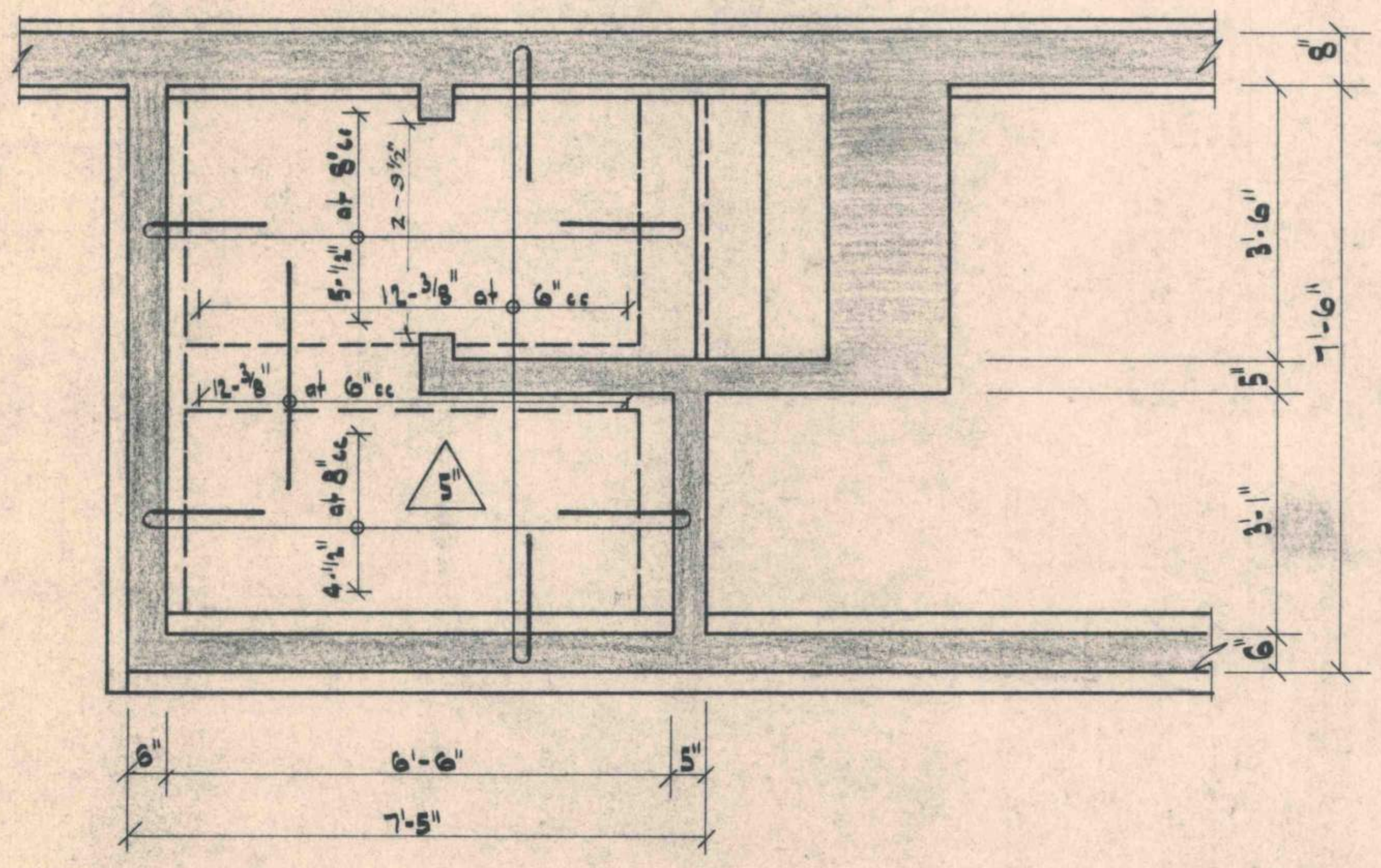


BLOCK D. - SLAB PLAN FOR 1ST., 2ND. & 3RD FLOORS.

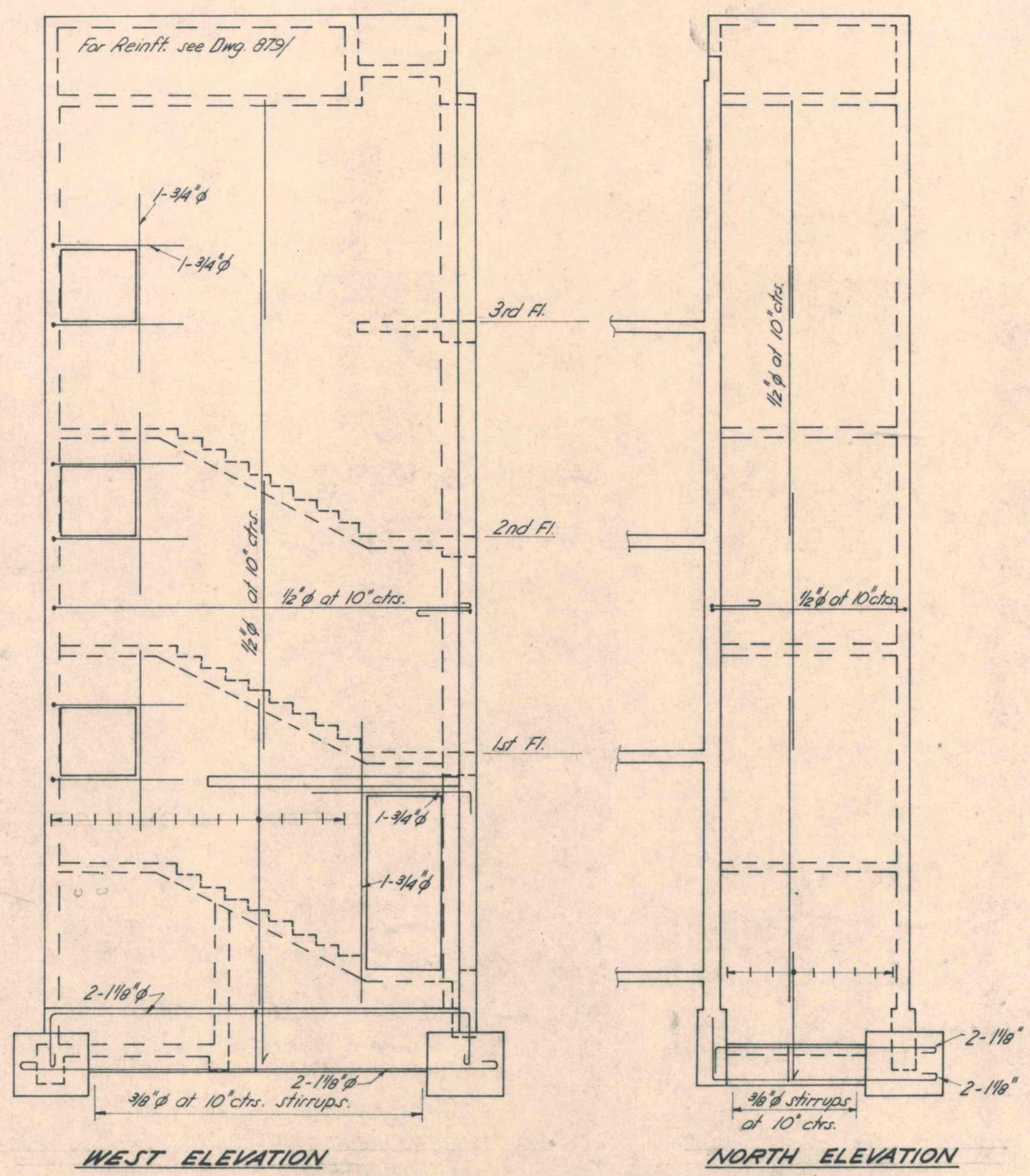
KOTUKU FLATS - KEMP ST., KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK D - SLAB PLAN DRAWN: J.J.O. TRACED: C.B.S. CHECKED: SCALES: 1/8", 1/2" = 1'-0" DATE: 2-11-67	STEWART C. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON. PH. 46321 WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION.	DWG. NO. 879/34 NO. OF SHEETS:



SECTION E-E



SECTION F-F

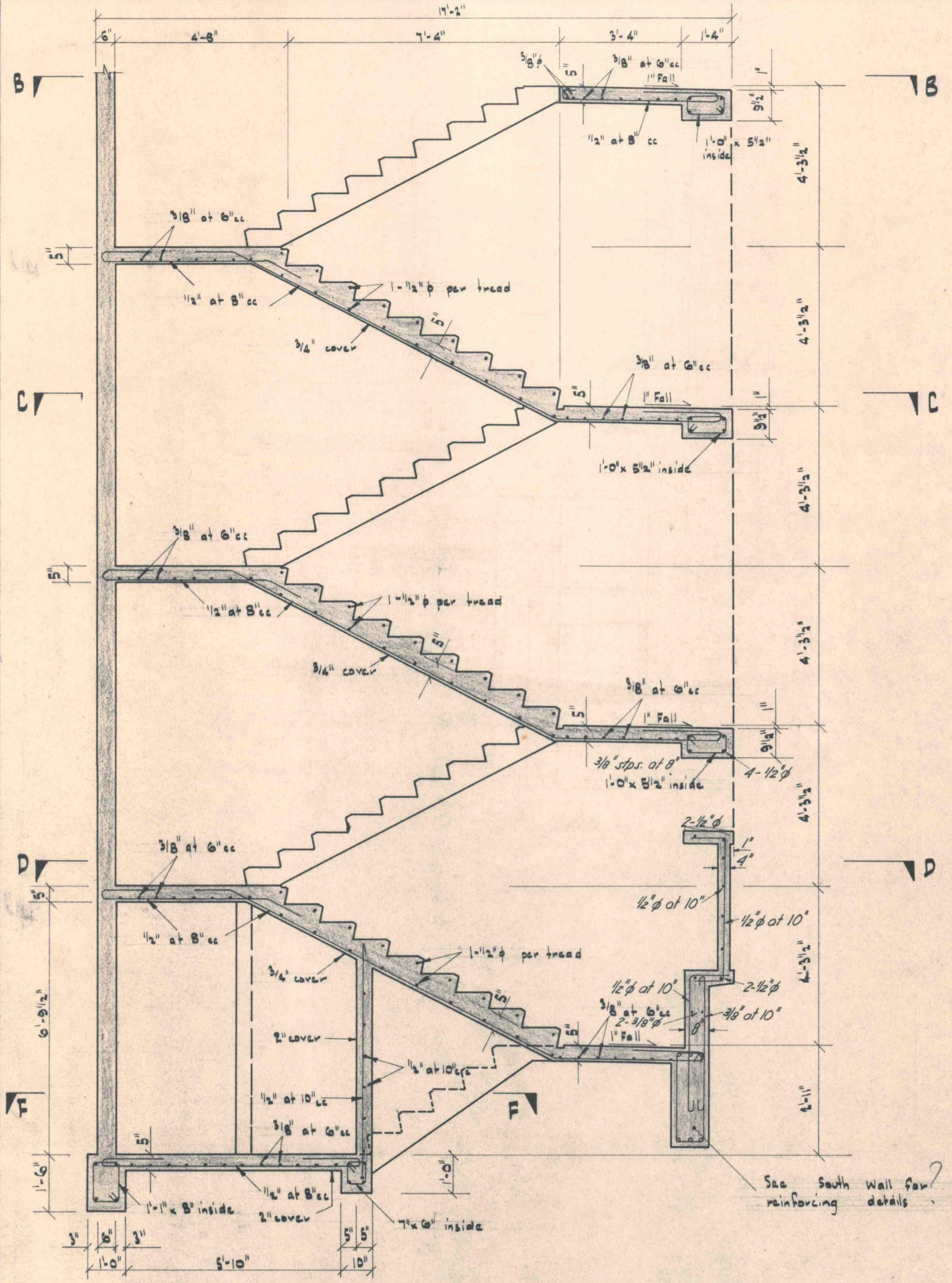


BLOCK D - WEST END

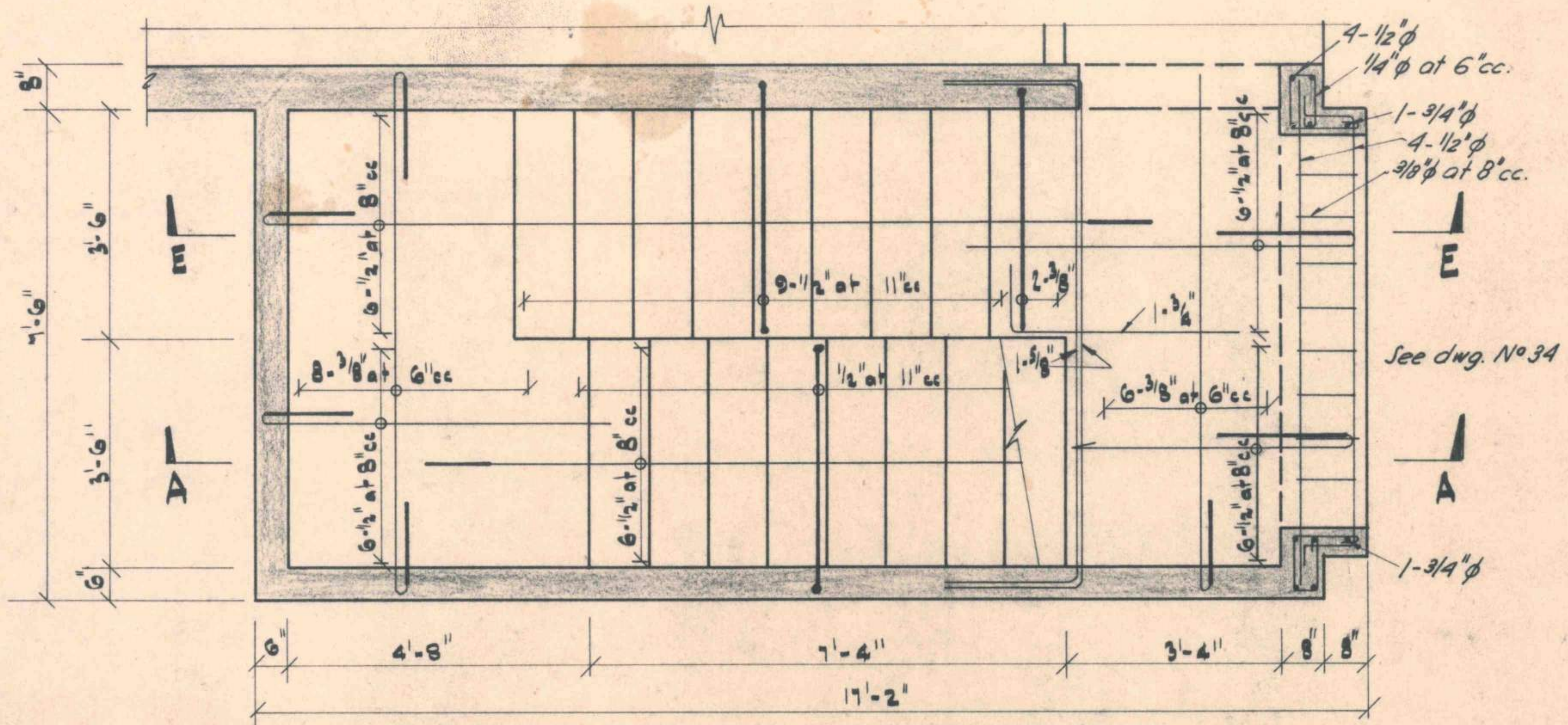
Scale: 1/4" = 1'-0"

10 holes

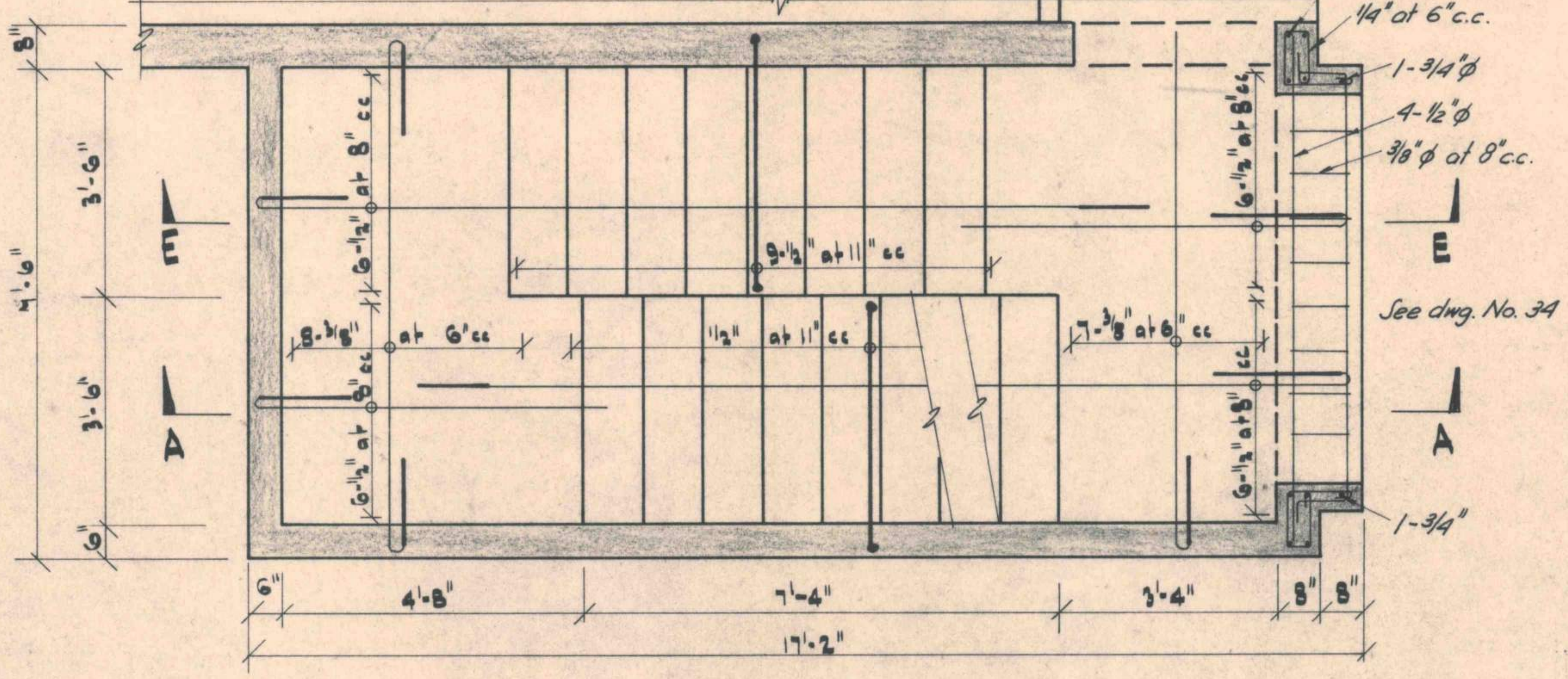
KOTUKU FLATS - KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK D - STAIRS AT WEST END DRAWN: JJO · TRACED: CBS · CHECKED: DATE: 22-3-68 · SCALES: 1/2" = 1'-0"	STEWART G. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON. WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	DWG. NO. 879/35



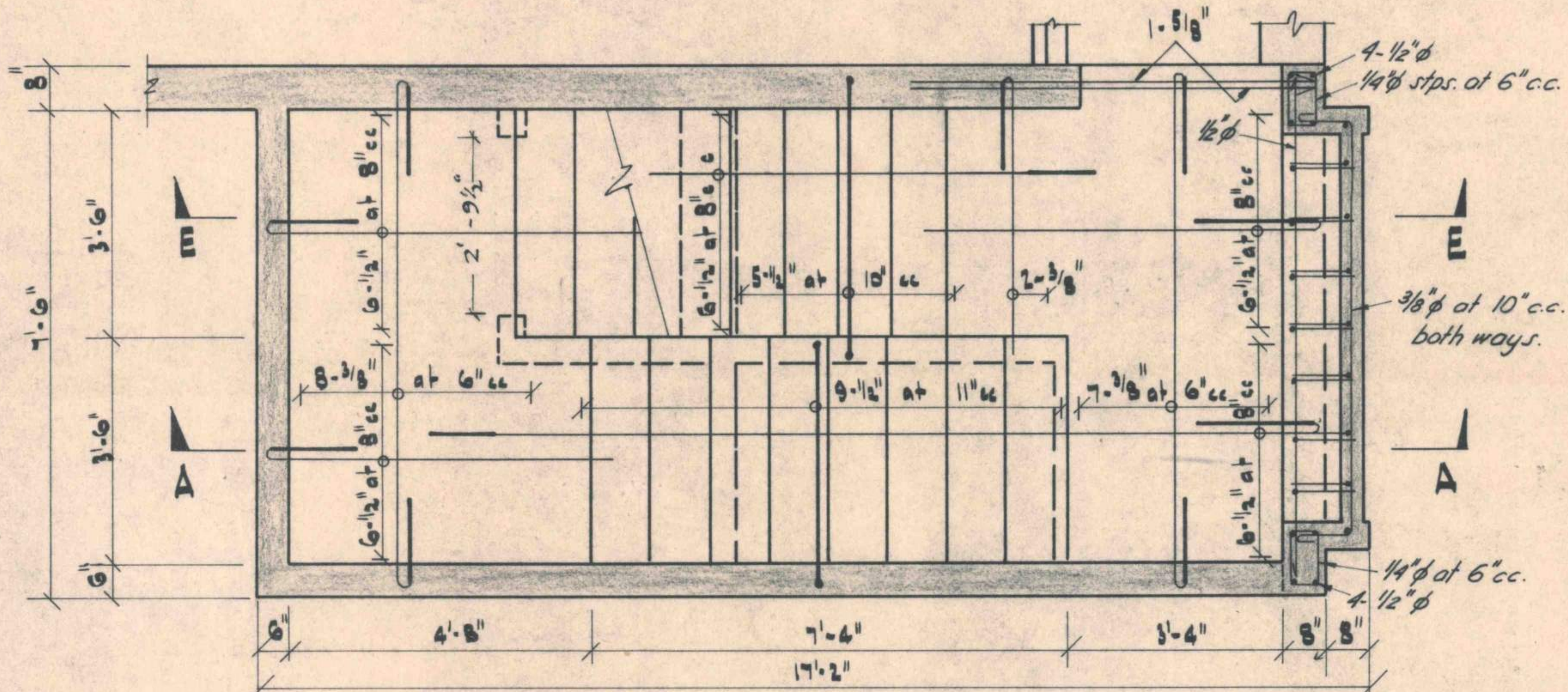
VERTICAL SECTION THROUGH STAIRS (SECTION A-A).



SECTION B-B

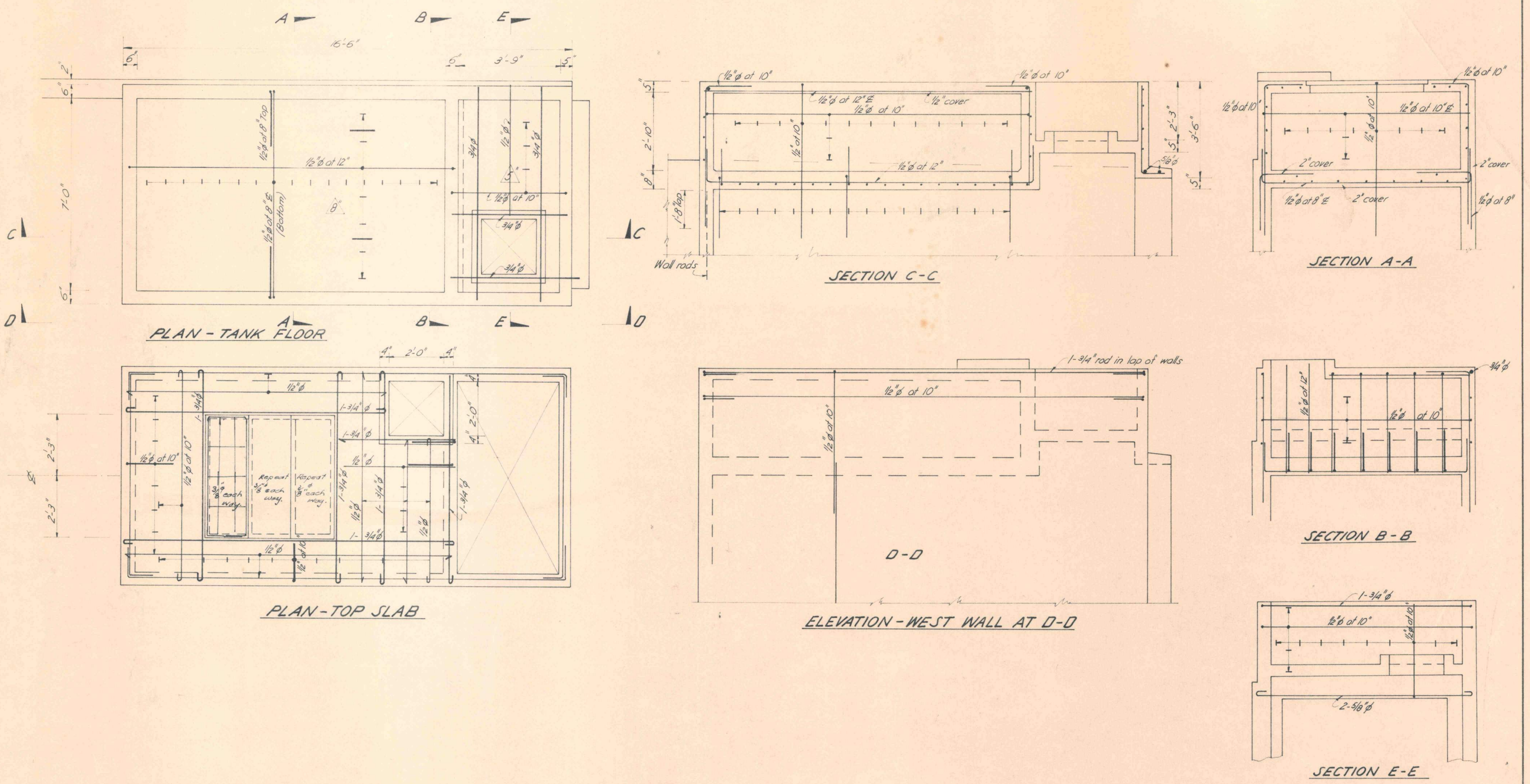


SECTION C-C



SECTION D-D

KOTUKU FLATS – KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK D. – STAIRS AT WEST END DRAWN: JJQ · TRACED: CBS · CHECKED: DATE: 22-3-68 · SCALES: 1/2" & 1/2" = 1'-0"	STEWART C. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 2, EVERTON TERRACE, WELLINGTON WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION.	DWG. NO: 879/36



10.10.68

KOTUKU FLATS - KEMP ST., KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK D - WEST END DETAILS - WATER TANK	STEWART G. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21 EVERTON TERRACE, WELLINGTON, PH. 46-321	DWG. NO:
	DRAWN: S.G.R. / TRACED: M.F. / CHECKED: S.G.R.	WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	879/37
	DATE: / SCALES:		No OF SHEETS:

247/1-44 + ~~[illegible]~~ 879/1-37

This is the Plan No......referred to in the Specification annexed to Contract made the ......day of..............19.69.between the Wellington City Council and..O.V.L. Builders Ltd

Deputy Town Clerk

O.V.L. BUILDERS LTD.

Contractor

Director

[Listed]

[193]

T.C

Wellington City Council

Kotuku Park Redevelopment

Structural Alterations

Design Features Report

Wellington City Council

Kotuku Park Redevelopment

Structural Alterations

Design Features Report

Prepared By [redacted]

Structural Engineer

Reviewed By [redacted]

Manager Structural Engineering

Opus International Consultants Ltd
Wellington Civil
L7, Majestic Centre, 100 Willis St
PO Box 12 003, Wellington 6144
New Zealand

Telephone: +64 4 471 7000
Facsimile: +64 4 471 1397

Date: February 2014
Reference: 4-60580.05
Status: For Building Consent

Contents

1 Introduction

The Wellington City Council proposes to complete a significant upgrade of Kotuku Flats as part of the Housing Upgrade Programme. Opus International Consultants Limited have been engaged to provide structural design services for the structural alterations required.

The following details the structure, assumptions and design parameters. The design has been completed to give the building an equivalent strength rating of 70% of New Building Standard (%NBS).

A producer statement of the associated works is included in Appendix C.

2 Building Description

2.1 Existing Building

Kotuku Park is comprised of four main residential blocks, of varying lengths but similar configurations. All blocks are four stories, with rectangular building layouts construction with in-situ reinforced concrete.

Concrete shears walls are the main resistance to any lateral seismic loads and vertical gravity loads in both directions. Long inter-tenancy transverse walls brace the building in the transverse direction and carry most of the weight, while short flexible walls brace the building on either side in the longitudinal direction.

Floors are typically 5 inch thick solid concrete slabs designed to span between inter-tenancy walls. The roof is generally lightweight, and ground floor a light timber floor supported by timber bearers, supported on concrete piles.

Pile foundations transfer vertical gravity loads and lateral seismic loads into the ground. The transverse walls sit directly on pile caps. The longitudinal walls sit on reinforced concrete ground beams that run the length of the buildings. These vary between sides, and span between the pile caps.

Blocks A and B connect, with a 50mm existing seismic gap between the two buildings.

2.2 Proposed Alterations

The key structural works being completed for Kotuku Park includes:

1. **Increasing the seismic gap between Blocks A and B**

   There is already an existing 50mm gap, however our analysis indicated that there is likely going to be more deflection at the top levels of the building. This could cause pounding and significant damage in this area in an earthquake event. We have therefore recommended this gap is increased to 150mm on levels 2 and 3 where the deflections are substantial at ULS. This will be achieved by cutting back the existing slab and replacing with a steel angle which can slide over the existing floor. We will not alter the roof as it is lightweight, and the damage will not be significant at ULS.

2. **Strengthening the longitudinal ground beam on the walkway side**

   Under seismic loading the existing ground beams will be subject to significant forces as they transfer the loads from the existing longitudinal walls to the piles. The ground beams on this side currently govern the capacity of the buildings, and we therefore propose to strengthen these to improve the seismic capacity of the buildings. We propose strengthening these beams by extending the width of the current beams, tying together with shear studs. We will also connect the new beam sections into the pile caps to ensure good load transfer. The new beam is to be continuous in the location of the longitudinal walls.

3. **Strengthening the longitudinal ground beams on the non-walkway side**

   The existing beams are having significant area of the concrete, top reinforcing bars and stirrups removed to accommodate the new doorways. In these locations, this greatly decreases the strength of the beams, and effects the anchoring connection at the base of the longitudinal walls. We are therefore adding new beams on either side of the existing beam to provide enough strength in the ground beams, ensuring good load transfer from the longitudinal walls to the new beams. The beam extensions are locally around areas of new doors. We are also improving the load transfer into the piles.

4. **Strengthening the transverse walls**

   Analysis confirmed where there are new door penetrations in the existing transverse walls, there will be inadequate tension capacity in the connection from the walls into the piles on the walkway side of the walls. The strength is only reduced in the walls where there are door penetrations on multiple levels. Strengthening is to be with a new steel tie, spanning two levels, bolted at regular centres to connect it to the existing wall, with a strong connection below ground floor level into the existing pile cap.

The structural drawings clearly show the works proposed, as included in Appendix A of this report.

3 Design Standards

A combination of NZSEE 2006 and NZS 3101 has been used in the assessment of the existing structures. Design of the strengthening works has been completed using NZS 3101 for all concrete elements, and NZS 3404 for design of the new steel tension tie.

The design standards used in this project include:

- NZS 3603: 1993
- NZS 3404: 1997
- NZS 3101: 2006
- NZS 1170.0: 2002
- NZS 1170.2: 2002
- NZS 1170.5: 2004

- NZS 2312:2002

4 Geotechnical and Soil Conditions

A preliminary geotechnical report for this project was completed in the concept design stage in 2011. This detailed the site as being located on reclaimed land fill, hard and domestic fill underlain by marine sediments, beach sand and sandy gravels. Below this is completely weathered greywacke, and therefore the site has been assessed to be Class C (Shallow Soil Site).

This information has been considered in the structural assessment. The geotechnical memo has been included in Appendix E of this report.

5 Design Loads

For the purposes of consideration of loading, this building is Importance Level 2 (IL2) in accordance with AS/NZS1170.0: 2002.

A live load on the roof of 0.25kPa was used, with 1.5kPa used for the accommodation areas, and 2kPa used for the balconies in accordance with NZS1170.1. It was found that generally, for the strengthening design, earthquake loads governed. The following design parameters were used:

- Importance Level: 2
- Soil Class: C
- Design Life: 50 years
- Ductility: 1.25

Further information is included in the structural calculations, as shown in Appendix D.

6 Serviceability Criteria

Particular elements are designed to the recommended serviceability deflection limits of AS/NZS 1170.0: 2002, Table C1. This is for earthquake loadings, gravity loadings, and wind loadings where appropriate.

7 Design Life for Durability

All structural elements of the building have been designed for a design life of 50 years.

The exposure zones used for durability for the concrete elements is B2, in accordance with NZS 3101.

For the timber framing and fixings, durability was in consideration with requirements of NZS3604.

For the steelwork, requirements were in accordance with NZS/AS 2312 2002 and NZS 3404.1 2009.

Further details of protection is included in the structural drawings, and specification included in Appendix C of this report.

8 Construction Monitoring

The design is based on the verification of specific design B1/VM1/VM4 aspects to the construction by a suitably qualified Chartered Professional Engineer in accordance with ACENZ/IPENZ level to CM3.

We confirm that Opus International Consultants Limited have been engaged to undertake construction monitoring to the recommended level above.

We intend to complete inspections of the following for this building:

1. Inspections of the reinforcing cages before the ground beams on the walkway side are poured.
2. Inspections of the reinforcing cages before the ground beams on the non-walkway side are poured, including remediation works for penetrations made in the existing ground beams.
3. Inspection of the penetrations made in the existing transverse walls for the doorways, and remediation works.
4. Inspection of the new steel tie beams installed.
5. Inspection of the new seismic gap.

Appendix A: Structural Drawings

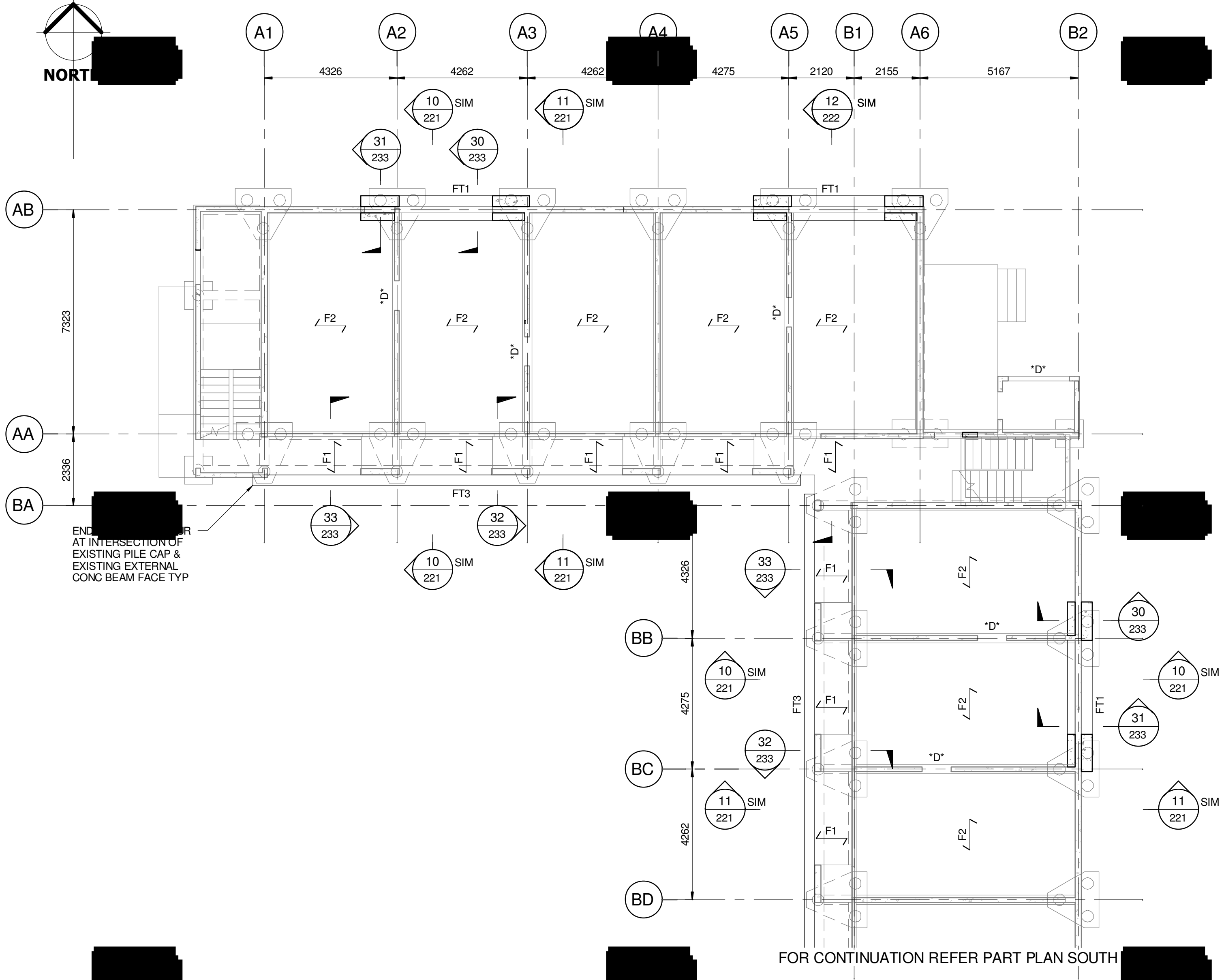
OPUS

WCC HOUSING UPGRADE PROGRAMME
KOTUKU PARK REDEVELOPMENT
5 KEMP STREET, KILBIRNIE, WELLINGTON

STRUCTURAL
BUILDING CONSENT

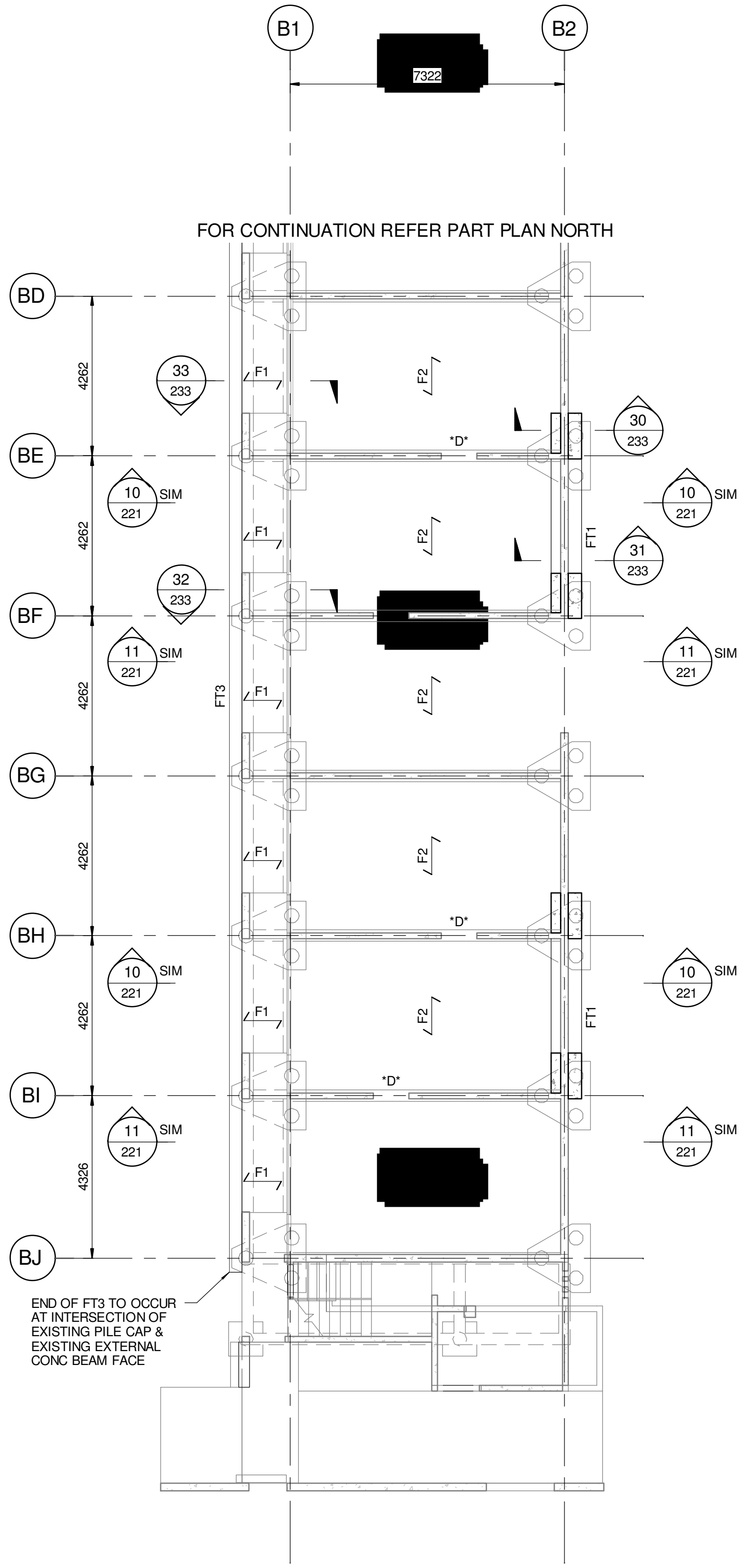
DIPs No: 5 / 2445 / 1 / 7502
Project No: 4-60580.05

Date: 17/02/2014 4:35:14 p.m.



BLOCKS A & B GROUND FLOOR PART PLAN NORTH

SCALE 1 : 100



BLOCK B GROUND FLOOR PART PLAN SOUTH

SCALE 1 : 100

NOTES

1. ALL DRAWINGS TO BE READ IN CONJUNCTION WITH THE OPUS STRUCTURAL SPECIFICATION.
2. EXISTING STRUCTURE IS SHOWN INDICATIVELY ONLY. VERIFY DIMENSIONS & CONFIGURATION OF EXISTING STRUCTURE ON SITE BEFORE COMMENCING ANY WORKS & NOTIFY ENGINEER IF ANY DIFFERENCES TO WHAT IS INDICATED ON THE DRAWINGS ARE ENCOUNTERED.
3. REFER TO ARCHITECTS DRAWINGS FOR ALL SET OUT DIMENSIONS, LEVELS, FALLS, SLAB SET DOWNS, REBATES, EDGE DETAILS & CAST IN ARCHITECTURAL ITEMS UNLESS NOTED OTHERWISE.
4. ANY SERVICES PENETRATIONS & FIXTURES SHOWN ARE SHOWN INDICATIVELY ONLY. REFER SERVICES DRAWINGS FOR LOCATION & SIZE OF SERVICES, SERVICES PENETRATIONS & SERVICES FIXTURES UNLESS NOTED OTHERWISE.
5. EXISTING CONCRETE TO BE REMOVED SHALL BE SAWCUT AT THE EXTENT OF DEMOLITION. ALL EXPOSED REINF TO BE GROUND DOWN 20mm, PRIMED WITH SIKA MONOTOP PRIMER & REPAIRED WITH SIKA REPAIR MORTAR.

LEGEND

FT1 THICKENING TO EXISTING OUTER FOUNDATION/EXISTING WALLS ACROSS 1 BAY. 350 THICKENING TO EXTERNAL FACE. 250 THICKENING TO INTERNAL FACE. REFER DRAWINGS 231, 232 & 233 FOR DETAILS.

FT2 THICKENING TO EXISTING OUTER FOUNDATION/EXISTING WALLS ACROSS 2 BAYS. 350 THICKENING TO EXTERNAL FACE. 250 THICKENING TO INTERNAL FACE. REFER DRAWINGS 231 & 233 FOR DETAILS.

FT3 THICKENING TO EXISTING WALKWAY FOUNDATION. 350 THICKENING TO EXTERNAL FACE. REFER DRAWING 233 FOR DETAILS. NOTE THAT FT3 TOP & BTM LONGITUDINAL BARS TO HAVE 90° VERT FULL LENGTH HOOKS OCCURING ADJACENT TO THE END CONC FACES SIM TO THE REINF ELEVATIONS SHOWN ON DRAWING 232.

EXISTING CONC WALL (THICKNESSES VARY).

"D" OPENING FOR DOOR CUT IN EXISTING CONC WALL. REFER ARCH DRAWINGS FOR DIMENSIONS.

F1 EXISTING CONC SLAB (THICKNESS VARIES).

F2 EXISTING TIMBER FLOORING SYSTEM (NOT SHOWN). 5"x2"-18" JOISTS ON 4"x3" BEARERS ON CONC PILES.

Revision	Amendment	Approved	Revision Date
1	FOR BUILDING [redacted]	C.V.A	18.02.2014

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Drawn	Designed	Approved	Revision Date
W.E	C.W	s(7)(2)(a)	31.01.2014

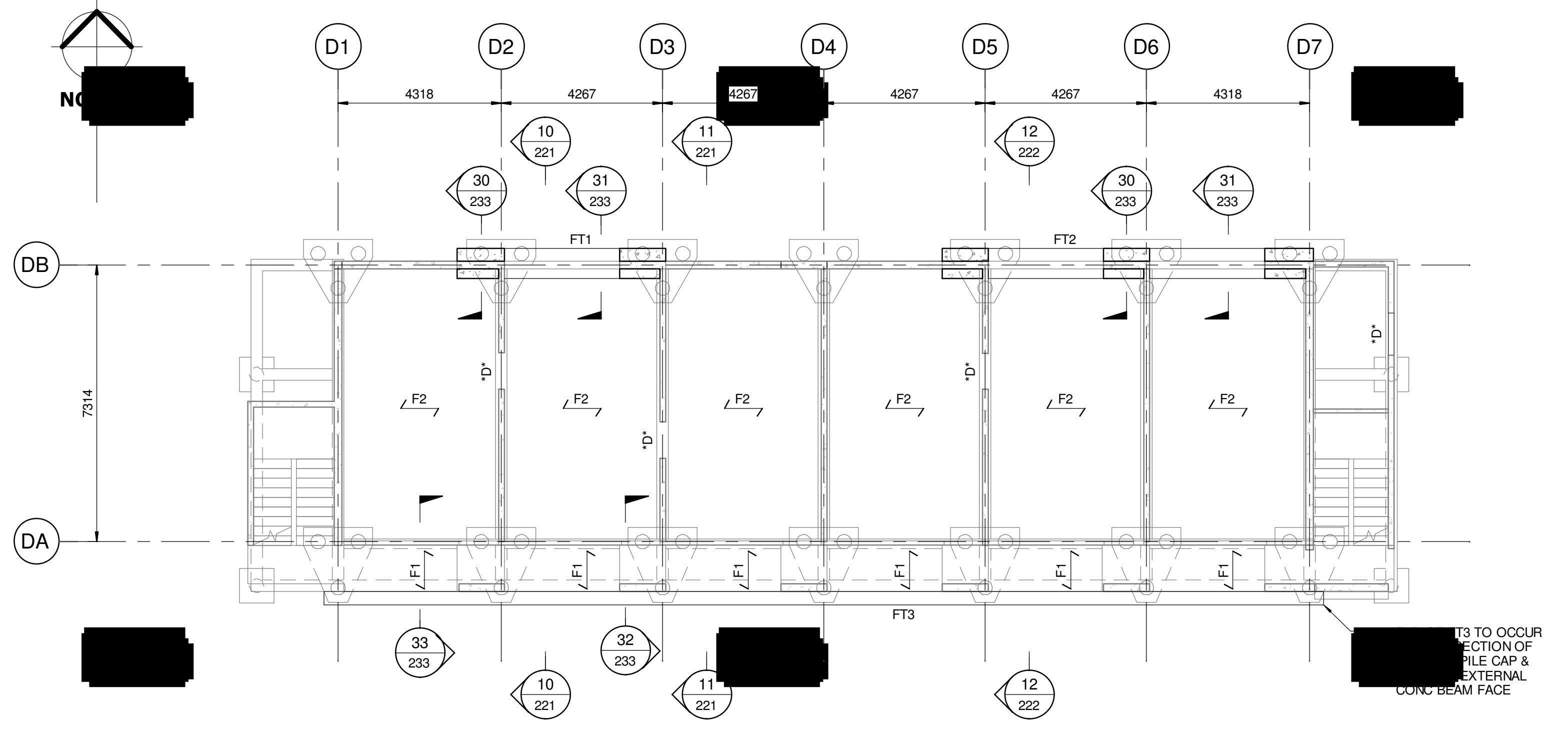
Project No.	Scale
4-60580.05	As indicated

Project
WCC HOUSING UPGRADE PROGRAMME
KOTUKU PARK REDEVELOPMENT
5 KEMP STREET, KILBIRNIE, WELLINGTON

Title
BLOCKS A & B
GROUND FLOOR PLANS

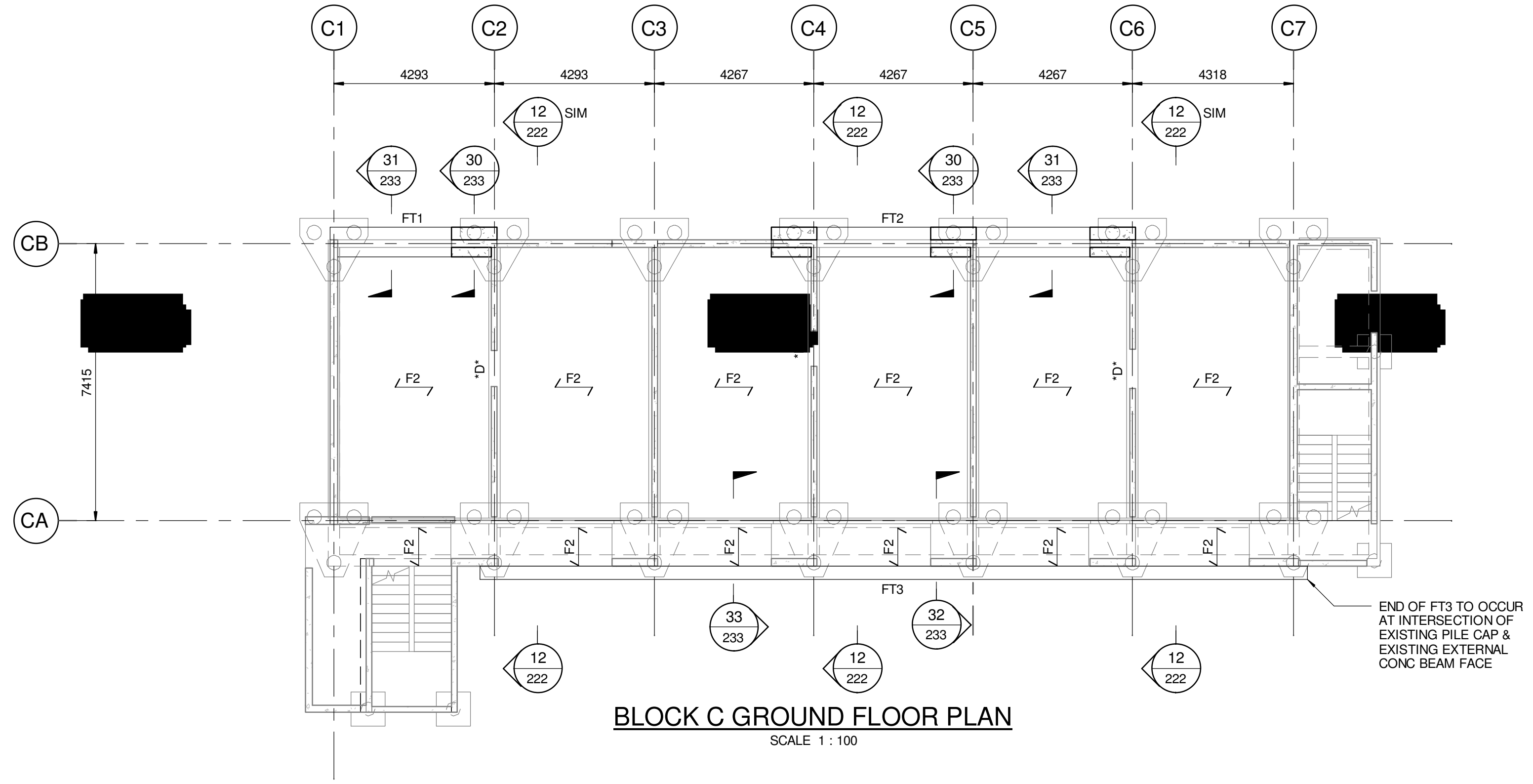
BUILDING CONSENT

Drawing No.	Sheet No.	Revision
5 / 2445 / 1 / 7502	211	R1



BLOCK D GROUND FLOOR PLAN

SCALE 1 : 100



BLOCK C GROUND FLOOR PLAN

SCALE 1 : 100

NOTES

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3. REFER TO ARCHITECTS DRAWINGS FOR ALL SET OUT DIMENSIONS, LEVELS, FALLS, SLAB SET DOWNS, REBATES, EDGE DETAILS & CAST IN ARCHITECTURAL ITEMS UNLESS NOTED OTHERWISE.
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LEGEND

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═	EXISTING CONC WALL (THICKNESSES VARY).
"D"	OPENING FOR DOOR CUT IN EXISTING CONC WALL. REFER ARCH DRAWINGS FOR DIMENSIONS.
F1	EXISTING CONC SLAB (THICKNESS VARIES).
F2	EXISTING TIMBER FLOORING SYSTEM (NOT SHOWN). 5"x2"-18" JOISTS ON 4"x3" BEARERS ON CONC PILES.

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Project No.	Scale
4-60580.05	As indicated

Project

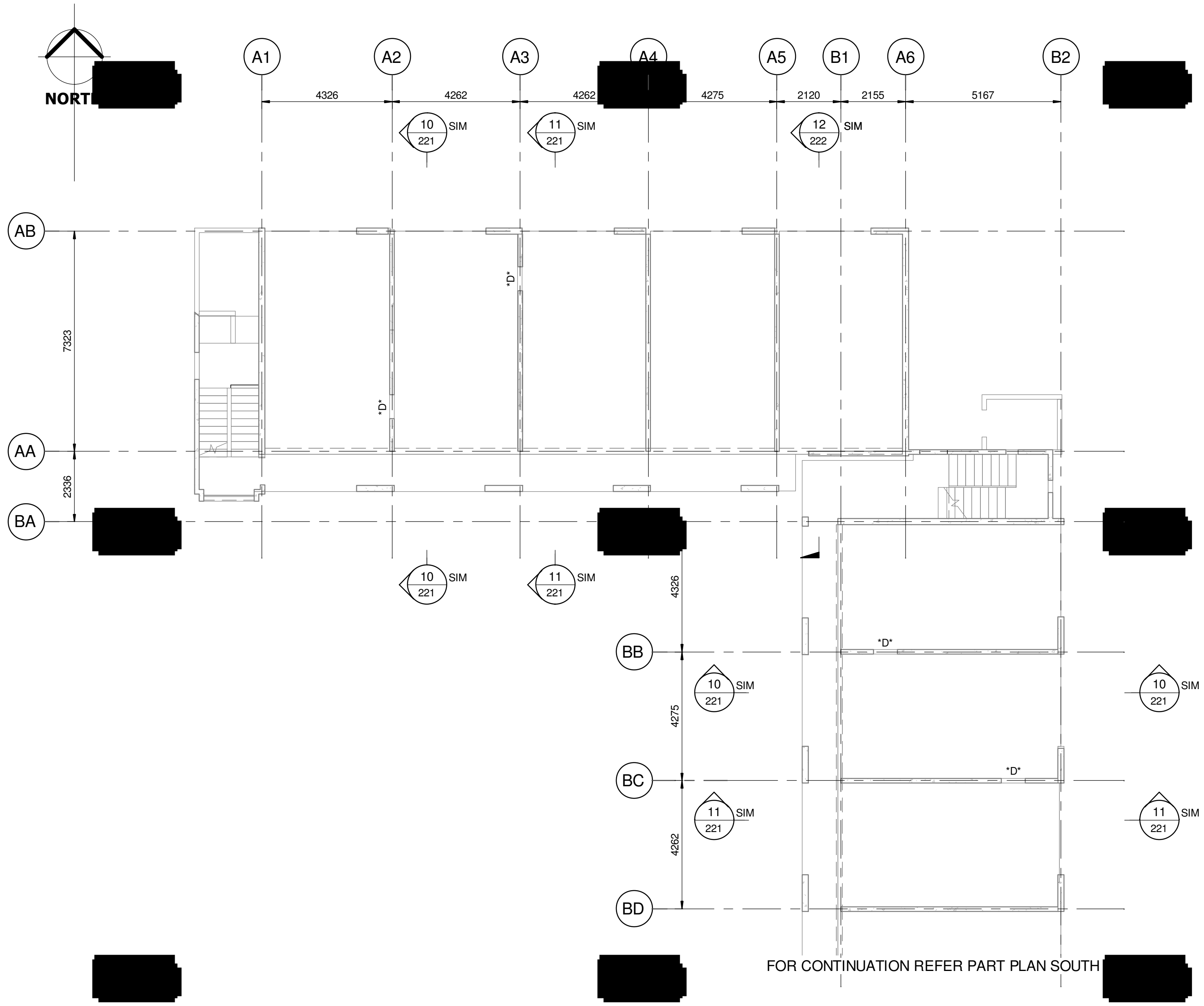
WCC HOUSING UPGRADE PROGRAMME
KOTUKU PARK REDEVELOPMENT
5 KEMP STREET, KILBIRNIE, WELLINGTON

Title

BLOCKS C & D
GROUND FLOOR PLANS

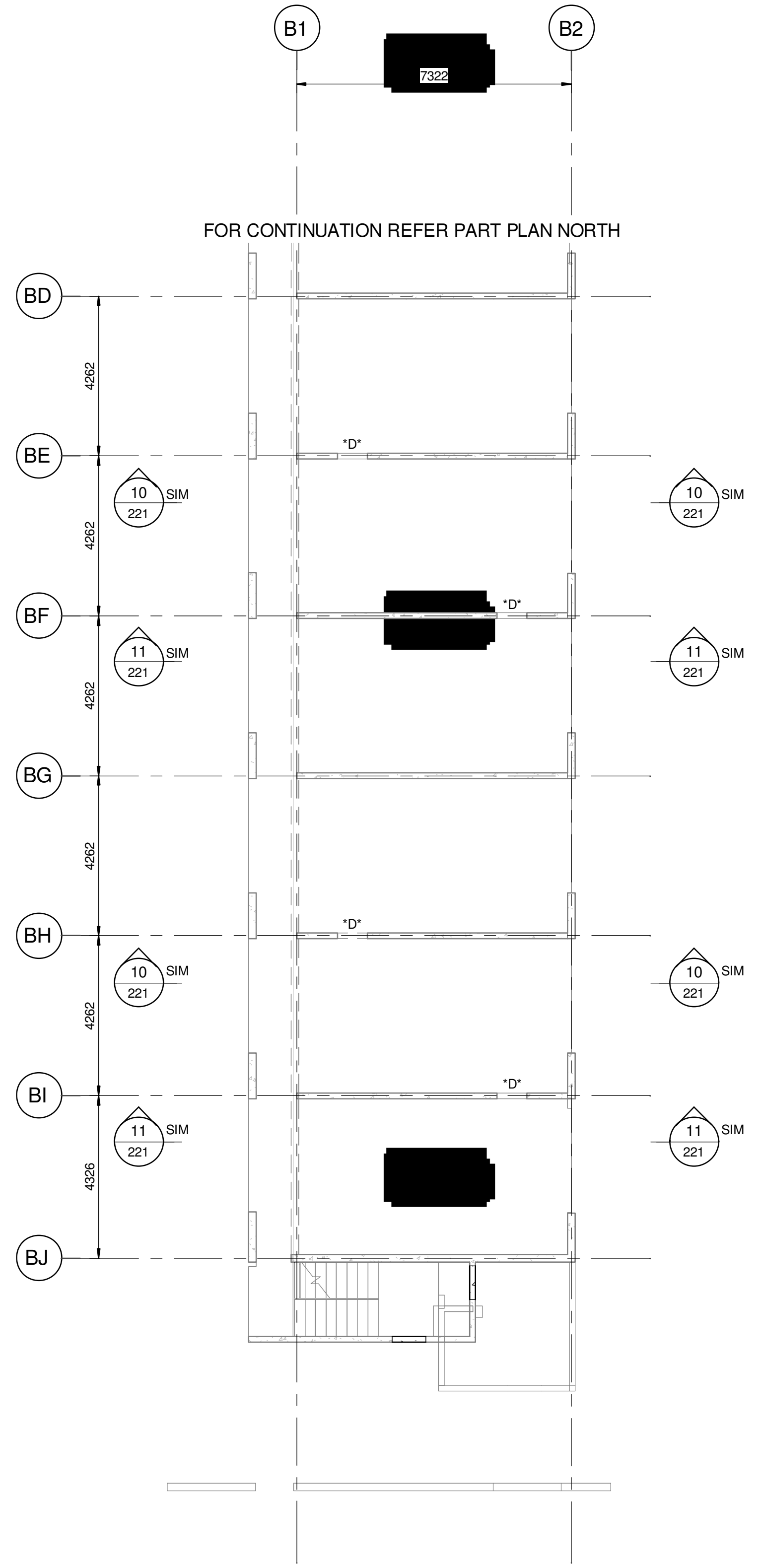
BUILDING CONSENT

Drawing No.	Sheet No.	Revision
5 / 2445 / 1 / 7502	212	R1



BLOCKS A & B LEVEL 1 PART PLAN NORTH

SCALE 1 : 100



BLOCK B LEVEL 1 PART PLAN SOUTH

SCALE 1 : 100

NOTES

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LEGEND

EXISTING CONC WALL (THICKNESSES VARY).

"D" OPENING FOR DOOR CUT IN EXISTING CONC WALL. REFER ARCH DRAWINGS FOR DIMENSIONS.

Revision	Amendment	Approved	Revision Date
1	FOR BUILDING [redacted]	C.V.A	18.02.2014

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W.E	C.W	[redacted] s(7)(2)(a)	31.01.2014

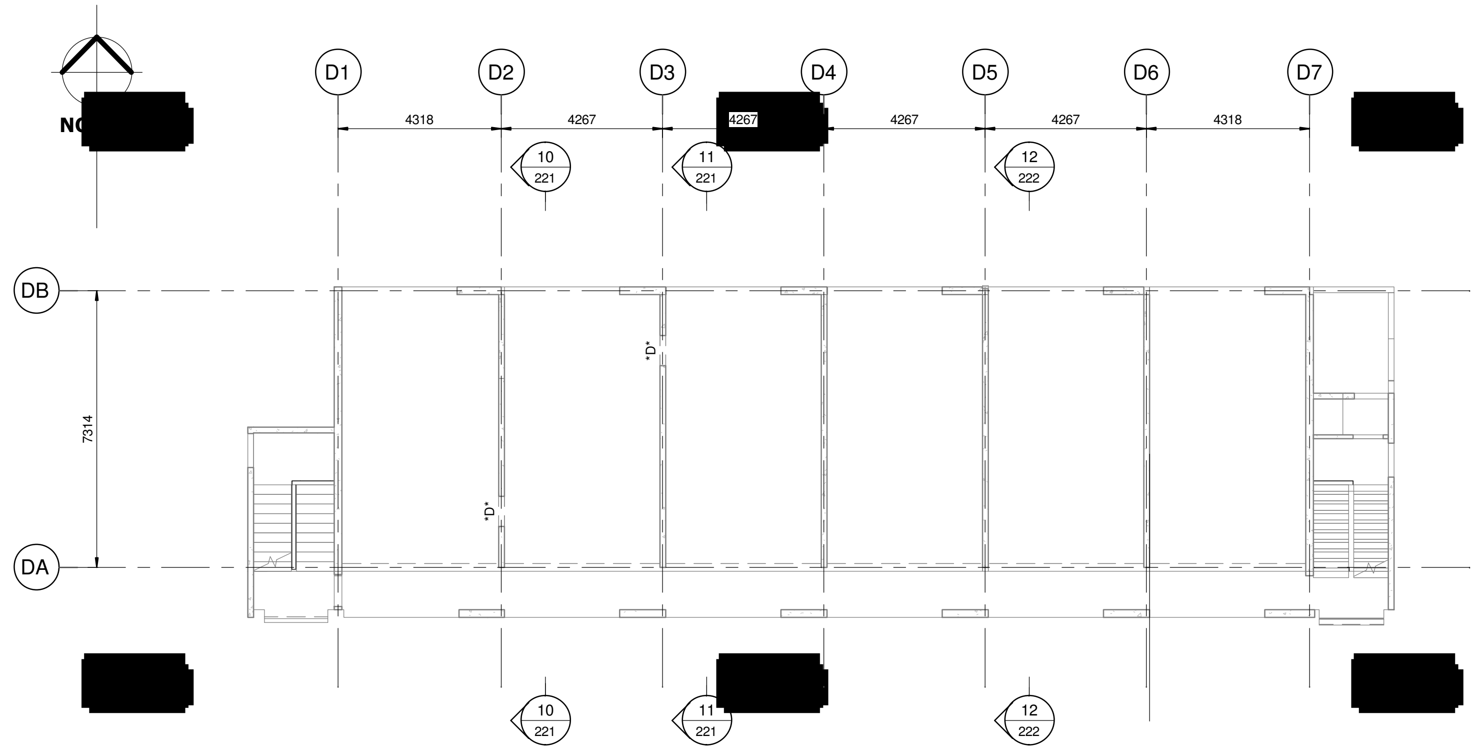
Project No.
4-60580.05 [redacted] As indicated

Project
WCC HOUSING UPGRADE PROGRAMME
KOTUKU PARK REDEVELOPMENT
5 KEMP STREET, KILBIRNIE, WELLINGTON

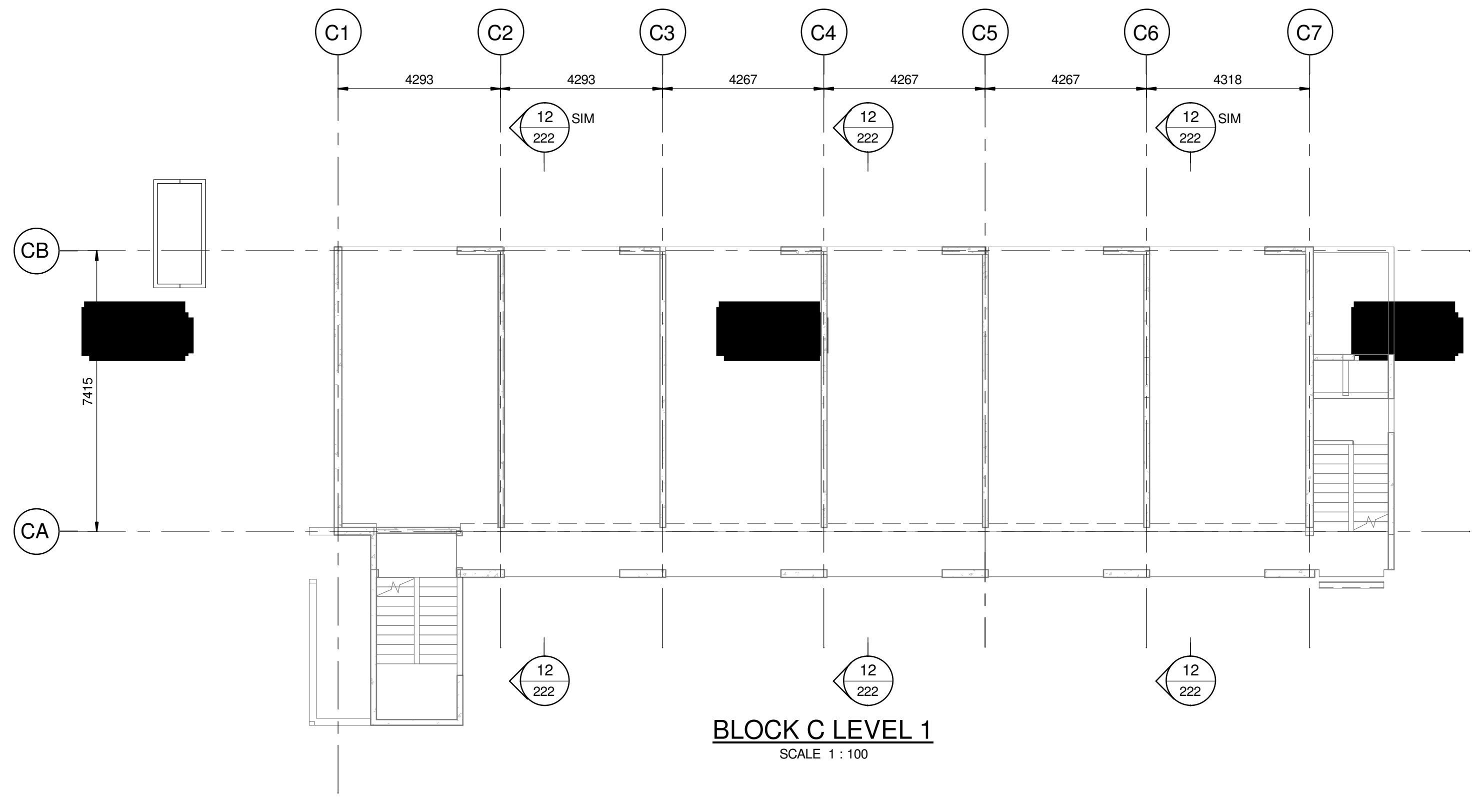
Title
BLOCKS A & B
LEVEL 1 PLANS

BUILDING CONSENT

Drawing No.	Sheet No.	Revision
5 / 2445 / 1 / 7502	213	R1



BLOCK D LEVEL 1
SCALE 1 : 100



BLOCK C LEVEL 1
SCALE 1 : 100

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4-60580.05	As indicated

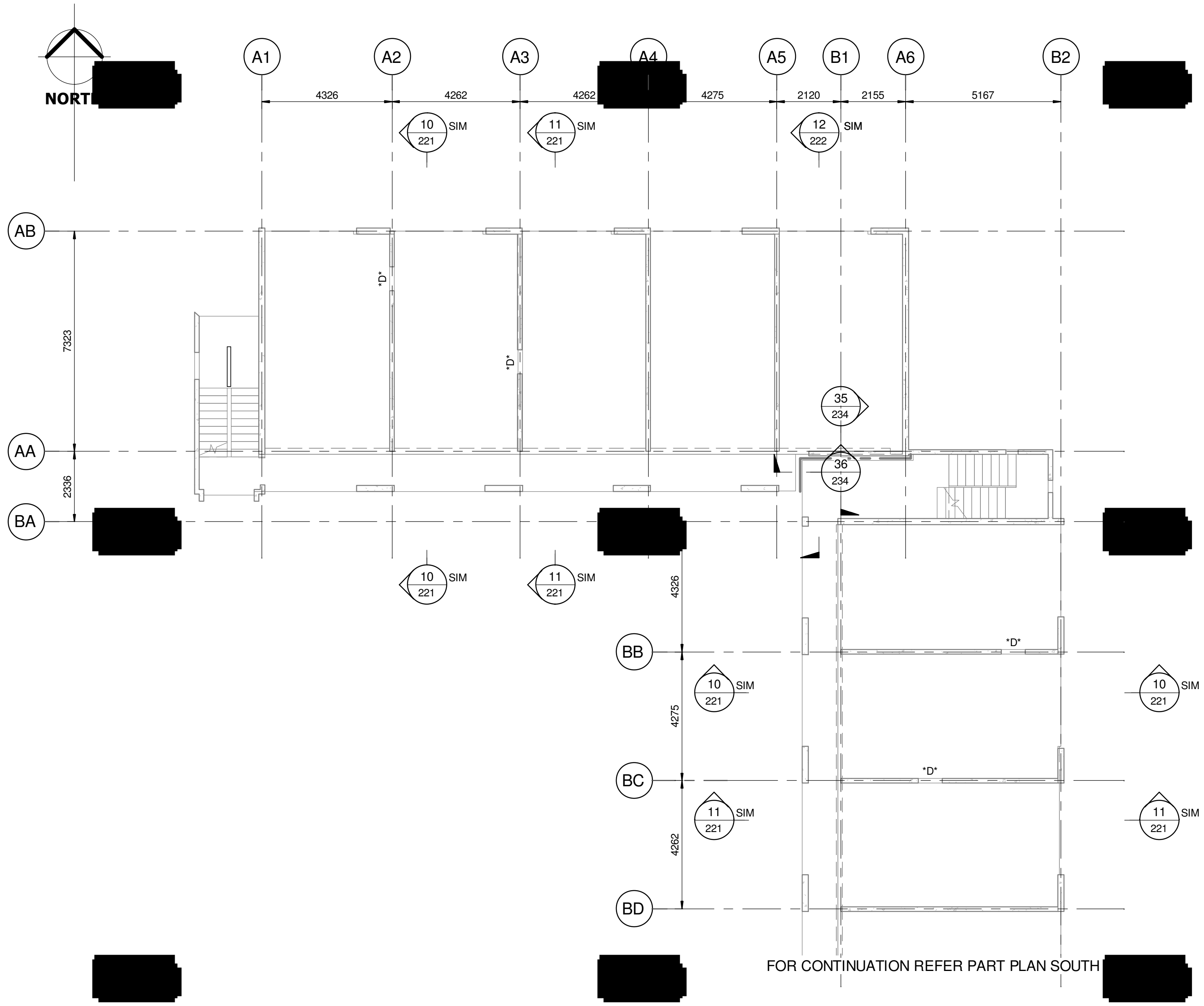
Project
WCC HOUSING UPGRADE PROGRAMME
KOTUKU PARK REDEVELOPMENT
5 KEMP STREET, KILBIRNIE, WELLINGTON

Title
BLOCKS C & D
LEVEL 1 PLANS

BUILDING CONSENT

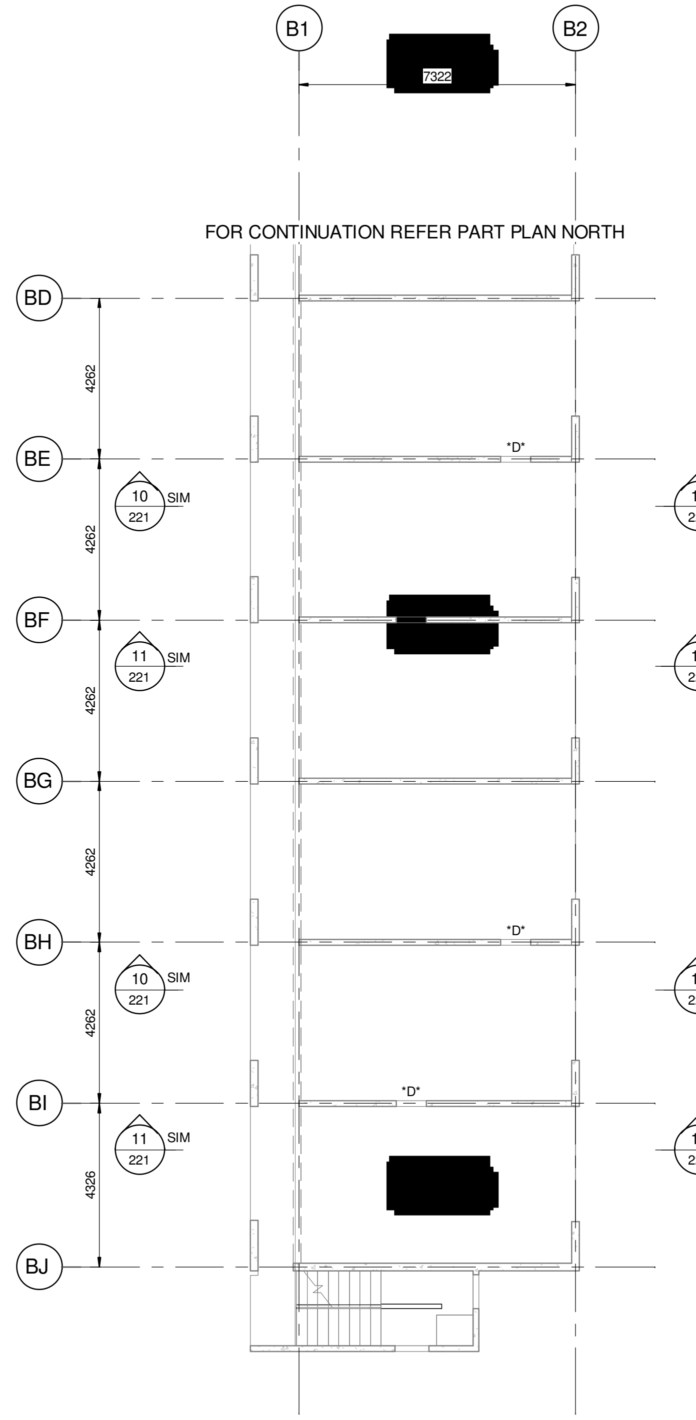
Drawing No.	Sheet No.	Revision
5 / 2445 / 1 / 7502	214	R1

Original sheet size A1 (841x594) Plot date: 17/02/2014 4:35:20 p.m. C:\#Revit Working\4-60580.05 Kotuku\KOTUKU_PARK_BLOCK_STRUCTURAL_LOCAL_(2014)_wewhe0.rvt



BLOCKS A & B LEVEL 2 PART PLAN NORTH

SCALE 1 : 100



BLOCK B LEVEL 2 PART PLAN SOUTH

SCALE 1 : 100

NOTES

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LEGEND

EXISTING SEISMIC GAP IN FLOOR SLAB BETWEEN BLOCKS A & B WIDENED TO 150mm. REFER DRAWING 234 FOR DETAILS.

EXISTING CONC WALL (THICKNESSES VARY).

"D" OPENING FOR DOOR CUT IN EXISTING CONC WALL. REFER ARCH DRAWINGS FOR DIMENSIONS.

Revision	Amendment	Approved	Revision Date
1	FOR BUILDING [redacted]	C.V.A	18.02.2014

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Drawn	Designed	Approved	Revision Date
W.E	C.W	s(7)(2)(a) [redacted]	31.01.2014

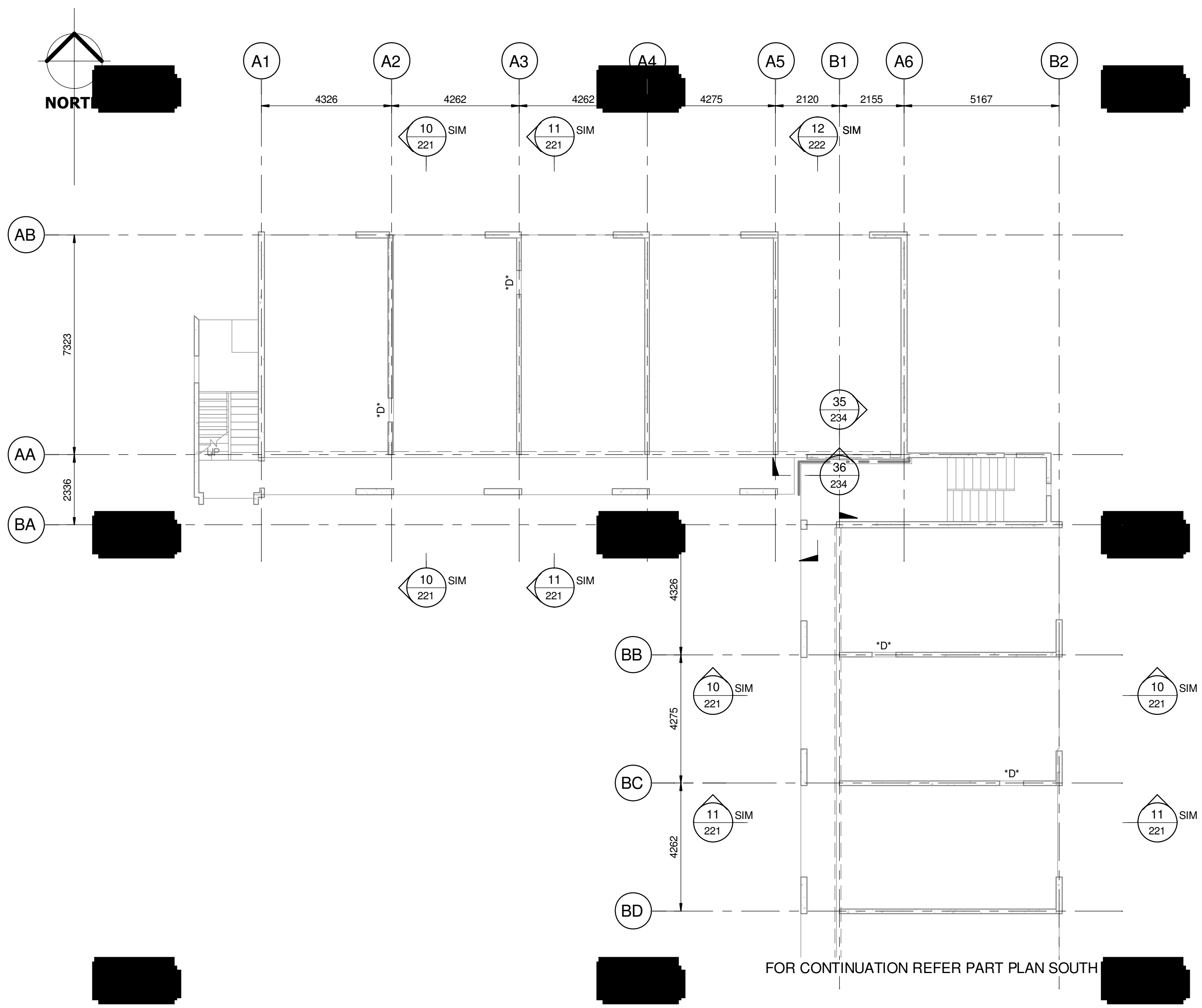
Project No.	Scale
4-60580.05	As indicated

Project
WCC HOUSING UPGRADE PROGRAMME
KOTUKU PARK REDEVELOPMENT
5 KEMP STREET, KILBIRNIE, WELLINGTON

Title
BLOCKS A & B
LEVEL 2 PLANS

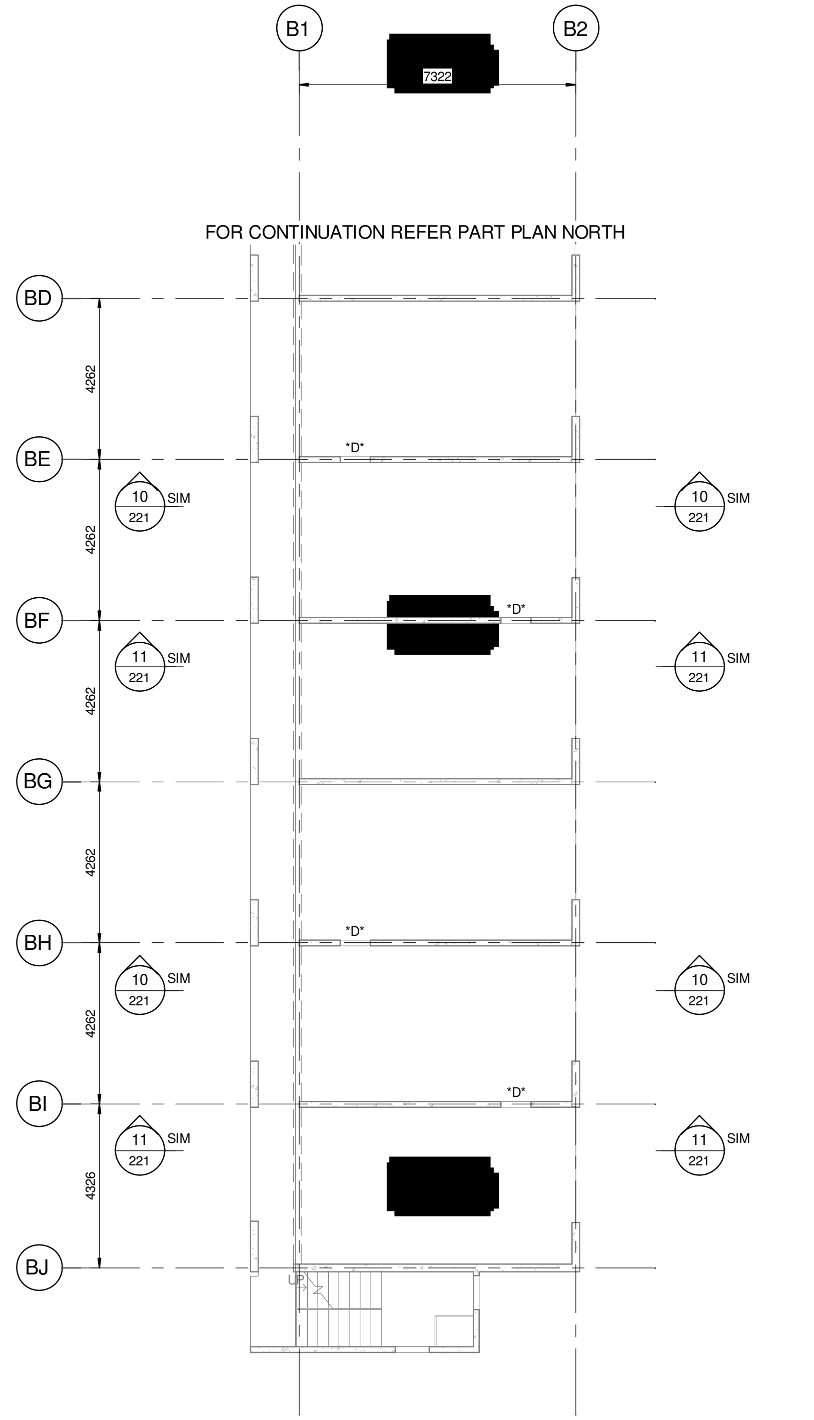
BUILDING CONSENT

Drawing No.	Sheet No.	Revision
5 / 2445 / 1 / 7502	215	R1



BLOCKS A & B LEVEL 3 PART PLAN NORTH

SCALE 1 : 100



BLOCK B LEVEL 3 PART PLAN SOUTH

SCALE 1 : 100

NOTES

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LEGEND

- EXISTING SEISMIC GAP IN FLOOR SLAB BETWEEN BLOCKS A & B WIDENED TO 150mm. REFER DRAWING 234 FOR DETAILS.
- EXISTING CONC WALL (THICKNESSES VARY).
- "D" OPENING FOR DOOR CUT IN EXISTING CONC WALL. REFER ARCH DRAWINGS FOR DIMENSIONS.

Revision	Amendment	Approved	Revision Date
1	FOR BUILDING [redacted]	C.V.A	18.02.2014

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Drawn	Designed		Revision Date
W.E	C.W	s(7)(2)(a) [redacted]	31.01.2014

Project No.	Scale
4-60580.05	As indicated

Project

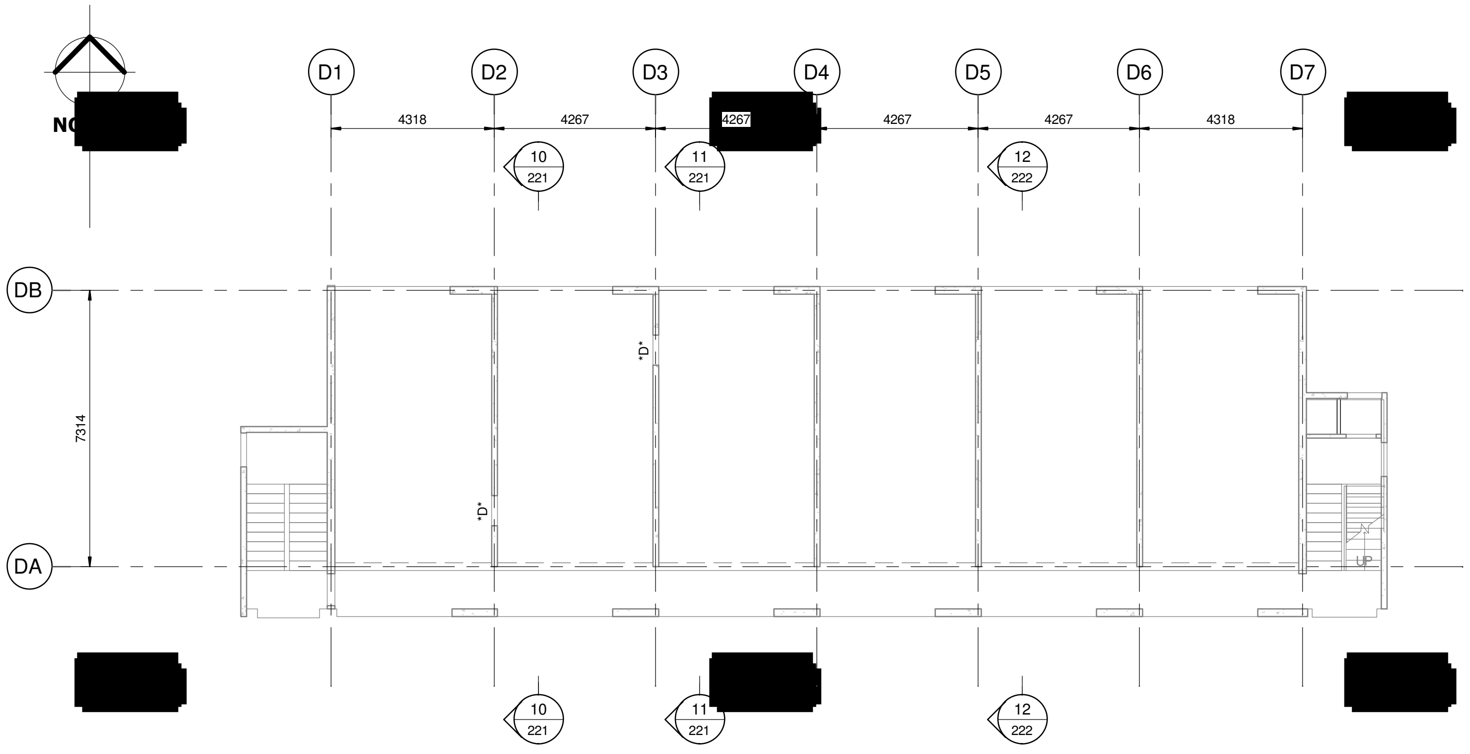
WCC HOUSING UPGRADE PROGRAMME
KOTUKU PARK REDEVELOPMENT
5 KEMP STREET, KILBIRNIE, WELLINGTON

Title

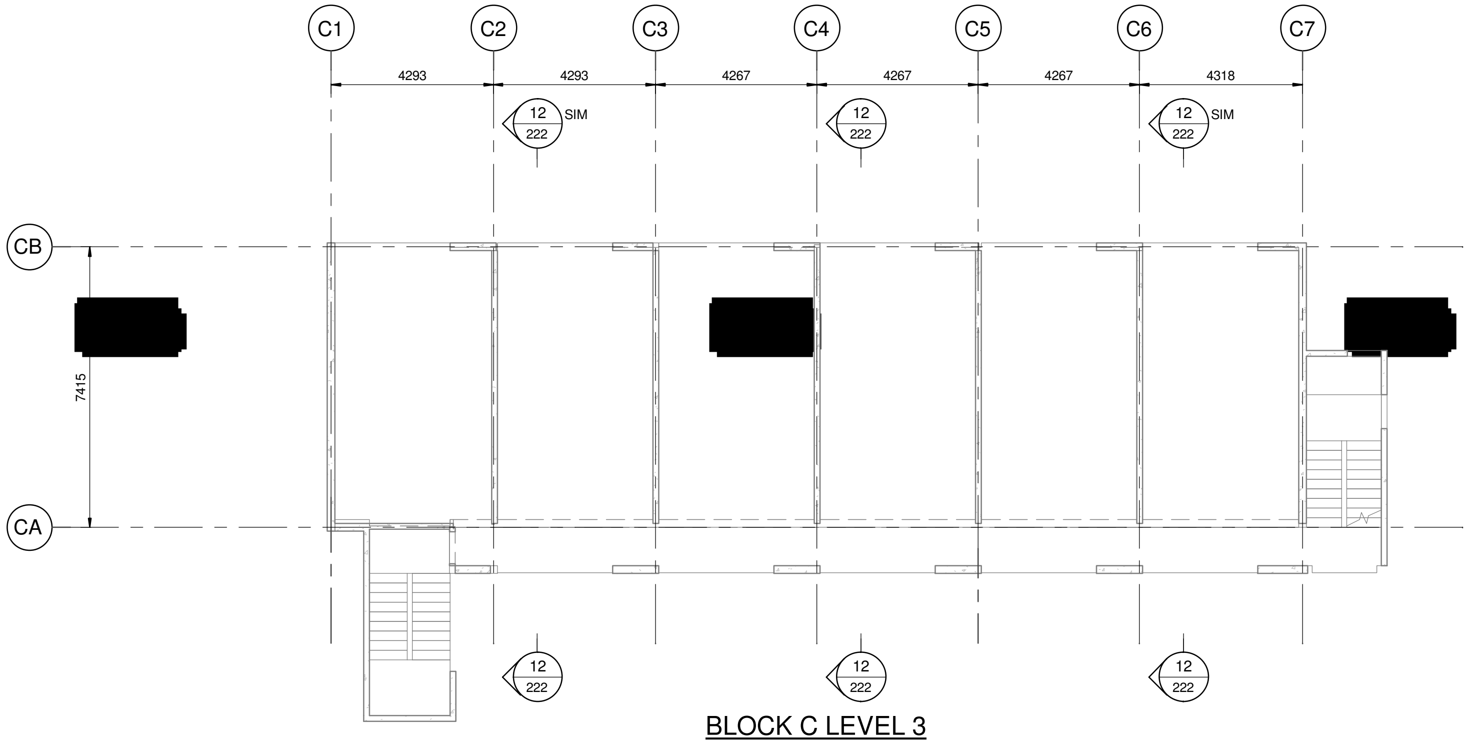
BLOCKS A & B
LEVEL 3 PLANS

BUILDING CONSENT

Drawing No.	Sheet No.	Revision
5 / 2445 / 1 / 7502	217	R1



BLOCK D LEVEL 3
SCALE 1 : 100



BLOCK C LEVEL 3
SCALE 1 : 100

NOTES

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LEGEND

EXISTING CONC WALL (THICKNESSES VARY).

"D" OPENING FOR DOOR CUT IN EXISTING CONC WALL. REFER ARCH DRAWINGS FOR DIMENSIONS.

Revision	Amendment	Approved	Revision Date
1	FOR BUILDING [redacted]	C.V.A	18.02.2014

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4-60580.05	As indicated

Project
WCC HOUSING UPGRADE PROGRAMME
KOTUKU PARK REDEVELOPMENT
5 KEMP STREET, KILBIRNIE, WELLINGTON

Title
BLOCKS C & D
LEVEL 3 PLANS

BUILDING CONSENT

Drawing No.	Sheet No.	Revision
5 / 2445 / 1 / 7502	218	R1

Original sheet size A1 (841x594) Plot date: 17/02/2014 4:35:27 p.m. C:\#Revit Working\4-60580.05 Kotuku\KOTUKU_PARK_BLOCK_STRUCTURAL_LOCAL_(2014)_wewhe0.rvt

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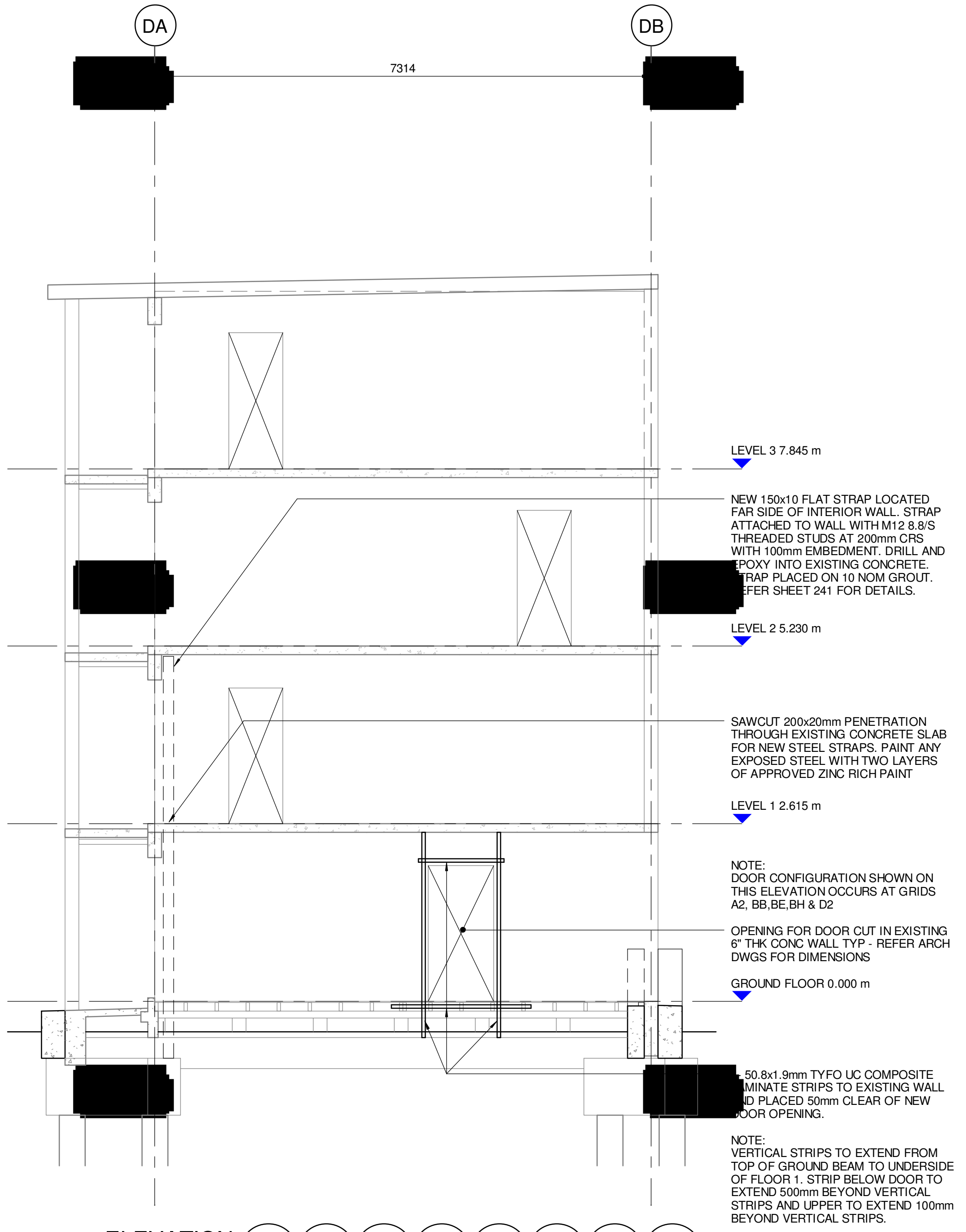
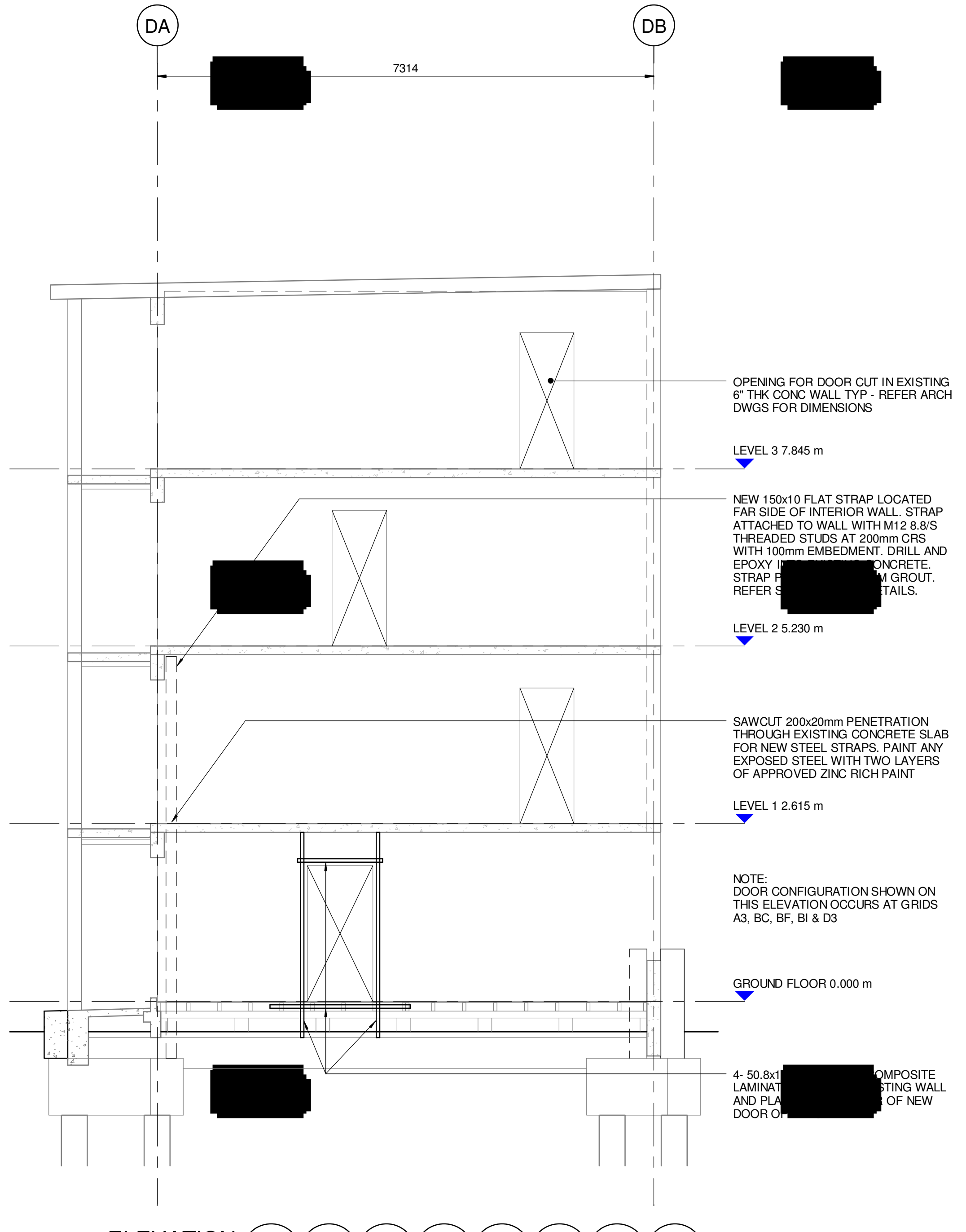


ELEVATION 10/211 10/212 10/213 10/214 10/215 10/216 10/217 10/218
SCALE 1 : 50

TYP 1 & 4 BEDROOM UNIT - TYPE A DOOR CONFIGURATION



ELEVATION 11/211 11/212 11/213 11/214 11/215 11/216 11/217 11/218
SCALE 1 : 50

TYP 1 & 4 BEDROOM UNIT - TYPE B DOOR CONFIGURATION

[redacted]

Revision	Amendment	Approved	Revision Date
1	FOR BUILDING [redacted]	C.V.A	18.02.2014

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W.E	C.W		31.01.2014

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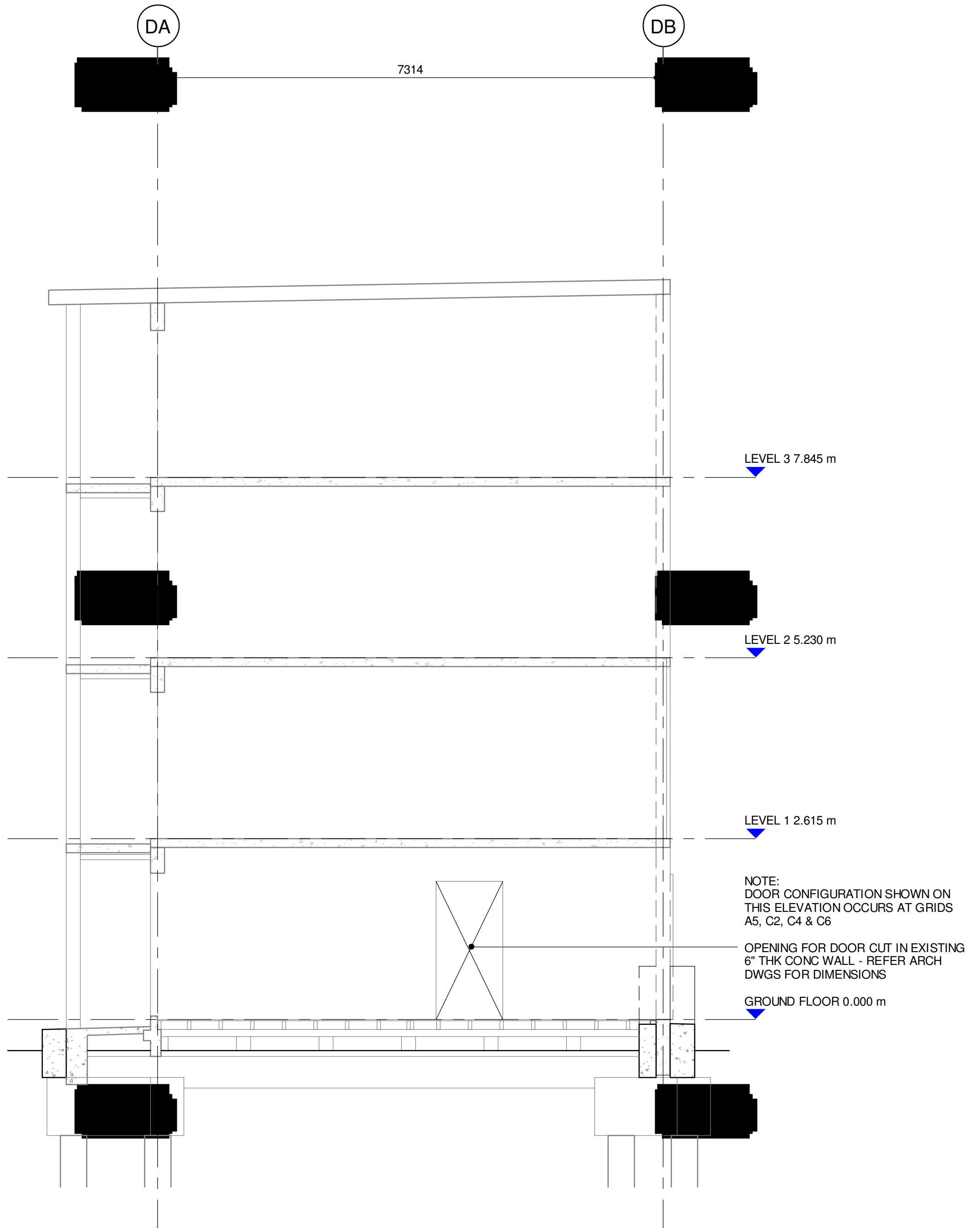
Project
WCC HOUSING UPGRADE PROGRAMME
KOTUKU PARK REDEVELOPMENT
5 KEMP STREET, KILBIRNIE, WELLINGTON

Title
ELEVATIONS

BUILDING CONSENT

Drawing No.	Sheet No.	Revision
5 / 2445 / 1 / 7502	221	R1



ELEVATION 12/211 12/212 12/213 12/214 12/215 12/216 12/217 12/218
SCALE 1 : 50

TYP 2 BEDROOM UNIT & STUDIO

NOTES

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WCC HOUSING UPGRADE PROGRAMME
KOTUKU PARK REDEVELOPMENT
5 KEMP STREET, KILBIRNIE, WELLINGTON

Title
ELEVATIONS

BUILDING CONSENT

Drawing No.	Sheet No.	Revision
5 / 2445 / 1 / 7502	222	R1

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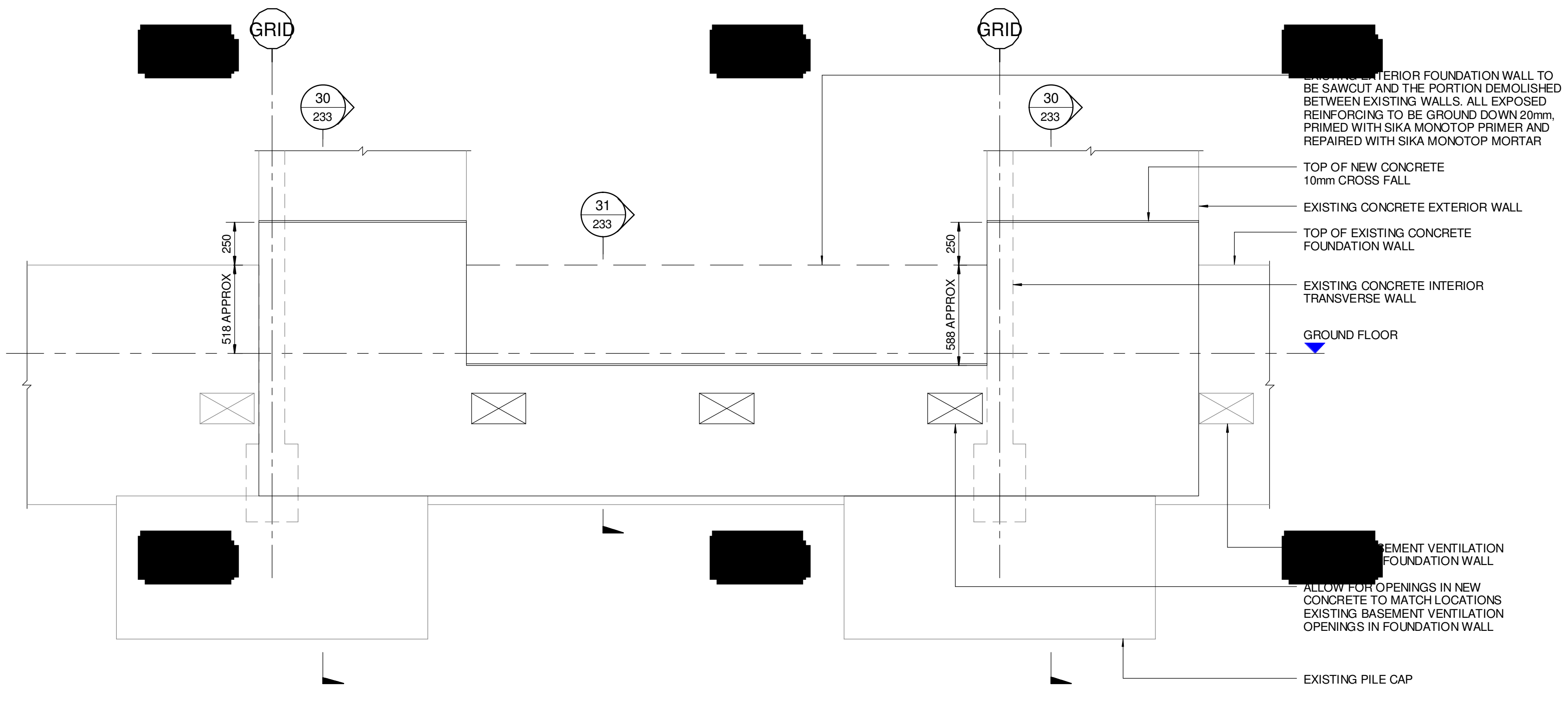
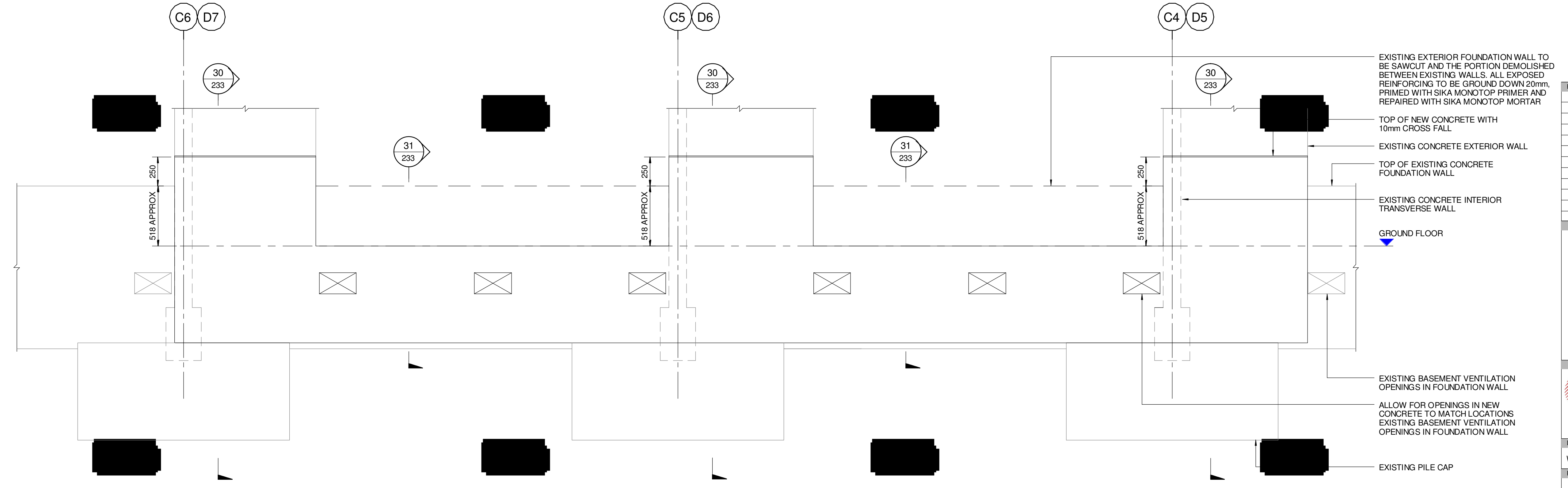


FT1 EXTERNAL ELEVATION GENERAL ARRANGEMENT

SCALE 1:20



FT2 EXTERNAL ELEVATION GENERAL ARRANGEMENT

SCALE 1:20

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1	FOR BUILDING [redacted]	C.V.A	18.02.2014

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4-60580.05	As indicated

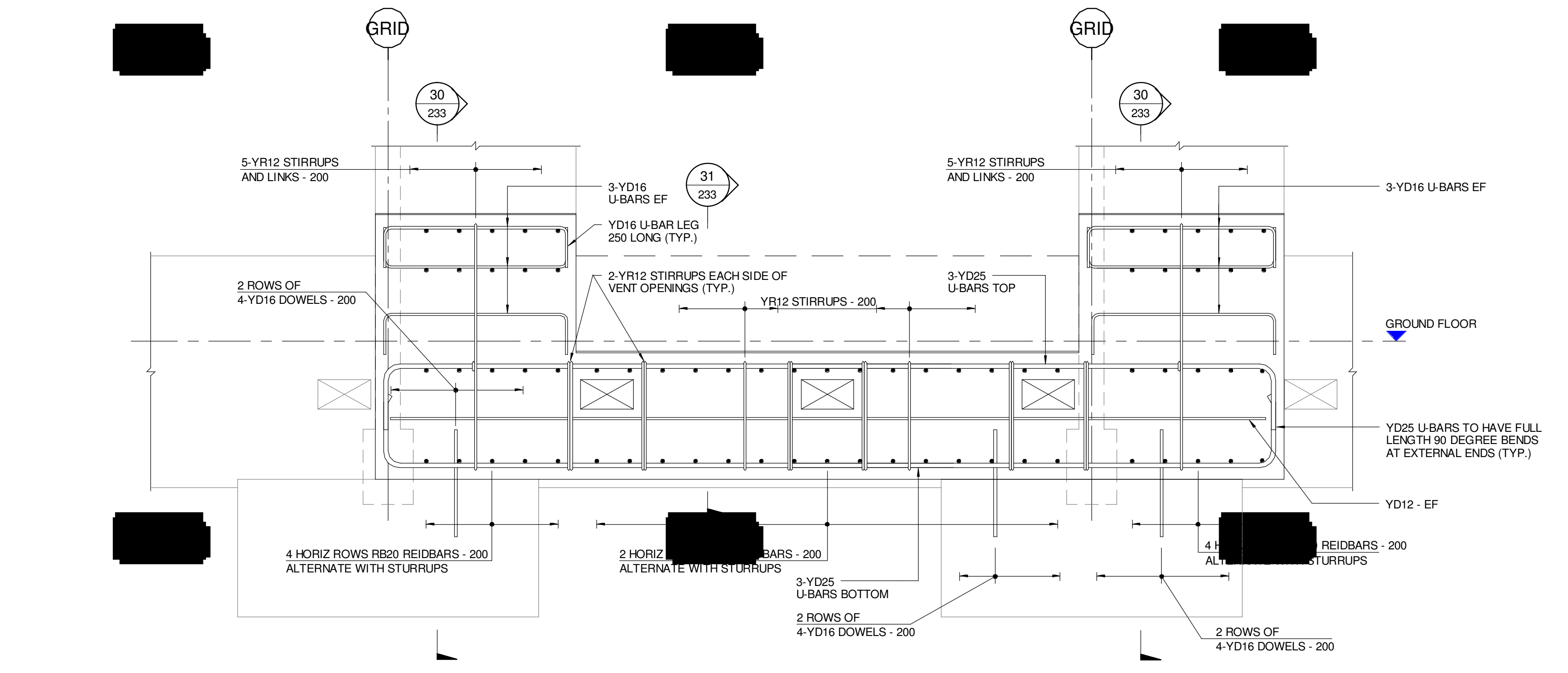
Project
WCC HOUSING UPGRADE PROGRAMME
KOTUKU PARK REDEVELOPMENT
5 KEMP STREET, KILBIRNIE, WELLINGTON

Title
CONCRETE DETAILS

BUILDING CONSENT

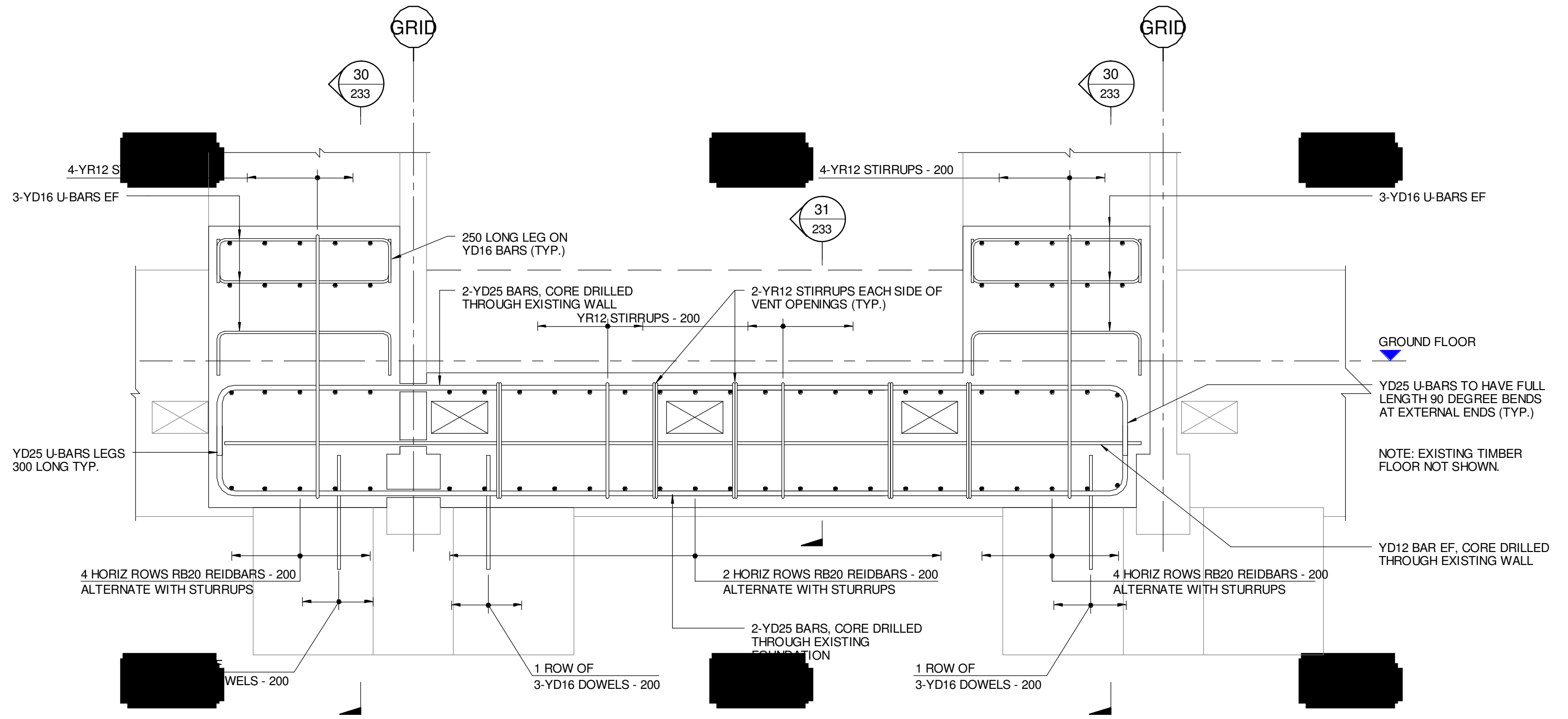
Drawing No.	Sheet No.	Revision
5 / 2445 / 1 / 7502	231	R1

Original sheet size A1 (841x594) Plot date: 17/02/2014 4:35:32 p.m. C:\#Revit Working\4-60580.05 Kotuku\KOTUKU_PARK_BLOCK_STRUCTURAL_LOCAL_(2014)_wewhe0.rvt



FT1 EXTERNAL ELEVATION - REINFORCEMENT

SCALE 1:20



FT1 INTERNAL ELEVATION - REINFORCEMENT

SCALE 1:20

NOTES

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10. ROUGHEN EXIST[redacted]CES INTERFACING WITH NEW CONC.

NOTE:

REINFORCEMENT DETAILS FOR BOTH EXTERNAL AND INTERNAL 2 BAY FT2 TYPE FOUNDATION THICKENING IS SIMILAR TO THAT SHOWN HERE FOR THE SINGLE BAY FT1 TYPE FOUNDATION THICKENING. ALLOW FOR THE YD25 BARS TO EXTEND OVER THE ENTIRE LENGTH OF THE FT2.

Revision	Amendment	Approved	Revision Date
1	FOR BUILDING [redacted]	C.V.A	18.02.2014

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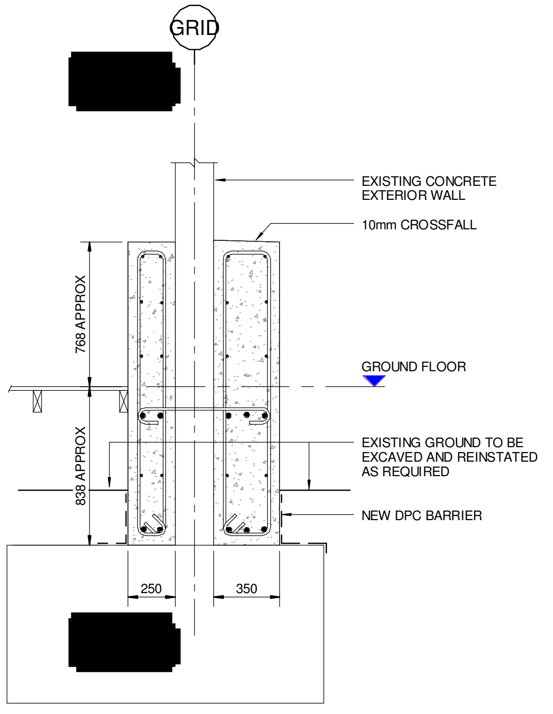
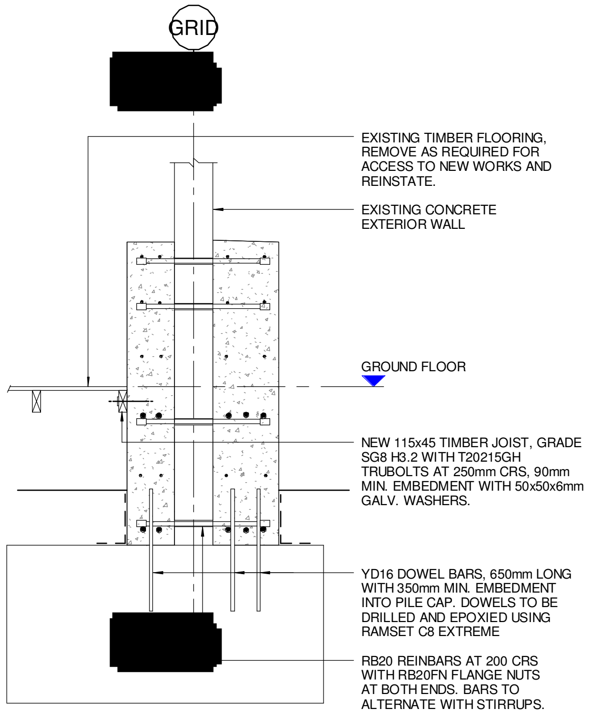
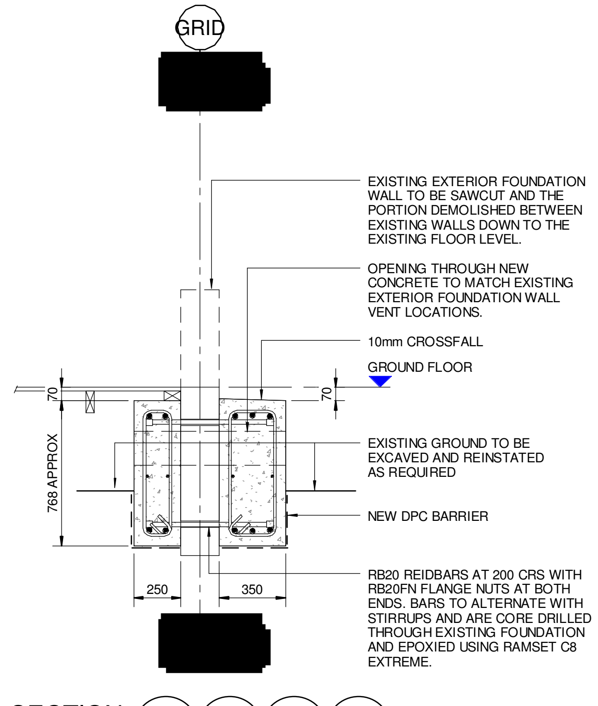
5 / 2445 / 1 / 7502	232	R1



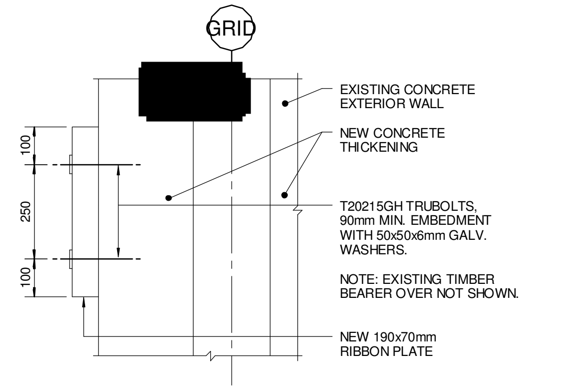
SECTION 30 211 30 212 30 231 30 233
SCALE 1 : 20
TYP FT1 & FT2 EXTENDING ABOVE GROUND FLOOR



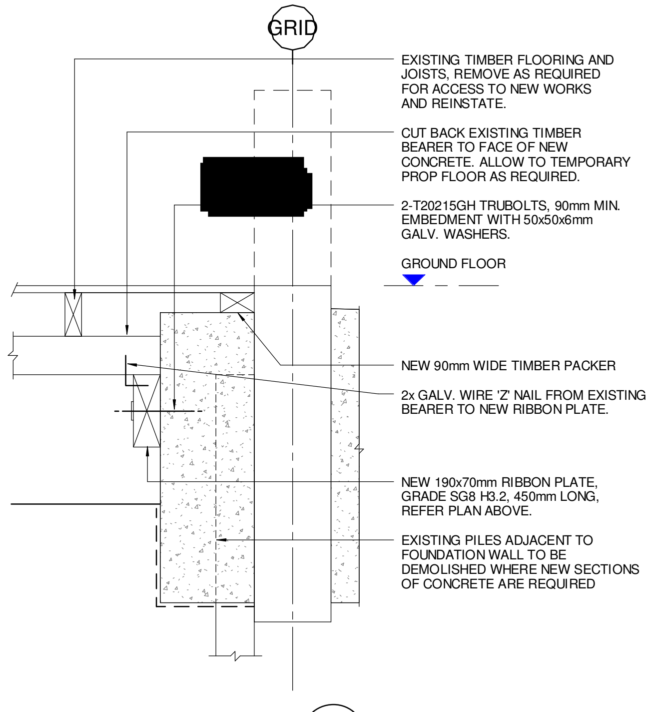
SECTION 30'
SCALE 1 : 20
BETWEEN STIRRUPS



SECTION 31 211 31 212 31 231 31 233
SCALE 1 : 20
TYP FT1 & FT2 AT NEW DOOR OPENINGS



RIBBON PLATE - PLAN
SCALE 1 : 10



SE[redacted] 31'
SCA[redacted]
SHOWING BEARER SUPPORTS BEYOND

NOTES

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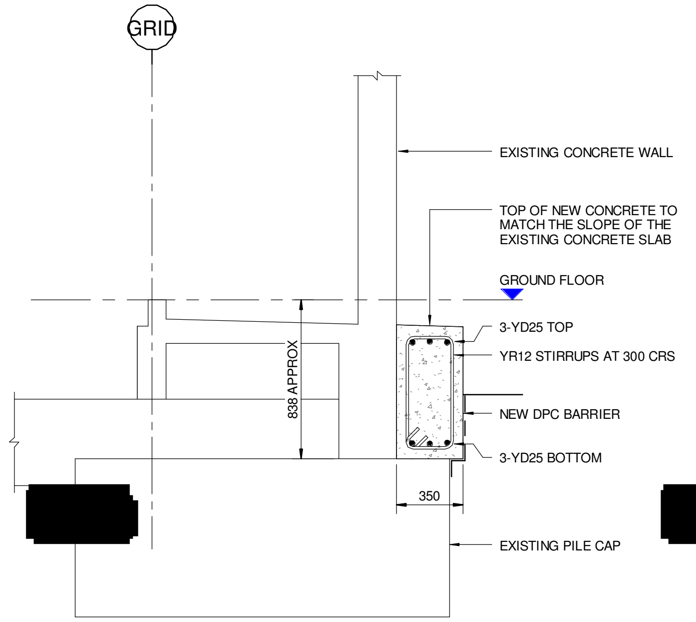
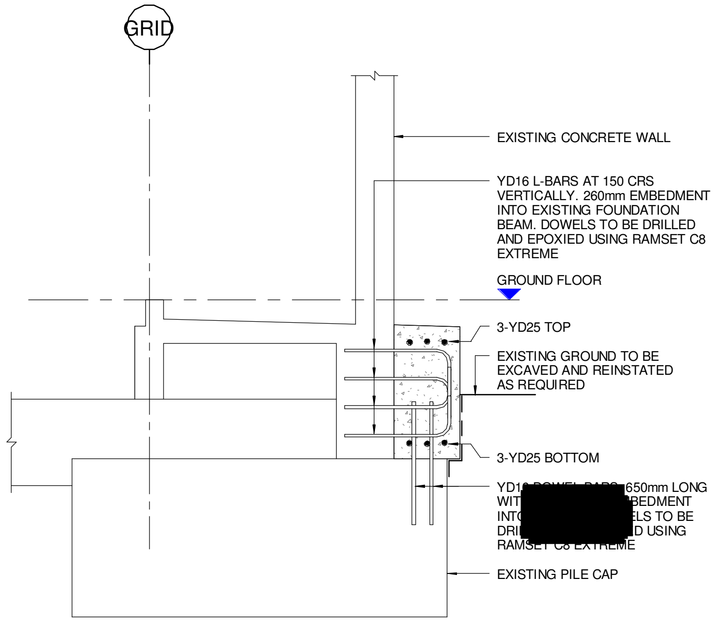
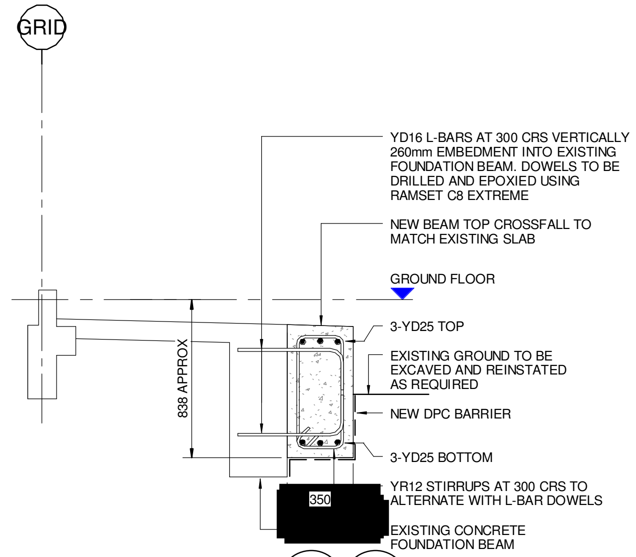


SECTION 32 211 32 212
SCALE 1 : 20
TYP FT3 AT WALKWAY WALL



SECTION 32'
SCALE 1 : 20
BETWEEN STIRRUPS



SECTION 33 211 33 212
SCALE 1 : 20
TYP FT3 BETWEEN WALKWAY WALLS

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1	FOR BUILDING [redacted]	C.V.A	18.02.2014

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Project No.	Scale
4-60580.05	As indicated

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Title
CONCRETE DETAILS

BUILDING CONSENT

Drawing No.	Sheet No.	Revision
5 / 2445 / 1 / 7502	233	R1

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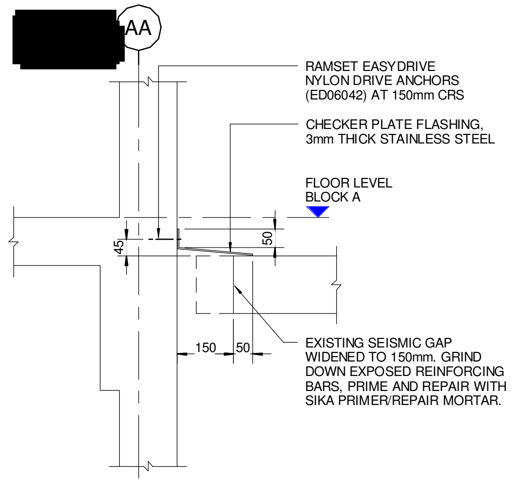
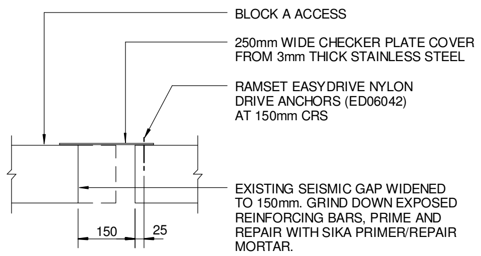


SECTION 35/215 35/217
SCALE 1 : 10

SEISMIC JOINT BETWEEN BLOCKS A & B
LEVELS 2 AND 3 ONLY



SECTION 36/215 36/217
SCALE 1 : 10

SEISMIC JOINT ACROSS APARTMENT ACCESS
LEVELS 2 AND 3 ONLY

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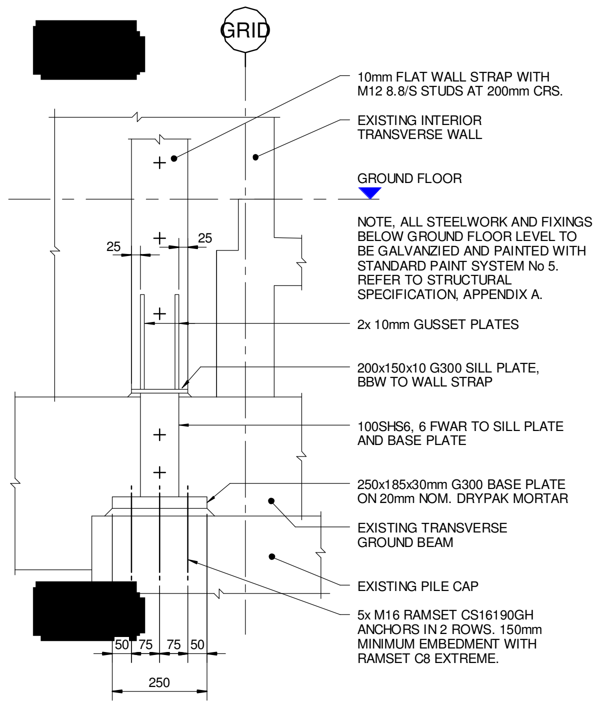
Title
CONCRETE DETAILS

BUILDING CONSENT

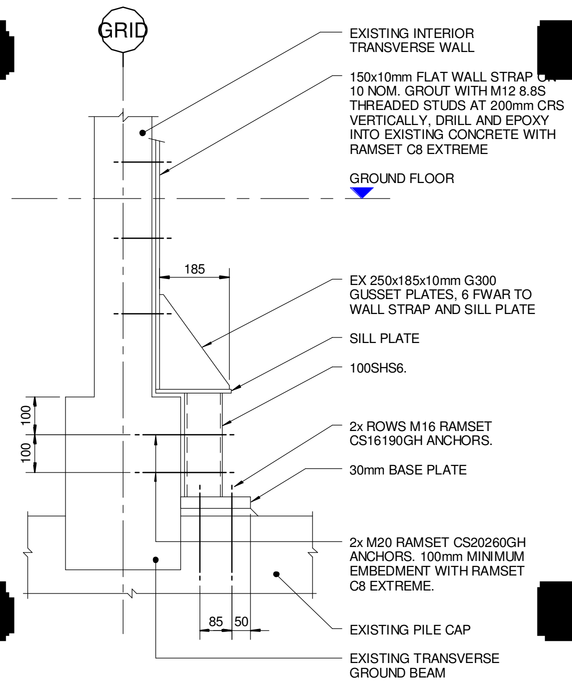
Drawing No.	Sheet No.	Revision
5 / 2445 / 1 / 7502	234	R1



TYPICAL STEEL WALL STRAP - ELEVATION

SCALE 1:10

FOUNDATION LEVEL BASE CONNECTION



TYPICAL STEEL WALL STRAP - SECTION

SCALE 1:10

FOUNDATION LEVEL BASE CONNECTION

NOTE:

ENSURE ALL NEW STUDS ARE PLACED TO AVOID EXISTING REINFORCEMENT. LOCATE AND MARK EXISTING REINFORCEMENT AND CONFIRM STUD CONFIGURATION BEFORE COMMENCING ANY STEEL FABRICATION. IF THE INDICATED STUD LOCATIONS CLASH WITH REINFORCEMENT, CONTACT THE ENGINEER FOR REVISED STUD LOCATIONS AND LAYOUT.

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Title
STEELWORK DETAILS

BUILDING CONSENT

Drawing No.	Sheet No.	Revision
5 / 2445 / 1 / 7502	241	R1

Appendix F
Discussion with BECA and BECA Geotechnical Desktop Study Report

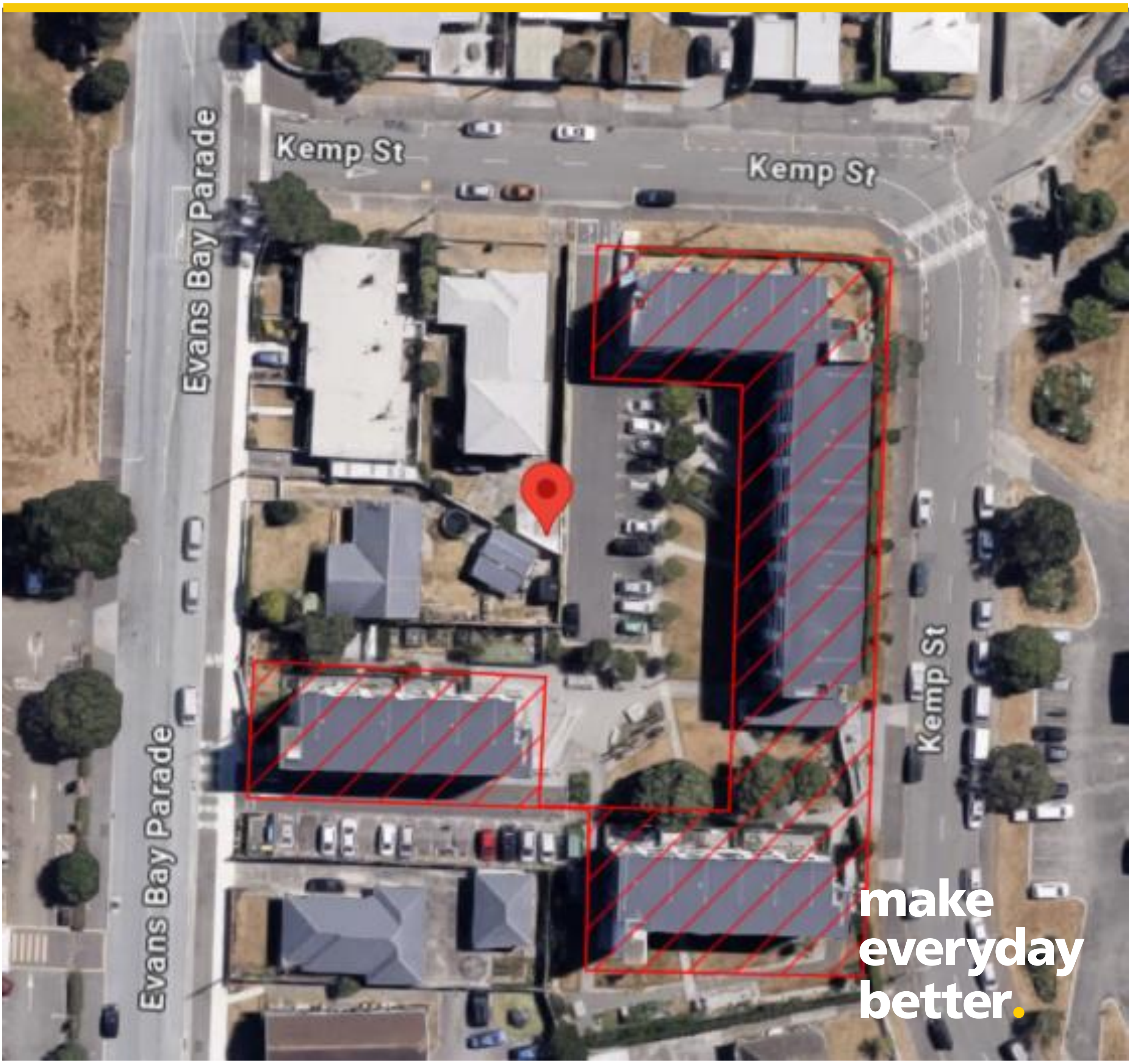
HUP2-T0-Seismic Assessments

Kotuku Flats, 5 Kemp Street, Kilbirnie (KOTA, KOTB, KOTC & KOTD)

Geotechnical Desktop Study Report

Prepared for Wellington City Council
Prepared by Beca Limited

26 April 2024



Contents

Appendices

Revision History

Revision Nº	Prepared By	Description	Date
0	[redacted]	For review	31/01/2024
1		Final	26/04/2024

Document Acceptance

Action	Name	Signed	Date
Prepared by	[redacted]	[redacted]	26/04/2024
Reviewed by			26/04/2024
Approved by			26/04/2024
on behalf of	Beca Limited		

1 Introduction

Beca Ltd (Beca) has been commissioned by Wellington City Council (WCC) to provide a geotechnical desktop study to support a Detailed Seismic Assessment being undertaken by other Consultants for the Kotuku Flats at Kilbirnie, Wellington. The scope of work undertaken by Beca was outlined in the Scope Change Order no 001 dated 16 January 2024.

The geotechnical desktop study has been undertaken to review, compile and summarise information relevant to the assessment of geological hazards and geotechnical considerations for the seismic assessment of the Kotuku Flats.

This study is based on readily available published information, historical records and WCC data.

2 Location and Site Features

The site address is 5 Kemp Street in the suburb of Kilbirnie, Wellington. The site is bounded by Kemp Street at the north and east, residential houses at the south, and Evans Bay Parade at the west. (The site layout is indicated on Figure 1, below).

The site is within a residential suburb, the ground is relatively flat, with elevation about 2m above mean sea level (Wellington 1953 datum).

The site is covered by four blocks of 4-storey apartment buildings, designed circa 1969.

Historical aerial photography from Retrolens, dating from about the late 1940s, shows the site was previously occupied by commercial/residential buildings.

There is no stream or river identified within 2km of site.

The site is about 300m southwest from the Evans Bay Beach.

3 Ground Conditions

3.1 Geology

The published geological map (Begg and Johnston, 2000) indicates the site to be underlain by reclaimed land with fill consisting of domestic waste; sand; boulders and rock.

The reclaimed land is expected to be underlain by bedrock of Rakaia Terrane greywacke, comprising completely to highly weathered, extremely weak to very weak sandstone typically with lesser mudstone (argillite).

3.2 Previous Investigation Data

Historical ground investigation data within/near to the site has been sourced from both the Beca Geotechnical Database and New Zealand Geotechnical Database (NZGD). NZGD investigation locations and topographic contours are presented in Figure 1 below. The ground investigation data from Beca Geotechnical Database were not shown in the figure due to the data not being available publicly. Copies of potentially relevant investigation logs are enclosed in Appendix A.

Figure 1: Locations of available historical site investigation data

3.2.1 Beca Geotechnical Database

The nearest investigation data available in the Beca Geotechnical Database are located about 200m northwest of the site and include 5 Cone Penetration Tests (CPTs) and 3 boreholes to depths of up to 15m. The investigations typically encountered a profile of 1-3m of surficial fill comprising variable silts and sands overlying marine sands comprising medium dense sands. The top of residually weathered greywacke was encountered at approximately 4.5 to 8.5m below ground level.

3.2.2 NZGD

The nearest investigation data available in the New Zealand Geotechnical Database (NZGD) are located 100m north of site and include 2 CPTs and 4 boreholes to depths of up to 20m. The investigations typically encountered a profile of: 2-3m thickness of uncontrolled fill comprising very loose to medium dense sands and gravels, overlying marine deposits, comprising very loose to medium dense silty sands. In-situ rock comprising completely to highly weathered greywacke was encountered, with the top of rock at 6.5-17m below ground level.

3.2.3 Council Records

The Wellington Council property file did not show there to be any geotechnical investigation points located at the site.

3.3 Groundwater

Groundwater levels across the site (as reported in the historical ground investigations) are summarised below. The water levels are about 2.3m depth below ground level, or 0.5m above mean sea level.

Table 1 Groundwater Levels

ID	Distance	Water level (m bgl)	Water level (m RL)	Date
BH_112613	100m E	2.2	0.5	28/03/2018
BH_112621	100m E	2.3	0.5	03/04/2018
BH_112620	100m E	2.1	0.5	27/03/2018
BH_112622	100m E	2.4	-0.1	27/03/2018

There does not appear to be long-term groundwater monitoring data available for the site.

4 Building Foundations

4.1 Available Foundation Information

Information about the foundations of the building have been sourced from the Wellington City Council files (D.V.L Builders Ltd., 1969), Structural Assessment Report by Romulus Consulting Group (Romulus, 2008), and Design Features Report – Kotuku Park Redevelopment by Opus International Consultants Limited (Opus, 2014).

Available drawings show the buildings to consist of four apartment blocks, all 4-storey reinforced concrete structures supported on reinforced concrete piles. The drawings do not show a basement within the buildings.

The building foundations consist of 192 reinforced concrete driven bulb piles tied with pile caps and a grillage of ground beams. The piling specification indicated piles were to be driven to a depth of 25 feet below ground level (i.e., 7.62m) and to be driven until the final set is ¼” per blow. Static pile testing with a maximum load of 70 tons was also proposed. The piles are understood to be installed by drilling 15 inch diameter of steel casing, hence we suggest to assume the pile diameter to be 15 inch (0.38m). No piling or testing records were available from the property files. The property files do not provide information regarding the diameter of the bulb, and the final pile depth.

Due to the absence of the information regarding the piles’ bulb diameter, we suggest assuming a constant diameter of 0.38m along the piles' length.

The drawings do not provide bearing capacity information.

Refer the historical drawings in Appendix B for selected details.

4.2 Inferred Founding Soil

An inferred founding soil profile for the structure has been assumed based on the available ground investigation data for the surrounding area and the mapped geology (refer Table 1 below).

The actual soil profile at the site could differ from this inferred profile, and where performance of the structure is sensitive to the actual ground conditions site specific ground investigation is recommended.

Table 2 Inferred Founding Soil Parameters

Inferred Soil Description	Inferred Top of unit (mbgl)	Inferred bottom of unit (mbgl)	Inferred Strength	Inferred Density
Very loose to medium dense silty sands	0	6.5	φ' = 26 - 29 deg	17kN/m^3
Completely to moderately weathered greywacke	6.5	N/A	UCS = 1MPa RQD = 0%	18kN/m^3

4.3 Inferred Pile Axial Capacity

We note from the specification that the piles were required to undergo static load testing up to 70 tons (i.e., 680kN), which possibly was the targeted ultimate bearing capacity of the pile.

An axial capacity calculation was undertaken assuming the piles were driven to refusal into the highly weathered greywacke unit, with a roughness class of R1 for the rock socket (i.e., grooves and indentation less than 1.0mm deep within the rock socket) and piles socketed at least 3 diameters into rock. The loose sands are not expected to provide substantial skin friction to the piles hence the bearing capacity is calculated based on end-bearing in the Greywacke unit only.

A wide range of RQD (e.g, 0 – 90% with average of 50%) was noted on the available borehole logs. Based on our local experience in dealing with similar soils, it is understood that highly weathered greywacke is commonly found to be highly fractured with extremely closely to closely spaced defects and typical RQD value of 0%. Hence the axial capacity calculation was undertaken by assuming a lower and upper bound RQD range of 0 – 50%.

For the purpose of the structural assessment, we suggest assuming unfactored axial capacity as follows:

- Compression: 530kN and undertaking a sensitivity check using 270kN per pile
- Tension: 95kN per pile

Vertical settlements arising from liquefaction within the sands under seismic conditions generate down-drag loads on the shafts of piled foundations. These will be treated as dead loads acting in combination with structural demands. We suggest assuming negative skin friction occurring within the whole reclaimed land unit, resulting in unfactored down-drag load of 55kN per pile.

4.4 Inferred Pile Lateral Capacity

A set of spring stiffnesses and capacity for the structural assessment are calculated using non-linear p-y (horizontal force / displacement) curves generated using the specific pile analysis software packages namely Ensoft LPile 2019. The provided p-y curves are then simplified by applying a bi-linear approximation.

Due to limited information of the piles and available investigation data, the provided lateral springs adopts the typical stratigraphy summarized in Table 1. A set of p-y curve for non-liquefied and liquefied state are provided in Appendix C for static and seismic cases, respectively.

4.5 Inferred Base Shear Capacity

The tie beam and pile cap are expected to fully contribute to the shear capacity under seismic case through friction at the underside of the structures and the lateral earth pressure. It is suggested to assume the tie beam and pile cap are founded on very loose to medium dense silty sands with a passive lateral earth pressure coefficient of 2.56 – 2.88 (assuming friction angle between 26 - 29 deg).

5 Seismic Design Criteria

The site subsoil class has been assessed based on NZS 1170.5:2004 Structural design actions, Part 5: Earthquake actions – New Zealand.

We note from Wellington City Council GIS that the site is classified as Site Subsoil class E.

Rock (in terms of NZGS (2005)) was encountered at depths ranging from 10 to 15m. Based on the anticipated depth to rock and strength description of the overlying soils (inferred from the historical ground investigations), a site subsoil class of D (deep soil) is recommended.

6 Observed Performance in Past Earthquakes

6.1 Ground Shaking Intensity

This site is understood to have been affected by the following past earthquakes:

- 1848 Marlborough earthquake
- 1855 Wairarapa earthquake
- 1934 Waitārere earthquake
- 1942 Wairarapa I earthquake
- 2013 Cook Strait earthquake
- 2013 Lake Grassmere earthquake
- 2016 Kaikōura earthquake

Table 3 below summarises estimated shaking intensity at the site (Downes 1995, USGS 2024) and/or measured acceleration at nearby strong motion instrument during historical earthquake events.

Table 3 Past Earthquake Events

Earthquake Event	Earthquake Magnitude	Measured PGA (g) Nearby	Shaking Intensity MMI	Estimated PGA at site[1]	Comments
1848 Marlborough Oct 15	7.1	Not recorded	7-8	0.2g – 0.4g	Earthquake event occurred prior to building construction
1855 Wairarapa Jan 23	8.2	Not recorded	9-10	0.7g – 1g	
1934 Waitārere Mar 05	7.2	Not recorded	5-6	0.06g – 0.1g	
1942 Wairarapa June 24	6.9-7.2	Not recorded	6-7	0.1 to 0.3g	
1942 Wairarapa August 2	6.8	Not recorded	6-7	0.1 to 0.3g	
2013 Cook Strait July 21	6.6	0.12 - 0.26g [2]	5.5-6.5	0.08g – 0.16g	

Earthquake Event	Earthquake Magnitude	Measured PGA (g) Nearby	Shaking Intensity MMI	Estimated PGA at site[1]	Comments
2013 Lake Grassmere Aug 16	6.6	0.06g - 0.24g [2]	5.5-6.5	0.08g – 0.16g	Strong to very strong shaking inferred to have been experienced by the building
2016 Kaikōura 13 Nov	7.8	0.12g – 0.24g[3]	6-7	0.1 – 0.21g	

[1] Estimated PGA at site based on the correlation between MMI and PGA based on correlation published by (Worden et al, 2012).

[2] Based on Holden et al. (2013)

[3] Based on Brendon et al. (2017)

6.2 Seismic Effects

Observations of seismic effects during historical earthquakes in NZ is limited by the short written history and relatively recent identification of a number of effects as discrete phenomenon, such as liquefaction or lateral spreading.

Readily available published records of historical effects have been reviewed.

The nearest liquefaction effects are about 4-5km from site as referred to in historic records published by researchers (Fairless and Berrill, 1984; Bastin et al., 2020), and includes the following records:

- 1848 Marlborough earthquake: Severe liquefaction with lateral spreading was reported at Barrett Hotel, south end of Lambton Quay, about 4km away from site.
- 1848 Marlborough earthquake: Minor liquefaction with lateral spreading was reported along Lambton Quay up to the Victoria University of Wellington Pipitea Campus. This liquefaction zone is about 5km away from site.
- 1855 Wairarapa earthquake: Severe liquefaction without lateral spreading was reported near corner of Boulcott and Willis Street, about 4km away from the site.

7 Potential Geohazards

7.1 Fault Rupture

The nearest mapped active faults (having proven activity in the last 125,000 years) have been identified from the GNS Active Faults Database, these include the SW-NE trending Evans Bay Fault. The Fault outcrops about 0.5km to the northeast of the site.

The published rupture characteristics for the Evans Bay Fault are as follows (GNS, 2021, Philip et al., 2019):

- Estimated Characteristic Magnitude (Mw) = 7.0 Richter or greater
- Recurrence Interval: 5000 – 10,000 years (Recurrence Interval Class IV)
- Elapsed time since last movement: 10,000 years

It is noted that the on-land extent and location of the Evans Bay Fault is considered to be poorly constrained. Considering the approximated distance and the mapping accuracy of this fault, the risk of direct fault rupture is considered moderate.

7.2 Ground Shaking

The Wellington area is one of the highest earthquake activity regions in New Zealand. The presence of local active faults (noted above) and historic ground shaking suggest damaging earthquakes may occur in the future.

Wellington City Council Seismic Hazards maps indicate the site is within moderate risk of ground shaking.

The ground shaking hazard, assuming an Importance Level 2 structure (in terms of AS/NZS1170.0 amendment 2 Table 3.2), is summarised in Table 3 below. The Peak Ground Acceleration (PGA) is derived from two sources in accordance with NZGS Module 1 (2016).

- NZTA bridge manual, which provides PGA unscaled for earthquake magnitude effects. These unscaled PGA (provided with an associated representative magnitude) are used in geotechnical analyses such as liquefaction assessments and analysis of seismically induced displacements.
- NZS1170.5 (NZ structural loadings code) based method which provides PGA scaled for earthquake magnitude effects. These scaled PGA are used in geotechnical design providing demands on structural elements.

Table 4 Seismic Loads

Source	Assumed site class (Site Class Factor)	Base Seismic Factor Z or C0(1000)	Design Life (Importance Level)	Annual Probability of Exceedance (Return Period Factor)		Design1 PGA [g] (Mrep)3	SLS Servicibility2 PGA [g] (Mrep)3
				(R_S)	(R_U)		
NZTA Bridge Manual	D (1.0)	0.45 (Wellington)	50y (IL 2)	1/50y (0.35)	1/500y (1.0)	0.346g (7.1)	0.12g (6.2)
NZS 1170.5	D (1.12)	0.4 (Wellington)	50y (IL 2)	1/25y (0.25)	1/500y (1.0)	0.45g (7.5)	0.11g (7.5)

Rs = return period factor for the Serviceability Limit State, Ru = return period factor for the Ultimate Limit State. [1]Ultimate Limit State or ULS/design level shaking for an IL2 structure. [2]Serviceability Limit earthquake or SLS. [3] Representative Magnitude.

Amplification of ground shaking in soft Quaternary alluvial soils is also likely.

7.3 Liquefaction/Cyclic Softening and Lateral Spreading

7.3.1 Definition

Liquefaction describes the short-term loss of strength of a loosely packed cohesionless (sandy) soil during an earthquake or other dynamic loading. Liquefaction occurs when the soil particles are disturbed and densify during dynamic loading, temporarily raising pore water pressures and reducing the effective stress between particles to near zero. This causes the affected soil to behave essentially like a liquid until the excess pore pressures are dissipated.

Liquefaction can have a number of significant effects where it occurs, including large lateral displacements affecting coastal or riverbank slopes (termed lateral spreading), post liquefaction settlements (due to the densification of the affected sandy layers and loss of material to the surface) and potentially large and uneven settlement of shallow founded structures underlain by liquefiable soils.

Unsaturated soils above the groundwater table are assumed not to be susceptible to liquefaction. However, if liquefaction occurs at shallow depth in a saturated soil, the overlying unsaturated soil may move toward a free face e.g., coastal or riverbank slopes, due to either lateral spreading or flow failure.

Cyclic softening is a liquefaction related phenomenon that occurs where cohesive soils are sheared during strong earthquake shaking. Cyclic softening can cause a significant strength loss in sensitive soils and may result in a liquefaction-like consequences including slope instability, building settlement or tilting.

7.3.2 Hazard Assessment

Based on the available ground investigation data there are likely to be loose sandy/silty soils within the reclaimed land unit, i.e., the top 6.5m of the soils underlying the site, which could be susceptible to liquefaction when saturated (groundwater at the site was measured at 2.3mbgl in 2018).

In the event liquefaction occurs, there may be a risk of settlement of the soils within the reclaimed land unit. Council hazard maps *(*Wellington Region Liquefaction Potential*)* indicate a high risk of liquefaction occurring at the site.

In terms of lateral spreading risk, although the site indicates high risk of liquefaction, the site is relatively flat and the closest water body is 300m away. Module 3 (MBIE, 2023) noted historical lateral spreading events in the 2010-2011 Canterbury earthquakes reported the zone affected by lateral spreading typically extended inland from the river banks up to 150 to 200m from the free face. Hence it is noted that there is moderate risk of lateral spreading toward Evans Bay Beach.

7.4 Slope Stability

The site is relatively flat. The risk of slope instability, in the absence of liquefaction, is considered low.

Wellington City Council Seismic Hazards maps indicate a low risk of slope instability occurring at the site.

7.5 Rockfall

As there are no nearby sources of elevated rocks, there is no risk of rockfall affecting the site.

7.6 Landslide Dam or Dam-Break

The site is not within a significant river valley and there are no dams in the area, therefore the risk of seismically induced landslide dams or dam breaks is considered unlikely at this site.

7.7 Tsunami

Tsunami are a series of long period waves generated by an impulsive source which suddenly displaces the water column. On reaching shore tsunami can cause severe damage to moored vessels, port facilities and coastal infrastructure. Impulsive sources that could generate a tsunami in the Evans Bay coastline may include fault rupture, submarine landslide or volcanic activity. Tsunami may have local sources that arrive rapidly with limited warning, regional sources generated in the vicinity of NZ that may have 1-3hours warning and distant sources that may have greater than 3 hours warning.

The latest information on the tsunami hazard for New Zealand is presented in a GNS report (Power, 2013), estimating that for the Wellington South a tsunami will reach a height of 6 m (50th percentile) above sea level about every 500 years on average (the 16th and 84th percentile heights are 5m and 7m respectively). For a 2500-year return period tsunami event the maximum wave height is modelled at about 9m (50th percentile). These are the modelled at-the-coast wave heights, the actual run-up or inundation will vary greatly depending on topography.

The site is about 300m from the Evans Bay coastline edge, at an average elevation of about 2m above mean sea level which places it at 4m above the expected run-up of a 500-year return tsunami and as such we would categorise this site as at moderate risk of structural damage from tsunami. We note the Wellington Region Emergency Management maps show this site to be within the orange tsunami evacuation zone, where evacuation is likely to be required following a large tsunami.

7.8 Tectonic Lowering Causing Inundation

The site is in a relatively low-lying area at an active subduction plate boundary with a number of nearby faults (Evans Bay Fault, Wellington Fault, Hikurangi Fault, Ohariu Fault) that may have the potential to generate sufficient vertical movement at the site to cause inundation or uplift. It is noted that the 1855 Wairarapa earthquake reported 1.5m uplift within the Wellington Central areas (Downes, 2005). As such, we have classified the risk of tectonic lowering causing inundation as moderate.

8 Uncertainties

Available ground investigation information is about 100-200 away from site and there is no ground investigation specifically undertaken for this site. The depth of bedrock has been assumed based on the surrounding ground investigation and inferred pile depth from the available historical information.

We have assumed that the piles are socketed into Greywacke rock and the lengths are based on the specification in lieu of available as built pile drawings. If alternatively, piles are founded within the reclaimed land deposits, the capacities may be significantly lower than the axial capacity values provided. Additionally, having longer or shorter piles due to uncertainty of the depth of Greywacke may pose different pile behaviour in terms of the lateral pile capacity than the lateral stiffness values provided.

Additional ground investigations and further geotechnical design works are proposed to be carried out as part of the strengthening design package.

9 Conclusions

9.1 Availability of Relevant Investigation Data

The nearest site investigation data are 4 geotechnical boreholes and 2 CPTs around 100m away.

9.2 Inferred Ground Conditions

This site is inferred to be underlain by very loose to medium dense silty sands with bedrock consisting of completely to highly weathered Greywacke at a depth of approx. 6.5m.

9.3 Geohazard Potential

Table 5 provides a summary of geohazards identified during the geotechnical desktop study.

Table 5 Geohazards Summary

Geohazard	Risk	Comment
Fault rupture	Moderate	Evans Bay Fault is located 0.5km away from site and the fault is poorly constrained.
Ground shaking	High	The site is in a relatively high-seismicity area.
Liquefaction/cyclic softening	High	The expected site soils likely to be susceptible to liquefaction or cyclic softening as the near surface soils are loose cohesionless soils.
Lateral spreading	Moderate	Liquefaction risk is high for this site, however the site is relatively flat and the closest water body is 300m away.
Slope stability	Low	The site is relatively flat.
Rockfall	No risk	No rockfall sources nearby
Landslide or dam break	No risk	There are no steep slopes or dams near the site.
Tsunami	Moderate	The site is classified as orange zone for tsunami.
Tectonic lowering causing inundation	Moderate	The site is in a high seismicity area and is low-lying.

The main geohazard relates to ground shaking and liquefaction.

Additional ground investigations and further geotechnical design works are proposed to be carried out as part of the strengthening design package.

10 Applicability

This report has been prepared by Beca on the specific instructions of our Client. It is solely for our Client's use for the purpose for which it is intended in accordance with the agreed scope of work. Any use or reliance by any person contrary to the above, to which Beca has not given its prior written consent, is at that person's own risk.

Should you be in any doubt as to the applicability of this report and/or its recommendations for the proposed development as described herein, and/or encounter materials on site that differ from those described herein, it is essential that you discuss these issues with the authors before proceeding with any work based on this document.

Notice to Reader:

This report has been verified by a geotechnical professional on the basis of the agreed commission. No amendments should be made to the content of this document without subsequent re-verification by the geotechnical author and verifier.

11 References

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A

Appendix A – Available Ground Investigation Data

GRIFFITHS DRILLING
RESULT DRIVEN GEOTECHNICAL SPECIALISTS

134 State Highway 58
Pauatahanui
P: 045277346
F: 045277347
www.griffithsdrilling.co.nz

SITE INVESTIGATION BORELOG

BH#	4	**JOB#**	-
Project:	Kilbirnie Pump Station	**Grid Ref:**	**N: -**
Location:	Evans Bay Park, Kilbirnie		**E: -**
Client:	Stantec	**Operator:**	[redacted]
DATE Start:	27/3/18	**DATE Finish:**	29/3/18
		Page:	1 of 1
Drill Rig:	Commachio MC450P	**SPT Hammer #:**	Auto
Drilling Method:	PQ Coring	**Flushing Type:**	Polymer Powder
Bore Diameter:	PQ	**Casing Diameter / Type:**	PW
Bore Final Depth:	20.0m	**Casing Final Depth:**	4.5m

Formation Drill Conditions
(L) – Loose, Unstable; **(S)** – Soft, Stable; **(F)** – Firm, Stable; **(B)** – Bands of hard and soft; **(M)** – Moderately Firm.; **(H)** – Hard to penetrate

Fluids:
(TL) Total Loss; **(SL)** Slow Loss; **(WS)** Water Struck; **(NL)** No Loss

Layer Change Depth (mbgl)	Geological Description *(Must Include: Colour, Texture, Composition, Fractures, Boundary type (gradual, abrupt?))*	Core Samples & Recovery: From (m)	To (m)	Recovery (mm)	Standard Penetration Test (SPT): Cone Type	Depth	SPT Counts	N Value	Sample (mm)
0.00	Jet Vac	2.00	3.00	1000	SP	1.5	2/1//2/0/0/0	2	170
2.00	Brown soft fill. Blue grey sandy silt.	3.45	4.50	650		3.0	0/1//0/1/0/1	2	110
4.00	Blue grey sandy silts.	4.95	6.00	1050		4.5	1/1//1/2/1/2	6	450
12.15	Green blue sand.	6.45	7.50	1050		6.0	1/1//2/3/3/3	11	370
13.50	Blue green sandy silts	7.95	9.00	1000		7.5	0/0//0/1/2/2	5	450
20.00	EOB	9.45	10.50	1050		9.0	1/2//3/4/4/5	16	450
		10.15	12.00	700		10.5	2/2//3/3/5/6	17	450
		12.45	13.50	1050		12.0	2/3//4/4/6/6	20	400
		13.95	15.00	1050		13.5	3/3//15/6/7/9	27	450
		15.45	16.50	1050		15.0	3/5//7/8/12/15	42	450
	100mm monitoring well installed to					16.5	4/7//20=o/l	50+	170
	12.30m. Screen set from 12.3 – 9.3m								
	Flush lockable toby.								

Water Level	Date / Time	Hole Depth	Water Level	Date / Time	Hole Depth
2.20m	28/3/18	-			

Stantec	**BOREHOLE LOG**	Job No: 80509051
		Hole No: BH04
		Sheet: 1 of 6
MWH NEW ZEALAND LTD Hazeldean Business Park 6 Hazeldean Road Christchurch 8024 Tel: 03 366 7449 Fax: 03 366 7780	Client: Wellington Water	Started: 26/03/18
	Project: Kilbirnie Storm Water upgrade investigations for Pump Station Location: Evans Bay Park, Kilbirnie Wellington	Finished: 28/03/18
	Description: Phase two geotechnical investigations	Logged: NWH/JD
		Checked: JW
	Easting: 1750346m Northing: 5424728m Inclination: Vertical	RL Surface: 2.7m
	Diameter (Int/Ext): 85mm/123mm Casing (Diam/Dpth): 127mm/4.5m	Datum: Wellington Datum 1953

Material Description: (Logging carried out in accordance with Guidelines for the Field Classification of Soil and Rock for Engineering Purposes. New Zealand Geotechnical Society, 2005)

Natural Defects: Type, orientation, spacing, persistence, roughness, wall strength, aperture, infill, seepage, no. of sets, block size

Weathering Grade: RS, CW, HW, MW, SW, UW

Strength UCS MPa: EW R0 <1, VW R1 1-5, W R2 5-20, MS R3 20-50, S R4 50-100, VS R5 100-250, ES R6 >250

Spacing mm: ECS <20, VCS 20-60, CS 60-200, MWS 200-600, WS 600-2000, VWS >2000

Depth (m)	Elevation (m)	Samples / Insitu Testing	Material Description	Length of Run (m)	Total Core Recovery %	Solid Core Recovery %	RQD %	Groundwater	Installation
0.0–0.1			TOPSOIL (0.1)						
0.1–0.3			Sandy SILT with trace of roots; brown, firm, moist; medium plasticity. Fine to medium sand (0.3)						
0.3–0.9	2.0		Sandy fine to medium GRAVEL with some silt; orange brown, loose, moist; angular to subangular (0.9)						
0.9–1.5			Silty medium to coarse SAND; orange brown, loose to medium dense, moist (1.5)						
1.5–1.95	1.0	SPT 2/1//2/0/0/0 N = 2	Silty fine to medium SAND; yellowish brown, very loose, moist; medium plasticity (1.95)	0.45	38				
1.95–3.0	0.0		Occasional cobbles (3)	1.05	100				
3.0–3.45		SPT 0/1//0/1/0/1 N = 2	Some fine gravels (3.45)	0.45	24				
3.45–3.7	-1.0		Sandy medium to coarse GRAVEL with minor clay/silt; yellowish brown, loose, moist (3.7)	1.05	62				
3.7–4.5			Gravelly fine to coarse SAND with some silt and shells; grey, loose to medium dense, moist; low plasticity [MARINE DEPOSITS] (4.5)						
4.5–4.95	-2.0	SPT 1/1//1/2/1/2 N = 4	With minor silt and shell fragments. [MARINE DEPOSITS] (4.95)	0.45	100				
5.0									

Drilling Method: **PQ**
Casing: **PW**
Contractor: **Griffiths Drilling**
Flush: **Polymer Powder**
Equipment Type: **Comacchio 450P Track Mounted PQ3 Triple Tube**

Remarks: See key sheets for abbreviations and symbols
- Material descriptions conform to FIELD DESCRIPTION OF SOIL AND ROCK, 2005, NZGS
- SPT testing performed to NZS4402.6.5.1

Stantec

BOREHOLE LOG

Job No: 80509051	Hole No: BH04
Sheet: 2 of 6	Started: 26/03/18
Finished: 28/03/18	Logged: NWH/JD
Checked: JW	RL Surface: 2.7m
Datum: Wellington Datum 1953	

MWH NEW ZEALAND LTD
Hazeldean Business Park
6 Hazeldean Road
Christchurch 8024
Tel: 03 366 7449
Fax: 03 366 7780

Client: Wellington Water
Project: Kilbirnie Storm Water upgrade investigations for Pump Station
Location: Evans Bay Park, Kilbirnie Wellington
Description: Phase two geotechnical investigations
Easting: 1750346m Northing: 5424728m Inclination: Vertical
Diameter (Int/Ext): 85mm/123mm Casing (Diam/Dpth): 127mm/4.5m

Material Description (Logging carried out in accordance with Guidelines for the Field Classification of Soil and Rock for Engineering Purposes. New Zealand Geotechnical Society, 2005)

Natural Defects: Type, orientation, spacing, persistence, roughness, wall strength, aperture, infill, seepage, no. of sets, block size

Weathering Grade: RS, CW, HW, MW, SW, UW
Strength UCS MPa: EW R0 <1, VW R1 1-5, W R2 5-20, MS R3 20-50, S R4 50-100, VS R5 100-250, ES R6 >250
Spacing mm: ECS <20, VCS 20-60, CS 60-200, MWS 200-600, WS 600-2000, VWS >2000

Depth (m)	Samples / Insitu Testing	Material Description	Length of Run (m)	Total Core Recovery %	Solid Core Recovery %	RQD %
5.0–6.0		Residual fine to medium, blue grey SANDSTONE, extremely weak recovered as Silty fine to medium SAND, blue grey, moist, loose, relic rock structure with quartz mineralisations. [MARINE DEPOSITS] *[continued]* *(6)*	1.05	100	100	100
6.0–6.45	SPT 1/1//2/3/3/3 N = 11	Becomes medium dense	0.45	82	90	100
6.45–7.5		*(7.5)*	1.05	95	90	100
7.5–7.95	SPT 0/0//0/1/2/2 N = 5	Becomes loose *(7.95)*	0.45	100	100	0
7.95–9.0		Some thin lenses of silt (>3mm) *(9)*	1.05	95	100	0
9.0–9.45	SPT 1/2//3/4/4/5 N = 16	Becomes medium dense.	0.45	100	100	0
9.45–10.0			1.05	100	100	0

Elevation (m): -3.0, -4.0, -5.0, -6.0, -7.0

Drilling Method: **PQ**
Casing: **PW**
Contractor: **Griffiths Drilling**
Flush: **Polymer Powder**
Equipment Type: **Comacchio 450P Track Mounted PQ3 Triple Tube**

Remarks: See key sheets for abbreviations and symbols
- Material descriptions conform to FIELD DESCRIPTION OF SOIL AND ROCK, 2005, NZGS
- SPT testing performed to NZS4402.6.5.1

Stantec

MWH NEW ZEALAND LTD
Hazeldean Business Park
6 Hazeldean Road
Christchurch 8024
Tel: 03 366 7449
Fax: 03 366 7780

BOREHOLE LOG

Job No: 80509051
Hole No: BH04

Client: Wellington Water
Project: Kilbirnie Storm Water upgrade investigations for Pump Station
Location: Evans Bay Park, Kilbirnie Wellington
Description: Phase two geotechnical investigations

Started: 26/03/18
Finished: 28/03/18
Logged: NWH/JD
Checked: JW

Easting: 1750346m Northing: 5424728m Inclination: Vertical
RL Surface: 2.7m
Diameter (Int/Ext): 85mm/123mm Casing (Diam/Dpth): 127mm/4.5m
Datum: Wellington Datum 1953

Column headings: Depth (m); Elevation (m); Samples / Insitu Testing; Material Description (Logging carried out in accordance with Guidelines for the Field Classification of Soil and Rock for Engineering Purposes. New Zealand Geotechnical Society, 2005); Graphic Log; Natural Defects (Type, orientation, spacing, persistence, roughness, wall strength, aperture, infill, seepage, no. of sets, block size); Weathering Grade (RS, CW, HW, MW, SW, UW); Strength UCS MPa (EW R0 <1, VW R1 1-5, W R2 5-20, MS R3 20-50, S R4 50-100, VS R5 100-250, ES R6 >250); Spacing mm (ECS <20, VCS 20-60, CS 60-200, MWS 200-600, WS 600-2000, VWS >2000); Length of Run (m); Total Core Recovery %; Solid Core Recovery %; RQD %; Groundwater; Installation

Material description: Becomes medium dense. *[continued]* ... (15)

Depth markers: 10.5, 11.0, 11.5, 12.0, 12.5, 13.0, 13.5, 14.0, 14.5, 15.0
Elevation markers: -8.0, -9.0, -10.0, -11.0, -12.0

Depth (m)	Samples / Insitu Testing	Length of Run (m)	Total Core Recovery %	Solid Core Recovery %	RQD %
10.5–10.95	SPT 2/3//8/3/5/6 N = 22	0.45	100	100	0
10.95–12.0		1.05	67	100	0
12.0–12.45	SPT 2/3//4/4/6/6 N = 20	0.45	89	100	0
12.45–13.0		0.55	100	100	20
13.5–13.95	SPT 3/3//5/6/2/9 N = 27	0.45	89	100	20
13.95–15.0		1.05	100	100	0

Drilling Method: **PQ**
Casing: **PW**
Contractor: **Griffiths Drilling**
Flush: **Polymer Powder**
Equipment Type: **Comacchio 450P Track Mounted PQ3 Triple Tube**

Remarks: See key sheets for abbreviations and symbols
- Material descriptions conform to FIELD DESCRIPTION OF SOIL AND ROCK, 2005, NZGS
- SPT testing performed to NZS4402.6.5.1

Information status: Final, 1 May 2018

Stantec

MWH NEW ZEALAND LTD
Hazeldean Business Park
6 Hazeldean Road
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BOREHOLE LOG

Job No: 80509051
Hole No: BH04

Client: Wellington Water
Project: Kilbirnie Storm Water upgrade investigations for Pump Station
Location: Evans Bay Park, Kilbirnie Wellington
Description: Phase two geotechnical investigations

Started: 26/03/18
Finished: 28/03/18
Logged: NWH/JD
Checked: JW

Easting: 1750346m Northing: 5424728m Inclination: Vertical
RL Surface: 2.7m
Diameter (Int/Ext): 85mm/123mm Casing (Diam/Dpth): 127mm/4.5m
Datum: Wellington Datum 1953

Material Description (Logging carried out in accordance with Guidelines for the Field Classification of Soil and Rock for Engineering Purposes. New Zealand Geotechnical Society, 2005)

Natural Defects: Type, orientation, spacing, persistence, roughness, wall strength, aperture, infill, seepage, no. of sets, block size

Weathering Grade: RS, CW, HW, MW, SW, UW
Strength UCS MPa: EW R0 <1, VW R1 1-5, W R2 5-20, MS R3 20-50, S R4 50-100, VS R5 100-250, ES R6 >250
Spacing mm: ECS <20, VCS 20-60, CS 60-200, MWS 200-600, WS 600-2000, VWS >2000

Depth (m)	Elevation (m)	Samples / Insitu Testing	Material Description	Natural Defects	Length of Run (m)	Total Core Recovery %	Solid Core Recovery %	RQD %
15.0–15.5		SPT 3/5// 7/8/12/15 N = 42	Becomes dense		0.45	100	100	0
15.5–16.5	-13.0		(16.5)		1.05	100	100	60
16.5–17.0	-14.0	SPT 4/7//20 N = >50	Highly weathered, yellowish brown, SANDSTONE, extremely weak to very weak, Closely to widely spaced defects.		0.20	100	100	60
17.0–18.0	-15.0			J@17m 70deg, Vn, No, Pl, R. J@17.5m 75deg, Vn, No, Pl, R. J@ 17.6m 90deg, Vn, No, Pl, R.	1.30	100	100	50
18.0–19.5	-16.0			J@ 18.6m 60deg, N, No, St, Sr. J@ 19.0m 70deg, Vn, No, Pl, R. J@ 19.4m 90deg, Vn, No, U, R.	1.50	90	90	90
19.5–20.0	-17.0		Borehole terminated at 20m due to target depth (20)	J@ 19.55m 80deg, T, No, Pl, R. J@ 19.6m 80deg, Vn, No, Pl, R. J@ 19.9m 80deg, Vn, No, Pl, R	0.50		100	80

Drilling Method: **PQ**
Casing: **PW**
Contractor: **Griffiths Drilling**
Flush: **Polymer Powder**
Equipment Type: **Comacchio 450P Track Mounted PQ3 Triple Tube**

Remarks: See key sheets for abbreviations and symbols
- Material descriptions conform to FIELD DESCRIPTION OF SOIL AND ROCK, 2005, NZGS
- SPT testing performed to NZS4402.6.5.1

Information status: Final, 1 May 2018

Stantec

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BOREHOLE LOG

Job No: 80509051
Hole No: BH04

Client: Wellington Water
Project: Kilbirnie Storm Water upgrade investigations for Pump Station
Location: Evans Bay Park, Kilbirnie Wellington
Description: Phase two geotechnical investigations
Easting: 1750346m Northing: 5424728m Inclination: Vertical
Diameter (Int/Ext): 85mm/123mm Casing (Diam/Dpth): 127mm/4.5m

Started: 26/03/18
Finished: 28/03/18
Logged: NWH/JD
Checked: JW
RL Surface: 2.7m
Datum: Wellington Datum 1953

Depth (m)	Elevation (m)	Samples / Insitu Testing	Material Description (Logging carried out in accordance with Guidelines for the Field Classification of Soil and Rock for Engineering Purposes. New Zealand Geotechnical Society, 2005)	Graphic Log	Natural Defects (Type, orientation, spacing, persistence, roughness, wall strength, aperture, infill, seepage, no. of sets, block size)	Weathering Grade (RS CW HW MW SW UW)	Strength UCS MPa (EW R0 <1, VW R1 1-5, W R2 5-20, MS R3 20-50, S R4 50-100, VS R5 100-250, ES R6 >250)	Spacing mm (ECS <20, VCS 20-60, CS 60-200, MWS 200-600, WS 600-2000, VWS >2000)	Length of Run (m)	Total Core Recovery %	Solid Core Recovery %	RQD %	Groundwater	Installation
					R.									
20.5														
	-18.0													
21.0														
21.5														
	-19.0													
22.0														
22.5														
	-20.0													
23.0														
23.5														
	-21.0													
24.0														
24.5														
	-22.0													
25.0														

Drilling Method: **PQ**
Casing: **PW**
Contractor: **Griffiths Drilling**
Flush: **Polymer Powder**
Equipment Type: **Comacchio 450P Track Mounted PQ3 Triple Tube**

Remarks: See key sheets for abbreviations and symbols
- Material descriptions conform to FIELD DESCRIPTION OF SOIL AND ROCK, 2005, NZGS
- SPT testing performed to NZS4402.6.5.1

Stantec

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BOREHOLE LOG

Job No: 80509051
Hole No: BH04

Client: Wellington Water
Started: 26/03/18
Project: Kilbirnie Storm Water upgrade investigations for Pump Station
Finished: 28/03/18
Location: Evans Bay Park, Kilbirnie Wellington
Logged: NWH/JD
Description: Phase two geotechnical investigations
Checked: JW
Easting: 1750346m Northing: 5424728m Inclination: Vertical
RL Surface: 2.7m
Diameter (Int/Ext): 85mm/123mm Casing (Diam/Dpth): 127mm/4.5m
Datum: Wellington Datum 1953

Date	Time	Drill core Type	Depth of BH (m)	Casing Type	Bottom of Casing (m)	Depth to Groundwater (m)
28/Mar/2018	00:00	PQ	20			2.2

Drill Bit Sizes:
PQ: 85mm id

Notes:
-

Casing Sizes:
PW: 127mm id

Notes:
-

Drilling Method: **PQ**
Casing: **PW**
Contractor: **Griffiths Drilling**
Flush: **Polymer Powder**
Equipment Type: **Comacchio 450P Track Mounted PQ3 Triple Tube**

Remarks: See key sheets for abbreviations and symbols
- Material descriptions conform to FIELD DESCRIPTION OF SOIL AND ROCK, 2005, NZGS
- SPT testing performed to NZS4402.6.5.1

Information status: Final, 1 May 2018

Stantec

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BOREHOLE LOG

Client: Wellington Water	Job No: 80509051
Project: Kilbirnie Storm Water upgrade investigations for Pump Station	Hole No: BH05
Location: Evans Bay Park, Kilbirnie Wellington	Sheet: 1 of 5
Description: Phase two geotechnical investigations	Started: 27/03/18
Easting: 1750335m Northing: 5424721m Inclination: Vertical	Finished: 28/03/18
Diameter (Int/Ext): 63mm/96mm	Logged: NWH/JD
	Checked: JW
	RL Surface: 2.6m
	Datum: Wellington Datum 1953

Material Description (Logging carried out in accordance with Guidelines for the Field Classification of Soil and Rock for Engineering Purposes. New Zealand Geotechnical Society, 2005)

Natural Defects: Type, orientation, spacing, persistence, roughness, wall strength, aperture, infill, seepage, no. of sets, block size

Weathering Grade: RS CW HW MW SW UW
Strength UCS MPa: EW R0 <1, VW R1 1-5, W R2 5-20, MS R3 20-50, S R4 50-100, VS R5 100-250, ES R6 >250
Spacing mm: ECS <20, VCS 20-60, CS 60-200, MWS 200-600, WS 600-2000, VWS >2000

Depth (m)	Elevation (m)	Samples / Insitu Testing	Material Description	Natural Defects	Length of Run (m)	Total Core Recovery %	Solid Core Recovery %	RQD %	Groundwater	Installation
0.0–0.1			TOPSOIL (0.1)							
0.1–1.5	2.0		Sandy GRAVEL and some silt; yellowish brown and orange, loose, moist; low plasticity (1.5)	High groundwater flow (from 1.0)	1.50					
1.5–2.2	1.0	SPT 3/3//2/3/3/2 N = 10	Silty fine to medium SAND; yellowish brown and orange, loose, moist to wet; low plasticity (2.2)		0.45	100				
2.2–3.0	0.0		Trace of fine gravel. [MARINE DEPOSITS] (3)		1.05	63				
3.0–3.95		SPT 1/2//1/1/0/1 N = 3	Sandy fine to coarse GRAVEL with some silt; yellowish brown and orange, very loose, saturated; low plasticity [MARINE DEPOSITS] (3.95)		0.45	50				
3.95–4.25	-1.0		Silty medium to coarse SAND with some shells and some organics; dark grey, loose, saturated [MARINE DEPOSITS] (4.25)		1.05	100				
4.25–5.0	-2.0	SPT 1/2//1/1/1/1 N = 4	Occasional medium gravel [MARINE DEPOSITS]		0.45	100				

Drilling Method: **HQ**	Casing: **HW**	Remarks: See key sheets for abbreviations and symbols - Material descriptions conform to FIELD DESCRIPTION OF SOIL AND ROCK, 2005, NZGS - SPT testing performed to NZS4402.6.5.1
Contractor: **Geotech Drilling**	Flush: **Polymer Powder**	
Equipment Type: **Track Mounted PQ Triple Tube**		

Information status: Final, 1 May 2018

Stantec

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BOREHOLE LOG

Job No: 80509051	Hole No: BH05
Sheet: 2 of 5	
Client: Wellington Water	Started: 27/03/18
Project: Kilbirnie Storm Water upgrade investigations for Pump Station	Finished: 28/03/18
Location: Evans Bay Park, Kilbirnie Wellington	Logged: NWH/JD
Description: Phase two geotechnical investigations	Checked: JW
Easting: 1750335m Northing: 5424721m Inclination: Vertical	RL Surface: 2.6m
Diameter (Int/Ext): 63mm/96mm	Datum: Wellington Datum 1953

Material Description: (Logging carried out in accordance with Guidelines for the Field Classification of Soil and Rock for Engineering Purposes. New Zealand Geotechnical Society, 2005)

Natural Defects: Type, orientation, spacing, persistence, roughness, wall strength, aperture, infill, seepage, no. of sets, block size

Weathering Grade: RS, CW, HW, MW, SW, UW
Strength UCS MPa: EW R0 <1, VW R1 1-5, W R2 5-20, MS R3 20-50, S R4 50-100, VS R5 100-250, ES R6 >250
Spacing mm: ECS <20, VCS 20-60, CS 60-200, MWS 200-600, WS 600-2000, VWS >2000

Depth (m)	Elevation (m)	Samples / Insitu Testing	Material Description	Length of Run (m)	Total Core Recovery %	Solid Core Recovery %	RQD %	Groundwater
			Occasional medium gravel [MARINE DEPOSITS] *[continued]* *(5.3)*					
5.5	-3.0		Sandy SILT; grey, moist; low plasticity. Fine to medium sand. [MARINE DEPOSITS] *(5.5)*	1.05	100			
			Silty medium to coarse SAND with some shells with some organics; dark grey, loose, saturated; medium plasticity [MARINE DEPOSITS] *(6)*					
6.0		SPT 1/2//2/2/2/3 N = 9	Silty fine SAND; grey, loose, moist; low plasticity *(6.8)*	0.45	100			
6.5	-4.0							
7.0			Becomes green and grey, medium dense with relic rock strucure.	1.05	71			
7.5	-5.0	SPT 2/2//3/4/5/6 N = 18		0.45	100			
8.0								
8.5	-6.0			1.05	54			
9.0		SPT 1/3//4/5/7/8 N = 24		0.45	100			
9.5	-7.0							
10.0				1.05	75			

Drilling Method: **HQ**
Casing: **HW**
Contractor: **Geotech Drilling**
Flush: **Polymer Powder**
Equipment Type: **Track Mounted PQ Triple Tube**

Remarks: See key sheets for abbreviations and symbols
- Material descriptions conform to FIELD DESCRIPTION OF SOIL AND ROCK, 2005, NZGS
- SPT testing performed to NZS4402.6.5.1

Stantec

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BOREHOLE LOG

Job No: 80509051	Hole No: BH05
Sheet: 3 of 5	Started: 27/03/18
Client: Wellington Water	Finished: 28/03/18
Project: Kilbirnie Storm Water upgrade investigations for Pump Station	Logged: NWH/JD
Location: Evans Bay Park, Kilbirnie Wellington	Checked: JW
Description: Phase two geotechnical investigations	RL Surface: 2.6m
Easting: 1750335m Northing: 5424721m Inclination: Vertical	Datum: Wellington Datum 1953
Diameter (Int/Ext): 63mm/96mm	

Depth (m)	Elevation (m)	Samples / Insitu Testing	Material Description (Logging carried out in accordance with Guidelines for the Field Classification of Soil and Rock for Engineering Purposes. New Zealand Geotechnical Society, 2005)	Natural Defects (Type, orientation, spacing, persistence, roughness, wall strength, aperture, infill, seepage, no. of sets, block size)	Length of Run (m)	Total Core Recovery %	Solid Core Recovery %	RQD %
			Becomes green and grey, medium dense with relic rock strucure. *[continued]* *(10.5)*					
10.5	-8.0	SPT 7/7// 8/10/11/12 N = 41	Completely to highly weathered, yellowish brown and grey, SANDSTONE, extremely weak to very weak, closely spaced defects		0.45	100	100	80
11.0								
11.5	-9.0				1.05	100	100	80
12.0		SPT 8/13 N = >50			0.15	100	100	70
12.5	-10.0				1.35	85	100	70
13.0								
13.5	-11.0							
14.0					1.50	100	100	40
14.5	-12.0							
15.0								

Weathering Grade: RS CW HW MW SW UW
Strength UCS MPa: EW R0 <1, VW R1 1-5, W R2 5-20, MS R3 20-50, S R4 50-100, VS R5 100-250, ES R6 >250
Spacing mm: ECS <20, VCS 20-60, CS 60-200, MWS 200-600, WS 600-2000, VWS >2000

Graphic Log / Groundwater / Installation

Drilling Method: **HQ**
Casing: **HW**
Contractor: **Geotech Drilling**
Flush: **Polymer Powder**
Equipment Type: **Track Mounted PQ Triple Tube**

Remarks: See key sheets for abbreviations and symbols
- Material descriptions conform to FIELD DESCRIPTION OF SOIL AND ROCK, 2005, NZGS
- SPT testing performed to NZS4402.6.5.1

Information status: Final, 1 May 2018

Stantec

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BOREHOLE LOG

Job No: 80509051
Hole No: BH05
Sheet: 4 of 5

Client: Wellington Water
Started: 27/03/18
Project: Kilbirnie Storm Water upgrade investigations for Pump Station
Finished: 28/03/18
Location: Evans Bay Park, Kilbirnie Wellington
Logged: NWH/JD
Description: Phase two geotechnical investigations
Checked: JW
Easting: 1750335m Northing: 5424721m Inclination: Vertical
RL Surface: 2.6m
Diameter (Int/Ext): 63mm/96mm
Datum: Wellington Datum 1953

Depth (m)	Elevation (m)	Samples / Insitu Testing	Material Description (Logging carried out in accordance with Guidelines for the Field Classification of Soil and Rock for Engineering Purposes. New Zealand Geotechnical Society, 2005)	Graphic Log	Natural Defects (Type, orientation, spacing, persistence, roughness, wall strength, aperture, infill, seepage, no. of sets, block size)	Weathering Grade (RS CW HW MW SW UW)	Strength UCS MPa (EW R0 <1, VW R1 1-5, W R2 5-20, MS R3 20-50, S R4 50-100, VS R5 100-250, ES R6 >250)	Spacing mm (ECS <20, VCS 20-60, CS 60-200, MWS 200-600, WS 600-2000, VWS >2000)	Length of Run (m)	Total Core Recovery %	Solid Core Recovery %	RQD %	Groundwater	Installation
15.5 – 16.0	-13.0		Completely to highly weathered, yellowish brown and grey, SANDSTONE, extremely weak to very weak, closely spaced defects *[continued]*						1.50	100	100	50		
16.5 – 18.0	-14.0, -15.0				J@16.8m 60deg, Vn, No, Pl, R. J@16.82m 70deg, Vn, No, Pl, R. J@ 17.1m 30deg, St, No, Pl, R. J@ 17.3m 60deg, Vn, No, Pl, R. J@ 17.8m 30deg, Vn, No, Pl, R.				1.50	87	100	50		
18.5 – 19.5	-16.0		(19.5)		J@ 19.0m 50deg, Vn, No, Pl, R. J@ 19.2m 70deg, Vn, No, Pl, R. J@ 19.3m 40deg, T, No, Pl, R.				1.50	100	100	40		
19.5 – 20.0	-17.0		Borehole terminated at 19.5m due to Target Depth											

Drilling Method: **HQ**
Casing: **HW**
Contractor: **Geotech Drilling**
Flush: **Polymer Powder**
Equipment Type: **Track Mounted PQ Triple Tube**

Remarks: See key sheets for abbreviations and symbols
- Material descriptions conform to FIELD DESCRIPTION OF SOIL AND ROCK, 2005, NZGS
- SPT testing performed to NZS4402.6.5.1

NZGD ID: BH_112620

Stantec

MWH NEW ZEALAND LTD
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Christchurch 8024
Tel: 03 366 7449
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BOREHOLE LOG

Job No: 80509051
Hole No: BH05

Client: Wellington Water
Started: 27/03/18
Project: Kilbirnie Storm Water upgrade investigations for Pump Station
Finished: 28/03/18
Location: Evans Bay Park, Kilbirnie Wellington
Logged: NWH/JD
Description: Phase two geotechnical investigations
Checked: JW
Easting: 1750335m   Northing: 5424721m   Inclination: Vertical
RL Surface: 2.6m
Diameter (Int/Ext): 63mm/96mm
Datum: Wellington Datum 1953

Date	Time	Drill core Type	Depth of BH (m)	Casing Type	Bottom of Casing (m)	Depth to Groundwater (m)
29/Mar/2018	00:00	HQ	19.5			2.1

	Drill Bit Sizes:	Notes:	Casing Sizes:	Notes:	
	HQ: 63mm id	-			

Drilling Method: **HQ**
Casing: **HW**
Contractor: **Geotech Drilling**
Flush: **Polymer Powder**
Equipment Type: **Track Mounted PQ Triple Tube**

Remarks: See key sheets for abbreviations and symbols
- Material descriptions conform to FIELD DESCRIPTION OF SOIL AND ROCK, 2005, NZGS
- SPT testing performed to NZS4402.6.5.1

GRIFFITHS DRILLING
RESULT DRIVEN GEOTECHNICAL SPECIALISTS

SITE INVESTIGATION BORELOG

BH#	5
JOB#	-

134 State Highway 58
Pauatahanui
P: 045277346
F: 045277347
www.griffithsdrilling.co.nz

Project:	Kilbirnie Pump Station			Grid Ref:	N: -
Location:	Evans Bay Park, Kilbirnie				E: -
Client:	Stantec	Operator:	[redacted]		
DATE Start:	28/3/18	DATE Finish:	29/3/18	Page:	1 of 1
Drill Rig:	Geotech Track Rig	SPT Hammer #:	Geotech 03		
Drilling Method:	HQ Coring	Flushing Type:	Polymer Powder		
Bore Diameter:	HQ	Casing Diameter / Type:	-		
Bore Final Depth:	19.5m	Casing Final Depth:	-		

Layer Change Depth (mbgl)	Formation Drill Conditions (L) – Loose, Unstable (B) – Bands of hard and soft (S) – Soft, Stable (M) – Moderately Firm. (F) – Firm, Stable (H) – Hard to penetrate Fluids: (TL) Total Loss; (SL) Slow Loss; (WS) Water Struck; (NL) No Loss Geological Description *Must Include: Colour, Texture, Composition, Fractures, Boundary type (gradual, abrupt?)*	Core Samples & Recovery: From (m)	To (m)	Recovery (%)	Standard Penetration Test (SPT): Cone Type	Depth	SPT Counts	N Value	Sample (%)
0.00	Jet Vac	0.00	1.50	-	SP	1.5	3/3//2/3/3/2	10	100
1.50	Fill	1.95	3.00	80		3.0	1/2//1/1/0/1	3	100
4.50	Sea shells. Grey silty gravels.	3.45	4.50	100		4.5	1/2//1/1/1/1	4	100
6.00	Green silty sands. Soft.	4.95	6.00	100		6.0	2/1//2/2/2/3	9	100
10.50	Soft green silty sands.	6.45	7.50	70		7.5	2/2//3/4/5/6	18	100
12.00	Hard silty sands.	7.95	9.00	60		9.0	1/3//4/5/7/8	24	100
19.50	EOB	9.45	10.50	70		10.5	7/7//8/10/11/12	41	100
		10.95	12.00	100					
		12.45	13.50	100					
		13.50	15.00	100					
		15.00	16.50	100					
	50mm monitoring well installed.	16.50	18.00	100					
	Screen set from 12.0m – 8.0m.	18.50	19.50	100					
	Flush lockable toby.								

Water Level	Date / Time	Hole Depth	Water Level	Date / Time	Hole Depth
-					

GRIFFITHS DRILLING
RESULT DRIVEN GEOTECHNICAL SPECIALISTS

SITE INVESTIGATION BORELOG

BH#	6
JOB#	-

134 State Highway 58
Pauatahanui
P: 045277346
F: 045277347
www.griffithsdrilling.co.nz

Project:	Kilbirnie Pump Station	Grid Ref:	N: -
Location:	Evans Bay Park, Kilbirnie		E: -
Client:	Stantec	Operator:	s(7)(2)(a)
DATE Start:	27/3/18	DATE Finish:	29/3/18
		Page:	1 of 1

Drill Rig:	Commachio MC450P	SPT Hammer #:	Auto
Drilling Method:	PQ Coring	Flushing Type:	Polymer Powder
Bore Diameter:	PQ	Casing Diameter / Type:	PW
Bore Final Depth:	15.00m	Casing Final Depth:	4.64m

Formation Drill Conditions
(L) – Loose, Unstable; (S) – Soft, Stable; (F) – Firm, Stable; (B) – Bands of hard and soft; (M) – Moderately Firm.; (H) – Hard to penetrate

Fluids: (TL) Total Loss; (SL) Slow Loss; (WS) Water Struck; (NL) No Loss

Layer Change Depth (mbgl)	Geological Description (Must Include: Colour, Texture, Composition, Fractures, Boundary type (gradual, abrupt?))	Core Samples & Recovery: From (m)	To (m)	Recovery (mm)	Standard Penetration Test (SPT): Cone Type	Depth	SPT Counts	N Value	Sample (mm)
0.00	Jet Vac	1.95	3.00	700	SP	1.5	3/2//2/2/4/2	10	250
1.50	Soft brown fill with rock boulders.	3.45	4.50	550		3.0	0/1//1/1/1/1	4	140
4.80	Course sand	4.95	6.00	500		4.5	3/1//2/1/0/1	4	400
5.20	Hard brown fill.	6.45	7.50	1050		6.0	2/2//3/3/3/4	13	450
6.00	Brown sandy silts.	7.95	9.00	800		7.5	2/2//3/3/4/4	14	450
10.50	Blue green sandy silts.	9.45	10.50	1050		9.0	1/2//2/4/3/6	15	450
15.00	EOB	10.95	12.00	1050		10.5	2/3//2/3/4/4	13	450
		12.45	13.50	1000		12.0	1/2//3/4/4/4	15	450
		13.95	15.00	1050		13.5	3/4//5/5/6/10	26	410
	50mm monitoring well installed to								
	3.0m depth. Screen set from 3.0m -								
	1.2m. Flush lockable toby.								

Water Level	Date / Time	Hole Depth	Water Level	Date / Time	Hole Depth
2.30m	29/3/18	-			

NZGD ID: BH_112621

Stantec

MWH NEW ZEALAND LTD
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6 Hazeldean Road
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Tel: 03 366 7449
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BOREHOLE LOG

Job No: 80509051
Hole No: BH06
Sheet: 1 of 4

Client: Wellington Water
Started: 28/03/18
Project: Kilbirnie Storm Water upgrade investigations for Pump Station
Finished: 03/04/18
Location: Evans Bay Park, Kilbirnie Wellington
Logged: NWH/JD
Description: Phase two geotechnical investigations
Checked: JW
Easting: 1750357m Northing: 542472m Inclination: Vertical
RL Surface: 2.8m
Diameter (Int/Ext): 85mm/123mm Casing (Diam/Dpth): 127mm/4.64m
Datum: Wellington Datum 1953

Material Description (Logging carried out in accordance with Guidelines for the Field Classification of Soil and Rock for Engineering Purposes. New Zealand Geotechnical Society, 2005)

Natural Defects: Type, orientation, spacing, persistence, roughness, wall strength, aperture, infill, seepage, no. of sets, block size

Weathering Grade: RS, CW, HW, MW, SW, UW
Strength UCS MPa: EW R0 <1, VW R1 1-5, W R2 5-20, MS R3 20-50, S R4 50-100, VS R5 100-250, ES R6 >250
Spacing mm: ECS <20, VCS 20-60, CS 60-200, MWS 200-600, WS 600-2000, VWS >2000

Depth (m)	Elevation (m)	Samples / Insitu Testing	Material Description	Natural Defects	Length of Run (m)	Total Core Recovery %
0.0–0.1			TOPSOIL (0.1)			
0.1–1.5	2.0 (at ~0.8)		Sandy GRAVEL with minor silt; yellowish brown, loose to medium dense, moist (1.5)		1.50	
1.5–1.95	1.0 (at ~1.8)	SPT 3/2//2/2/4/2 N = 10	Silty fine SAND with trace of gravel; yellowish brown, loose, moist; low plasticity. Subrounded.		0.45	56
1.95–3.0	0.0 (at ~2.8)				1.05	67
3.0–3.45		SPT 0/1//1/1/1/1 N = 4			0.45	31
3.45–4.5	-1.0 (at ~3.8)		(4.2)		1.05	52
4.2–			Silty medium to coarse SAND with some shells and gravel; dark grey, loose, saturated; low plasticity [MARINE DEPOSITS]	Drilling became very hard High groundwater flow through coarse sand layer		
4.5–4.95	-2.0 (at ~4.8)	SPT 3/1//2/1/0/1 N = 4			0.45	89
5.0						

Drilling Method: **PQ**
Casing: **PW**
Contractor: **Griffiths Drilling**
Flush: **Polymer Powder**
Equipment Type: **Comacchio 450P Track Mounted PQ3 Triple Tube**

Remarks: See key sheets for abbreviations and symbols
- Material descriptions conform to FIELD DESCRIPTION OF SOIL AND ROCK, 2005, NZGS
- SPT testing performed to NZS4402.6.5.1

Information status: Final, 1 May 2018

NZGD ID: BH_112621

Stantec

BOREHOLE LOG

MWH NEW ZEALAND LTD
Hazeldean Business Park
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Christchurch 8024
Tel: 03 366 7449
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Job No: 80509051	Hole No: BH06
Sheet: 2 of 4	
Client: Wellington Water	Started: 28/03/18
Project: Kilbirnie Storm Water upgrade investigations for Pump Station	Finished: 03/04/18
Location: Evans Bay Park, Kilbirnie Wellington	Logged: NWH/JD
Description: Phase two geotechnical investigations	Checked: JW
Easting: 1750357m Northing: 542472m Inclination: Vertical	RL Surface: 2.8m
Diameter (Int/Ext): 85mm/123mm Casing (Diam/Dpth): 127mm/4.64m	Datum: Wellington Datum 1953

Material Description: (Logging carried out in accordance with Guidelines for the Field Classification of Soil and Rock for Engineering Purposes. New Zealand Geotechnical Society, 2005)

Natural Defects: Type, orientation, spacing, persistence, roughness, wall strength, aperture, infill, seepage, no. of sets, block size

Weathering Grade: RS, CW, HW, MW, SW, UW
Strength UCS MPa: EW R0 <1, VW R1 1-5, W R2 5-20, MS R3 20-50, S R4 50-100, VS R5 100-250, ES R6 >250
Spacing mm: ECS <20, VCS 20-60, CS 60-200, MWS 200-600, WS 600-2000, VWS >2000

Depth (m)	Elevation (m)	Samples / Insitu Testing	Material Description	Length of Run (m)	Total Core Recovery %	Solid Core Recovery %	RQD %
to 5.2			(5.2)				
5.2–5.8			Silty clayey medium to coarse SAND with some shells and gravel; grey, loose, moist [MARINE DEPOSITS] (5.8)	1.05	57		
5.8–8.9	-3.0	SPT 2/2//3/5/3/4 N = 13 (6.0–6.45)	Sandy SILT; brownish grey, stiff, moist to wet; medium plasticity. Fine to medium grained sand. [MARINE DEPOSITS] (8.9)	0.45	100		
	-4.0			1.05	100		
	-5.0	SPT 2/2//3/3/4/4 N = 14 (7.5–7.95)		0.45	100		
	-6.0			1.05	76		
8.9–9.0			Some relic rock structure with quartz mineralisation [MARINE DEPOSITS] (9)				
9.0–10.0		SPT 1/2//2/4/3/6 N = 15 (9.0–9.45)	Completely weathered, residual soil, grey, find to medium SANDSTONE. Extremely weak.	0.45	100		
	-7.0			1.05	100	100	80

Depth scale: 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5, 9.0, 9.5, 10.0

Drilling Method: **PQ**	Casing: **PW**
Contractor: **Griffiths Drilling**	Flush: **Polymer Powder**
Equipment Type: **Comacchio 450P Track Mounted PQ3 Triple Tube**	

Remarks: See key sheets for abbreviations and symbols
- Material descriptions conform to FIELD DESCRIPTION OF SOIL AND ROCK, 2005, NZGS
- SPT testing performed to NZS4402.6.5.1

Stantec

MWH NEW ZEALAND LTD
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BOREHOLE LOG

Job No: 80509051
Hole No: BH06

Client: Wellington Water
Project: Kilbirnie Storm Water upgrade investigations for Pump Station
Location: Evans Bay Park, Kilbirnie Wellington
Description: Phase two geotechnical investigations
Started: 28/03/18
Finished: 03/04/18
Logged: NWH/JD
Checked: JW
Easting: 1750357m Northing: 542472m Inclination: Vertical
RL Surface: 2.8m
Diameter (Int/Ext): 85mm/123mm Casing (Diam/Dpth): 127mm/4.64m
Datum: Wellington Datum 1953

Material Description (Logging carried out in accordance with Guidelines for the Field Classification of Soil and Rock for Engineering Purposes. New Zealand Geotechnical Society, 2005)

Natural Defects: Type, orientation, spacing, persistence, roughness, wall strength, aperture, infill, seepage, no. of sets, block size

Weathering Grade: RS, CW, HW, MW, SW, UW
Strength UCS MPa: EW R0 <1, VW R1 1-5, W R2 5-20, MS R3 20-50, S R4 50-100, VS R5 100-250, ES R6 >250
Spacing mm: ECS <20, VCS 20-60, CS 60-200, MWS 200-600, WS 600-2000, VWS >2000

Depth (m)	Elevation (m)	Samples / Insitu Testing	Material Description	Length of Run (m)	Total Core Recovery %	Solid Core Recovery %	RQD %
10.0–10.5			Completely weathered, residual soil, grey, find to medium SANDSTONE. Extremely weak. *[continued]*				
10.5–10.95	-8.0	SPT 2/3//2/3/4/4 N = 13		0.45	100	100	60
10.95–12.0	-9.0			1.05	100	100	60
12.0–12.45		SPT 0/2//3/4/4/4 N = 15		0.45	100	100	90
12.45–13.5	-10.0			1.05	100	90	90
13.5–15.0	-11.0, -12.0		Borehole terminated at 15m due to limit of machine - Refusal (15)	1.50	100	100	70

Drilling Method: **PQ**
Casing: **PW**
Contractor: **Griffiths Drilling**
Flush: **Polymer Powder**
Equipment Type: **Comacchio 450P Track Mounted PQ3 Triple Tube**

Remarks: See key sheets for abbreviations and symbols
- Material descriptions conform to FIELD DESCRIPTION OF SOIL AND ROCK, 2005, NZGS
- SPT testing performed to NZS4402.6.5.1

Information status: Final, 1 May 2018

NZGD ID: BH_112621

Stantec

MWH NEW ZEALAND LTD
Hazeldean Business Park
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BOREHOLE LOG

Job No: 80509051
Hole No: BH06

Client: Wellington Water
Started: 28/03/18
Project: Kilbirnie Storm Water upgrade investigations for Pump Station
Location: Evans Bay Park, Kilbirnie Wellington
Finished: 03/04/18
Logged: NWH/JD
Description: Phase two geotechnical investigations
Checked: JW
Easting: 1750357m Northing: 542472m Inclination: Vertical
RL Surface: 2.8m
Diameter (Int/Ext): 85mm/123mm Casing (Diam/Dpth): 127mm/4.64m
Datum: Wellington Datum 1953

Date	Time	Drill core Type	Depth of BH (m)	Casing Type	Bottom of Casing (m)	Depth to Groundwater (m)
03/Apr/2018	00:00	PQ	15			2.3

Drill Bit Sizes:
PQ: 85mm id

Notes:
-

Casing Sizes:
PW: 127mm id

Notes:
-

Drilling Method: **PQ**
Casing: **PW**
Contractor: **Griffiths Drilling**
Flush: **Polymer Powder**
Equipment Type: **Comacchio 450P Track Mounted PQ3 Triple Tube**

Remarks: See key sheets for abbreviations and symbols
- Material descriptions conform to FIELD DESCRIPTION OF SOIL AND ROCK, 2005, NZGS
- SPT testing performed to NZS4402.6.5.1

Information status: Final, 1 May 2018

Stantec

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Fax: 03 366 7780

BOREHOLE LOG

Job No: 80509051
Hole No: BH07
Sheet: 1 of 4

Client: Wellington Water
Started: 26/03/18
Project: Kilbirnie Storm Water upgrade investigations for Pump Station
Finished: 27/03/18
Location: Evans Bay Park, Kilbirnie Wellington
Logged: NWH/JD
Description: Phase two geotechnical investigations
Checked: JW
Easting: 1750263m Northing: 5424721m Inclination: Vertical
RL Surface: 2.3m
Diameter (Int/Ext): 63mm/96mm
Datum: Wellington Datum 1953

Depth (m)	Elevation (m)	Samples / Insitu Testing	Material Description (Logging carried out in accordance with Guidelines for the Field Classification of Soil and Rock for Engineering Purposes. New Zealand Geotechnical Society, 2005)	Graphic Log	Natural Defects (Type, orientation, spacing, persistence, roughness, wall strength, aperture, infill, seepage, no. of sets, block size)	Weathering Grade (RS CW HW MW SW UW)	Strength UCS MPa (EW R0 <1, VW R1 1-5, W R2 5-20, MS R3 20-50, S R4 50-100, VS R5 100-250, ES R6 >250)	Spacing mm (ECS <20, VCS 20-60, CS 60-200, MWS 200-600, WS 600-2000, VWS >2000)	Length of Run (m)	Total Core Recovery %	Solid Core Recovery %	RQD %	Groundwater	Installation
0.0–0.1	2.0		TOPSOIL (0.1)											
0.1–1.5	1.0		Gravelly medium to coarse COBBLES with some sand and minor silt; greyish brown, blocky; loose, moist; Sub angular to angular (1.5)						1.50					
1.5–1.95		SPT 2/2//1/2/2/3 N = 8	Medium to coarse GRAVEL with some sand and silt; loose, moist (1.95)						0.45	56				
1.95–2.3	0.0		Sandy fine to coarse GRAVEL with some silt; yellowish brown, moist (2.3)						1.05	100				
2.3–2.9			BOULDER; grey, Sandstone greywacke (2.9)											
2.9–4.0	-1.0	SPT 5/4//3/3/1/1 N = 8	Sandy medium to coarse GRAVEL; yellowish brown, loose, moist; Fine to medium sand. (4)						0.45	100				
									1.05	100				
4.0–4.2	-2.0		Silty fine to coarse SAND and some shells; light grey and grey, loose to medium dense, moist; low plasticity [MARINE DEPOSITS] (4.2)											
4.2–4.4			Silty CLAY; dark grey, soft, moist; medium plasticity [MARINE DEPOSITS] (4.4)						0.45	100				
4.4–5.0			Silty fine to medium SAND; bluish grey, loose to medium dense, moist											

Drilling Method: **HQ**
Casing: **HW**
Contractor: **Geotech Drilling**
Flush: **Polymer Powder**
Equipment Type: **Track Mounted HQ Triple Tube**

Remarks: See key sheets for abbreviations and symbols
- Material descriptions conform to FIELD DESCRIPTION OF SOIL AND ROCK, 2005, NZGS
- SPT testing performed to NZS4402.6.5.1

02/05/18 MWH NEW ZEALAND LTD. Project: 80509051, Kilbirnie Storm Water upgrade investigations for Pump Station, Evans Bay Park, Kilbirnie Wellington www.mwhglobal.com/nz

Information status: Final, 1 May 2018

Stantec

BOREHOLE LOG

MWH NEW ZEALAND LTD
Hazeldean Business Park
6 Hazeldean Road
Christchurch 8024
Tel: 03 366 7449
Fax: 03 366 7780

Job No: 80509051
Hole No: BH07
Sheet: 2 of 4

Client: Wellington Water
Started: 26/03/18
Project: Kilbirnie Storm Water upgrade investigations for Pump Station
Finished: 27/03/18
Location: Evans Bay Park, Kilbirnie Wellington
Logged: NWH/JD
Description: Phase two geotechnical investigations
Checked: JW
Easting: 1750263m Northing: 5424721m Inclination: Vertical
RL Surface: 2.3m
Diameter (Int/Ext): 63mm/96mm
Datum: Wellington Datum 1953

Material Description (Logging carried out in accordance with Guidelines for the Field Classification of Soil and Rock for Engineering Purposes. New Zealand Geotechnical Society, 2005)

Natural Defects: Type, orientation, spacing, persistence, roughness, wall strength, aperture, infill, seepage, no. of sets, block size

Weathering Grade: RS, CW, HW, MW, SW, UW
Strength UCS MPa: EW R0 <1, VW R1 1-5, W R2 5-20, MS R3 20-50, S R4 50-100, VS R5 100-250, ES R6 >250
Spacing mm: ECS <20, VCS 20-60, CS 60-200, MWS 200-600, WS 600-2000, VWS >2000

Depth (m)	Elevation (m)	Samples / Insitu Testing	Material Description	Length of Run (m)	Total Core Recovery %	Solid Core Recovery %	RQD %
5.0–5.5	-3.0		[MARINE DEPOSITS] (5)				
			Silty fine to medium SAND and trace of organics; dark brown and grey, medium dense, moist; low plasticity (5.15)	1.05	100		
			Wood fragment. (5.35)				
6.0			Silty fine to medium SAND and trace of organics; dark brown and grey, medium dense, moist; low plasticity (5.9)				
6.0–6.45	-4.0	SPT 6/2//2/4/4/5 N = 15	Sandy fine to medium GRAVEL with some silt; grey, dense, moist; low plasticity. Fine to medium grained sand. (6.5)	0.45	100		
6.5–7.5	-5.0		Completely weathered, grey, SANDSTONE, extremely weak to very weak	1.05	90	40	0
7.5–7.95		SPT 2/2//3/4/5/6 N = 18		0.45	100	100	10
8.0–9.0	-6.0			1.05	70	100	10
9.0–9.45	-7.0	SPT 4/5//4/6/8/11 N = 29		0.45	100		
9.5–10.0				1.05	100	100	10

Drilling Method: **HQ**
Casing: **HW**
Contractor: **Geotech Drilling**
Flush: **Polymer Powder**
Equipment Type: **Track Mounted HQ Triple Tube**

Remarks: See key sheets for abbreviations and symbols
- Material descriptions conform to FIELD DESCRIPTION OF SOIL AND ROCK, 2005, NZGS
- SPT testing performed to NZS4402.6.5.1

Stantec MWH NEW ZEALAND LTD Hazeldean Business Park 6 Hazeldean Road Christchurch 8024 Tel: 03 366 7449 Fax: 03 366 7780	BOREHOLE LOG	Job No: 80509051 Hole No: BH07 Sheet: 3 of 4
	Client: Wellington Water	Started: 26/03/18
	Project: Kilbirnie Storm Water upgrade investigations for Pump Station Location: Evans Bay Park, Kilbirnie Wellington	Finished: 27/03/18 Logged: NWH/JD
	Description: Phase two geotechnical investigations	Checked: JW
	Easting: 1750263m Northing: 5424721m Inclination: Vertical	RL Surface: 2.3m
	Diameter (Int/Ext): 63mm/96mm	Datum: Wellington Datum 1953

Depth (m)	Elevation (m)	Samples / Insitu Testing	Material Description (Logging carried out in accordance with Guidelines for the Field Classification of Soil and Rock for Engineering Purposes. New Zealand Geotechnical Society, 2005)	Graphic Log	Natural Defects (Type, orientation, spacing, persistence, roughness, wall strength, aperture, infill, seepage, no. of sets, block size)	Weathering Grade (RS CW HW MW SW UW)	Strength UCS MPa (EW R0 <1, VW R1 1-5, W R2 5-20, MS R3 20-50, S R4 50-100, VS R5 100-250, ES R6 >250)	Spacing mm (ECS <20, VCS 20-60, CS 60-200, MWS 200-600, WS 600-2000, VWS >2000)	Length of Run (m)	Total Core Recovery %	Solid Core Recovery %	RQD %	Groundwater	Installation
	-8.0		Completely weathered, grey, SANDSTONE, extremely weak to very weak *[continued]*											
10.5		SPT 4/7// 8/11/11/13 N = 43							0.45	100	60	0		
11.0	-9.0								1.05	100	100	0		
11.5														
12.0	-10.0	SPT 6/9// 11/13/13/13 N = 48							0.45	100	100	40		
12.5									1.05	100	100	40		
13.0	-11.0													
13.5		SPT 11/7// 15/16/15/4 N = 55							0.45	100	100	90		
14.0	-12.0								1.05	100	100	100		
14.5														
15.0			Borehole terminated at 15m due to limit of machine - Refusal *(15)*											

Drilling Method: **HQ**	Casing: **HW**	Remarks: See key sheets for abbreviations and symbols - Material descriptions conform to FIELD DESCRIPTION OF SOIL AND ROCK, 2005, NZGS - SPT testing performed to NZS4402.6.5.1
Contractor: **Geotech Drilling**	Flush: **Polymer Powder**	
Equipment Type: **Track Mounted HQ Triple Tube**		

Information status: Final, 1 May 2018

02/05/18 MWH NEW ZEALAND LTD. Project: 80509051, Kilbirnie Storm Water upgrade investigations for Pump Station, Evans Bay Park, Kilbirnie Wellington www.mwhglobal.com/nz

Stantec

MWH NEW ZEALAND LTD
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BOREHOLE LOG

Job No: 80509051
Hole No: BH07

Client: Wellington Water
Started: 26/03/18
Project: Kilbirnie Storm Water upgrade investigations for Pump Station
Location: Evans Bay Park, Kilbirnie Wellington
Finished: 27/03/18
Logged: NWH/JD
Description: Phase two geotechnical investigations
Checked: JW
Easting: 1750263m Northing: 5424721m Inclination: Vertical
RL Surface: 2.3m
Diameter (Int/Ext): 63mm/96mm
Datum: Wellington Datum 1953

Date	Time	Drill core Type	Depth of BH (m)	Casing Type	Bottom of Casing (m)	Depth to Groundwater (m)
27/Mar/2018	00:00	HQ	15			2.4

	Drill Bit Sizes:	Notes:	Casing Sizes:	Notes:	
	HQ: 63mm id	-			

Drilling Method: **HQ**
Casing: **HW**
Contractor: **Geotech Drilling**
Flush: **Polymer Powder**
Equipment Type: **Track Mounted HQ Triple Tube**

Remarks: See key sheets for abbreviations and symbols
- Material descriptions conform to FIELD DESCRIPTION OF SOIL AND ROCK, 2005, NZGS
- SPT testing performed to NZS4402.6.5.1

NZGD ID: BH_112622

GRIFFITHS DRILLING
RESULT DRIVEN GEOTECHNICAL SPECIALISTS

SITE INVESTIGATION BORELOG

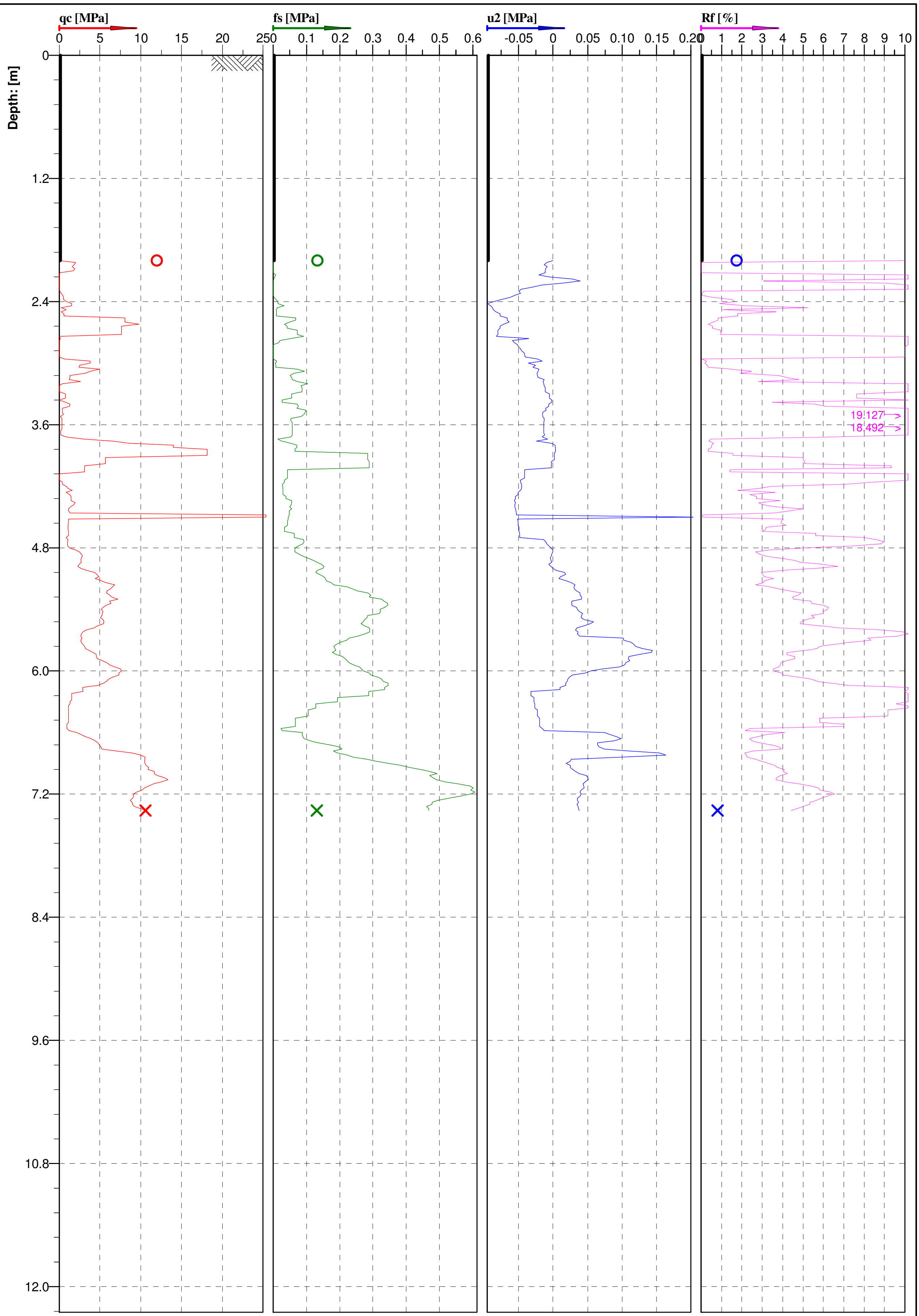
BH#	7				
JOB#	-				
Project:	Kilbirnie Pump Station			Grid Ref:	N: -
Location:	Evans Bay Park, Kilbirnie				E: -
Client:	Stantec	Operator:	[redacted] s(7)(2)(a)		
DATE Start:	27/3/18	DATE Finish:	27/3/18	Page:	1 of 1

134 State Highway 58
Pauatahanui
P: 045277346
F: 045277347
www.griffithsdrilling.co.nz

Drill Rig:	Geotech Track Rig	SPT Hammer #:	Geotech 03
Drilling Method:	HQ Coring	Flushing Type:	Polymer Powder
Bore Diameter:	HQ	Casing Diameter / Type:	-
Bore Final Depth:	15.0m	Casing Final Depth:	-

Layer Change Depth (mbgl)	Formation Drill Conditions (L) – Loose, Unstable (B) – Bands of hard and soft (S) – Soft, Stable (M) – Moderately Firm. (F) – Firm, Stable (H) – Hard to penetrate Fluids: (TL) Total Loss; (SL) Slow Loss; (WS) Water Struck; (NL) No Loss Geological Description *Must Include: Colour, Texture, Composition, Fractures, Boundary type (gradual, abrupt?)*	Core Samples & Recovery From (m)	To (m)	Recovery (%)	Standard Penetration Test (SPT) Cone Type	Depth	SPT Counts	N Value	Sample (%)
0.00	Jet Vac	0.00	1.50	-	SP	1.5	2/2//1/2/2/3	8	100
1.50	Fill	1.95	3.00	95		3.0	5/4//3/3/1/1	8	100
1.70	Green sandy silts. Gravels.	3.45	4.50	100		4.5	PUSH TUBE	-	-
10.50	Green silty sands. Small gravels.	4.95	6.00	100		6.0	6/2//2/4/4/5	15	100
15.00	EOB	6.45	7.50	100		7.5	2/2//3/4/5/6	18	100
		7.95	9.00	90		9.0	4/5//4/6/8/11	29	100
		9.45	10.50	100		10.5	4/7//8/11/11/13	43	100
	50mm monitoring well installed to	10.95	12.00	100		12.0	6/9//11/13/13/13	50	100
	15.0m. Blank un-slotted from 15.0m -	12.45	13.50	100		13.5	7/11//15/16/15/4 = 15mm	50	100
	12.0m. Slotted from 12.0m – 3.0m.	13.95	15.00	100					
	Blank from 3.0m – 0.0m. Flush								
	Lockable toby installed.								

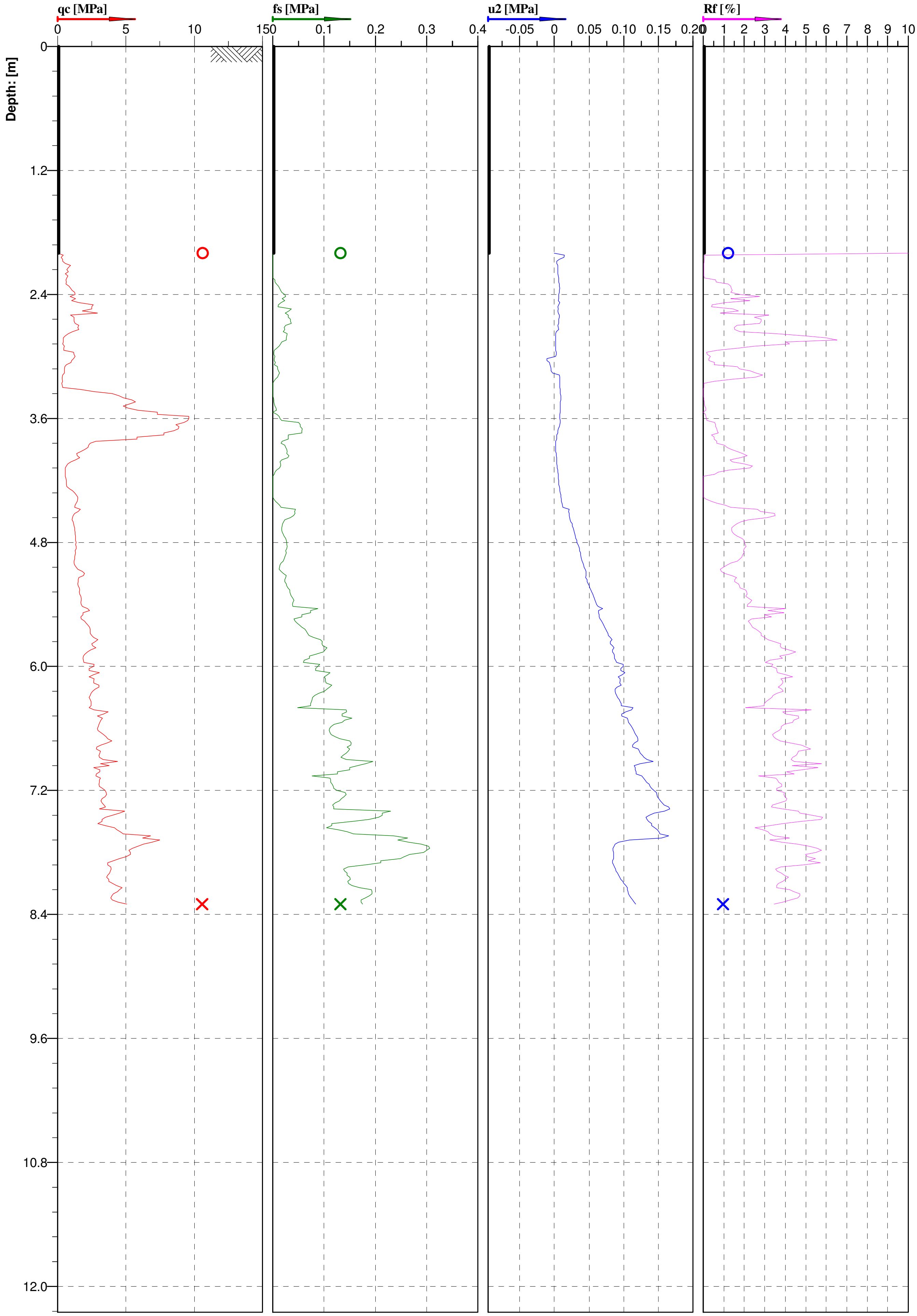
Water Level	Date / Time	Hole Depth	Water Level	Date / Time	Hole Depth
2.40m	27/3/18	15.0m			



GRIFFITHS DRILLING

Cone No: 4616
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Evans Bay Park, Kilbirnie	Position: (5424725.37 mN, 1750318.61 mE)	Ground level: 0.00	Test No.: CPT3
Project ID: 3	Client:	Date: 3/04/2018	Scale: 1 : 50
Project: Kilbirnie Substation		Page: 1/1	Fig.:
Qc Refusal		File: cpt3.cpt	



GRIFFITHS DRILLING

Cone No: 4616
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Evans Bay Park, Kilbirnie	Position: (5424728.72 mN, 1750335.43 mE)	Ground level: 0.00	Test No.: CPT4
Project ID: 4	Client: Stantec	Date: 3/04/2018	Scale: 1 : 50
Project: Kilbirnie Pump Station		Page: 1/1	Fig.:
		File: cpt4.cpt	

B

Appendix B – Historical Drawings

SECTION II PILING

1 Refer to conditions of Contract and Preliminary clauses which shall apply to all works of this section. GENERAL

Note: The term 'Engineer' in this and subsequent sections refers to the Consulting Structural Engineer or his nominated representative.

2 This contract includes the following: SCOPE

(a) The driving of 192 number, reinforced concrete bulb piles.

(b) The supply of all plant, labour and materials required by same.

(c) The correct positioning of the piles with reference to principal grid lines.

Note: The General Contractor shall set out the longitudinal and transverse grid lines for each block of buildings, and the piling sub-contractor use these as his reference for positioning individual piles.

3 For purposes of tendering, piles shall be assumed to be driven to a depth of twenty-five (25) feet below existing ground level. Any variation in length shall be in accordance with clause 4. LENGTH OF PILES

The length of piles shall be measured from the bottom of the bulb to ground level.

4 The Contractor shall tender on the following : VARIATION IN LENGTH

A price per pile in accordance with the length specified in Clause 3 above plus or minus the variation in length required to found the bulb at the depth required to give the final set as hereafter specified.

In this case, the piling sub-contractor shall submit with his tender the unit rate per foot of pile for adjusting the final cost.

Bore logs are given on the drawings for the guidance of contractors.

The bulb shall be based on original strata.

5 The overlaying ground is hard filling. This may be pre-bored for the depth of the reclaimed filling only, and the bored holes filled with loose material prior to driving. PRE-BORING

6 All piles shall be driven until the final set is $\frac{1}{4}$" per blow from the ram as specified hereafter. FINAL SET

7 The first pile driven in each pile group shall be subject to a penetrometer test and the information shall be submitted to the Engineer prior to concreting. PENETROMETER TEST

8 The contractor when tendering shall allow for testing at least one pile and the price submitted shall be inclusive. In the event of the pile tested not meeting the requirements as specified hereafter the contractor shall remove the defective pile and redrive another one. Further, the Engineer may, if he considers it necessary, call for the testing of this new pile and the cost of same shall be borne by the piling sub-contractor. TESTING

The test pile shall be loaded as follows:

Initial load to 25 tons

Then this load shall be increased by 15 tons at half hourly intervals until a final load of 70 tons is applied to the pile.

This load of 70 tons shall be held for 24 hours. The test load shall then be reduced at the rate of 20 tons per hour.

The final set, when the loading has been removed, shall not exceed $\frac{1}{8}$ inch.

9 The pile shall be formed by driving a 15 inch dia. steel casing plugged with aggregate and driven to the required set, using a 30 cwt. ram falling 16 ft. per blow. The ram shall fall freely inside the tube and shall strike on the gravelplug. PILE PROCEDURE

When the necessary resistance has been obtained the tube shall be withdrawn a few inches as the plug is expelled and the bulb shall be formed.

The reinforcing steel consisting of six $\frac{3}{4}$ inch dia. m.s. rods spirally wound with 8 gauge hard drawn wire at 4 inch pitch shall then be inserted in the tube.

The stem of the pile shall be progressively filled with charges of concrete and each charge rammed. These charges shall not be greater than 2 cubic feet of concrete. Withdraw the tube as the concrete is lightly rammed.

Concrete shall be one part cement, one and a half parts sand and three parts of gravel. The aggregates shall be measured by volume and thoroughly mixed with the sand and cement in a revolving concrete mixer in accordance with the provisions of NZSS 1900 Chapter 9:3.

The minimum compressive test shall be 3,500 lbs. per square inch at 28 days.

10 No concrete shall be poured until the final set has been approved by the Consulting Engineer or his representative. INSPECTION

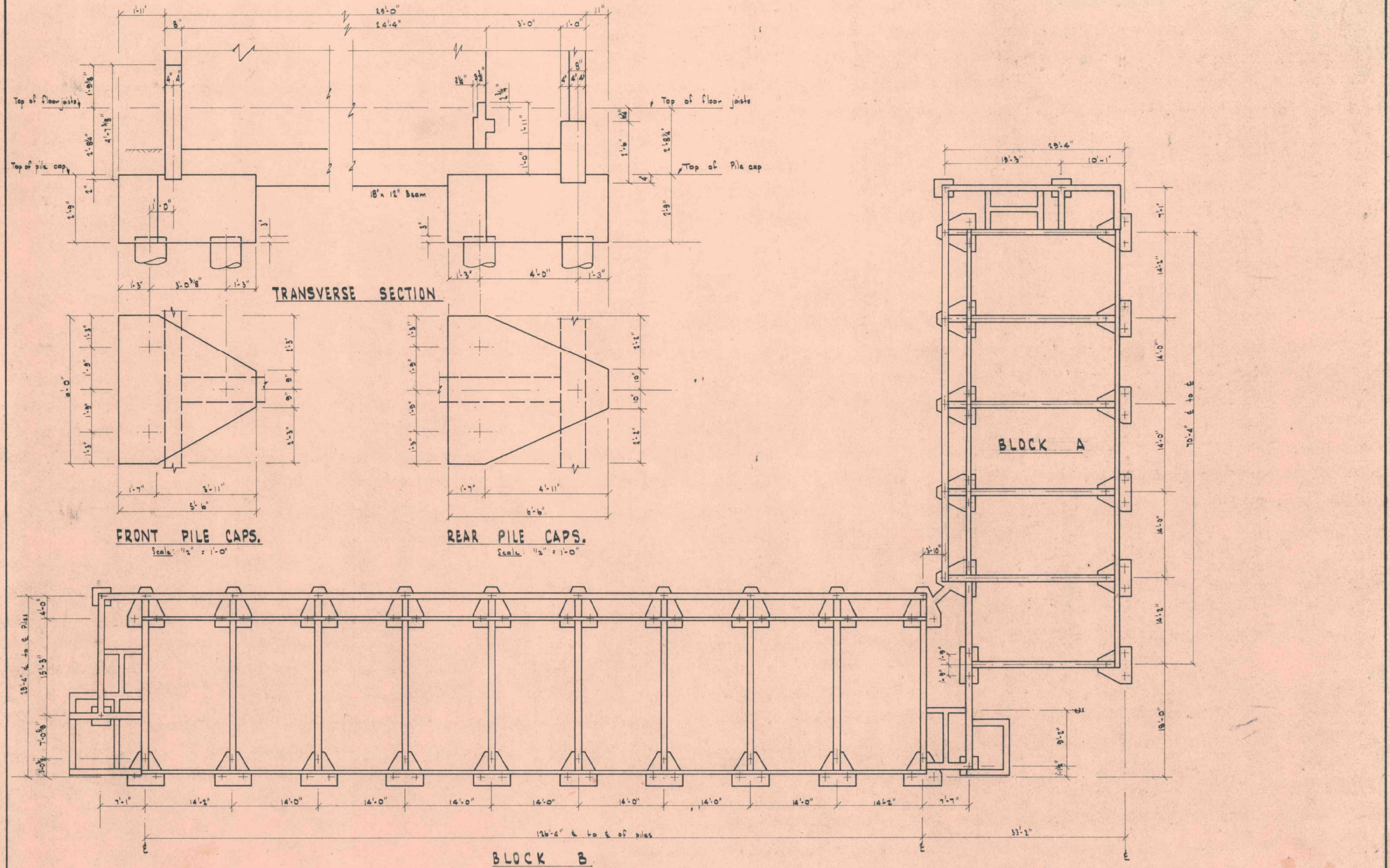
11 The Contractor may submit his tender based on an alternative type of piling. If so he must submit with his tender a brief specification of the construction and driving of such piles. ALTERNATIVE TYPE OF PILING

12 The minimum level of the top of the concrete in each pile shall be twelve (12) inches above the level of the soffit of the pile cap in each case. <u>CONCRETING</u>

Reinforcing steel as specified above shall extend from the bulb to within two (2) inches of the top of the pile cap.

13 The piling sub-contractor shall remove all excess reinforcing steel, and wire, from the site on completion and leave the site clean and tidy. <u>CLEAN UP</u>

14 The General Contractor, not the piling sub-contractor, shall be responsible for cutting back the concrete pile heads. <u>CUTTING OFF</u>



KOTUKU FLATS – KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION

BLOCKS A & B. FOUNDATION PLAN

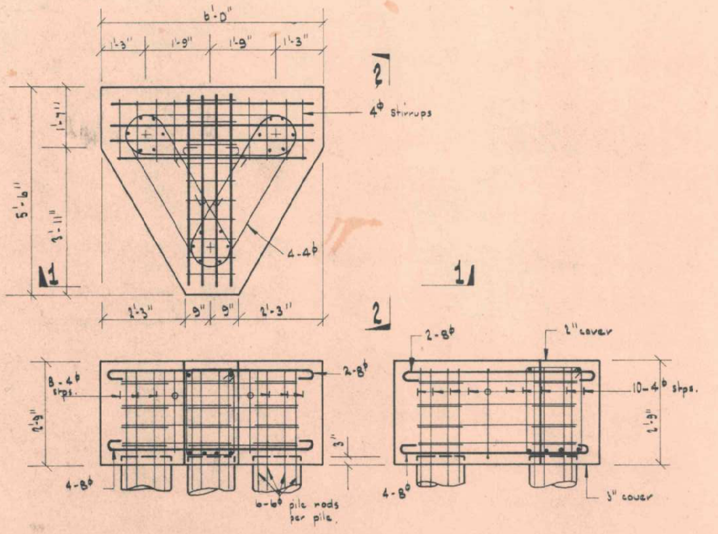
DRAWN: SGR | TRACED: OBS. | CHECKED:

DATE: 31-1-68 | SCALES: 1/8" & 1/4" = 1'-0"

STEWART G. REES & ASSOCIATES
CONSULTING CIVIL & STRUCTURAL ENGINEERS
21, EVELTON TERRACE, WELLINGTON. PH. 46321

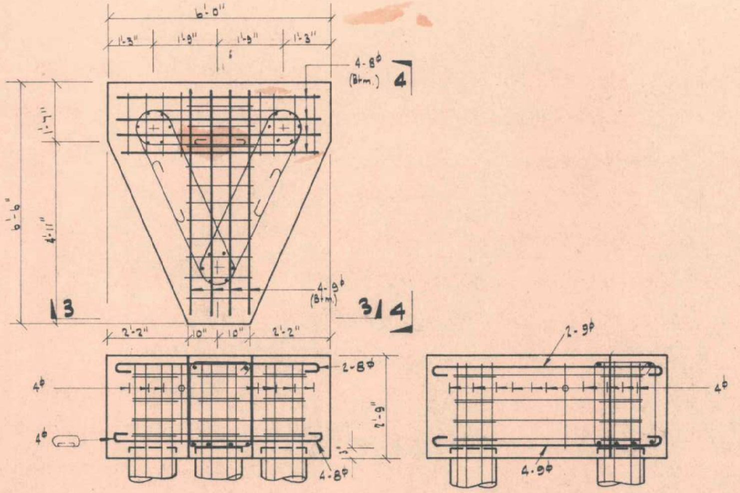
WELLINGTON CITY CORPORATION
ARCHITECTURAL DIVISION.

DWG NO: 879/1



SECTION 1-1 SECTION 2-2

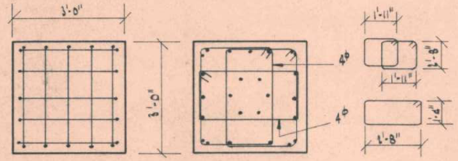
REINFORCEMENT DETAILS FRONT PILECAPS 'A'



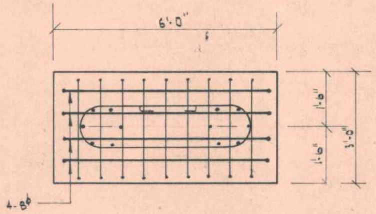
SECTION 3-3 SECTION 4-4

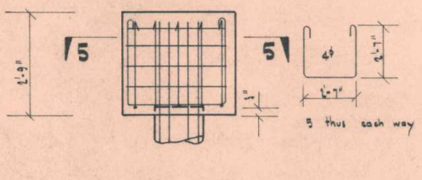
REINFORCEMENT DETAILS REAR PILECAPS 'B'

NOTE:
See foundation beam drawings for details of foundation reinforcing which runs into pilecaps.

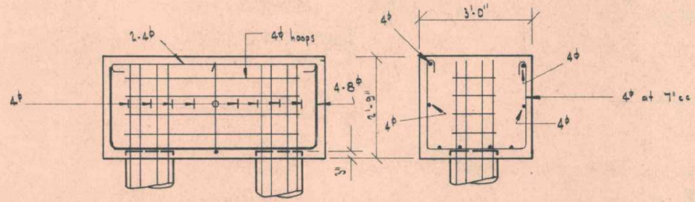


SECTION 5-5



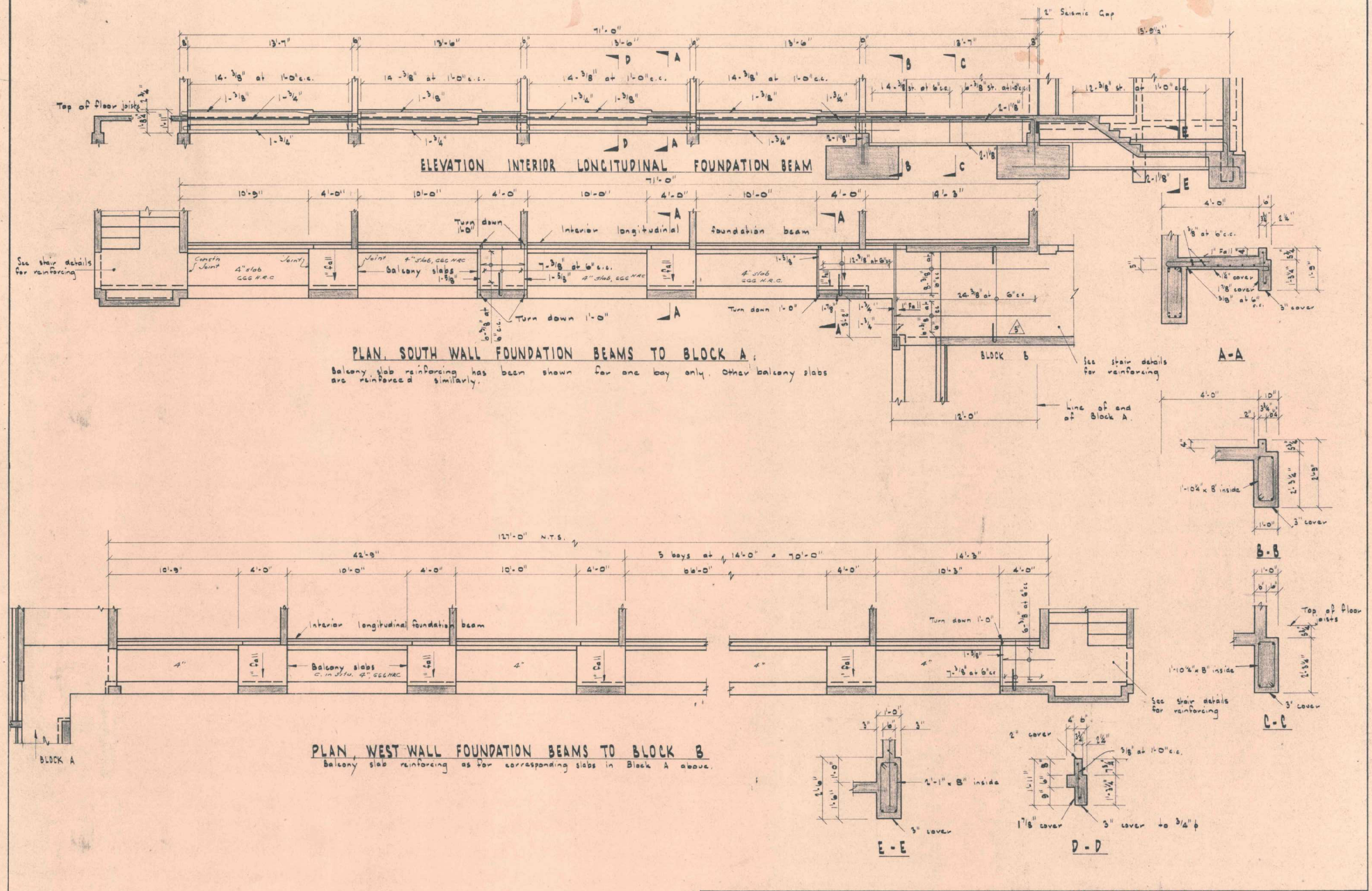


PILECAP 'C'

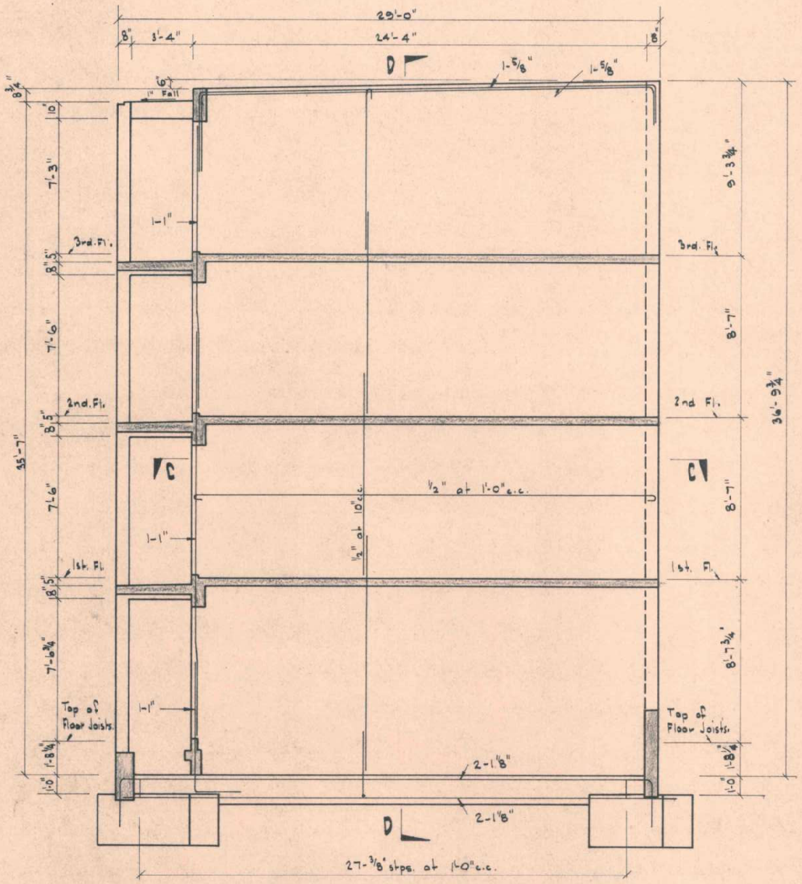


PILECAP 'D'

KOTUKU FLATS - KEMP ST. KILBIRNIE. FOR THE WELLINGTON CITY CORPORATION	PILECAP REINFORCING DETAILS.	STEWART G. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 5 EVERTON TERRACE, WELLINGTON. PH. 46-321	DWG. NO.
	DRAWN: SGR TRACED: CBS CHECKED: DATE: 8-2-68 SCALES: 1/2" = 1'-0"	WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	879/2

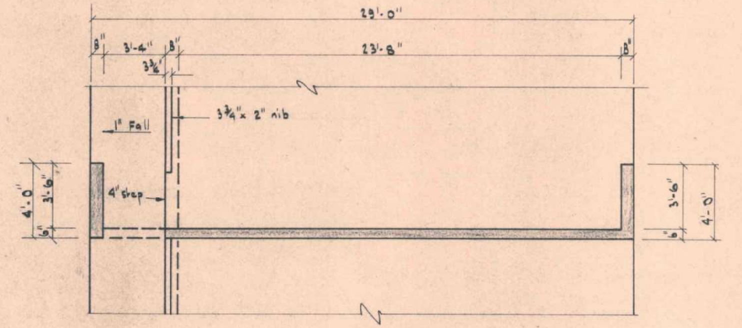


KOTUKU FLATS - KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCKS A & B. GROUND FL. SLAB PLANS	STEWART G. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 61 EVERTON TERRACE WELLINGTON PHONE: 46-321	DWG. NO: 879/3
	DRAWN: J.J.Q. TRACED: C.G.S. CHECKED:	WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	
	DATE: 29-11-67 SCALES: 1/4", 1/2" : 1'-0"		NO. OF SHEETS:

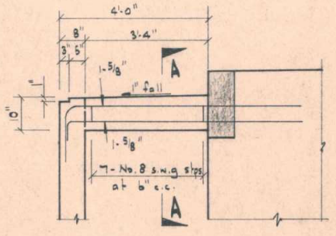


ELEVATION, TYPICAL INTERIOR TRANSVERSE WALL.

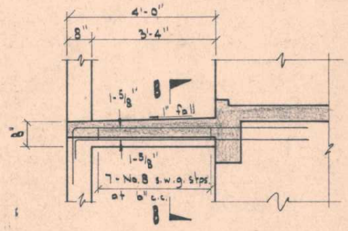
Wall is 6" thick reinforced with 1/2"φ at 10" c.c. vertically and 1/2"φ at 1'-0" c.c. horizontally. Typical bars have been shown.



HORIZONTAL SECTION, TYPICAL INTERIOR TRANSVERSE WALL AT 1ST., 2ND., & 3RD. FLOOR LEVELS.

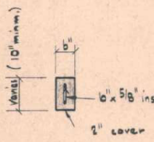


ELEVATION ROOF BEAM

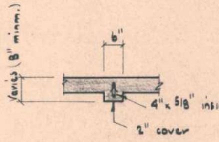


ELEVATION SLAB BEAM

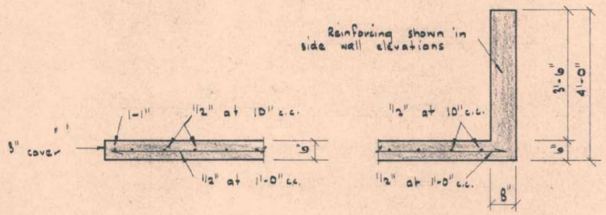
(Typical for 1st., 2nd. & 3rd. floors



A - A

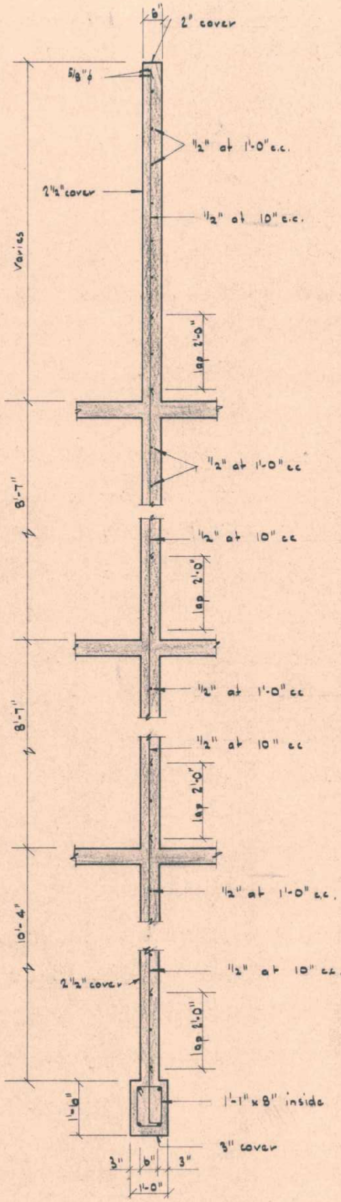


B - B



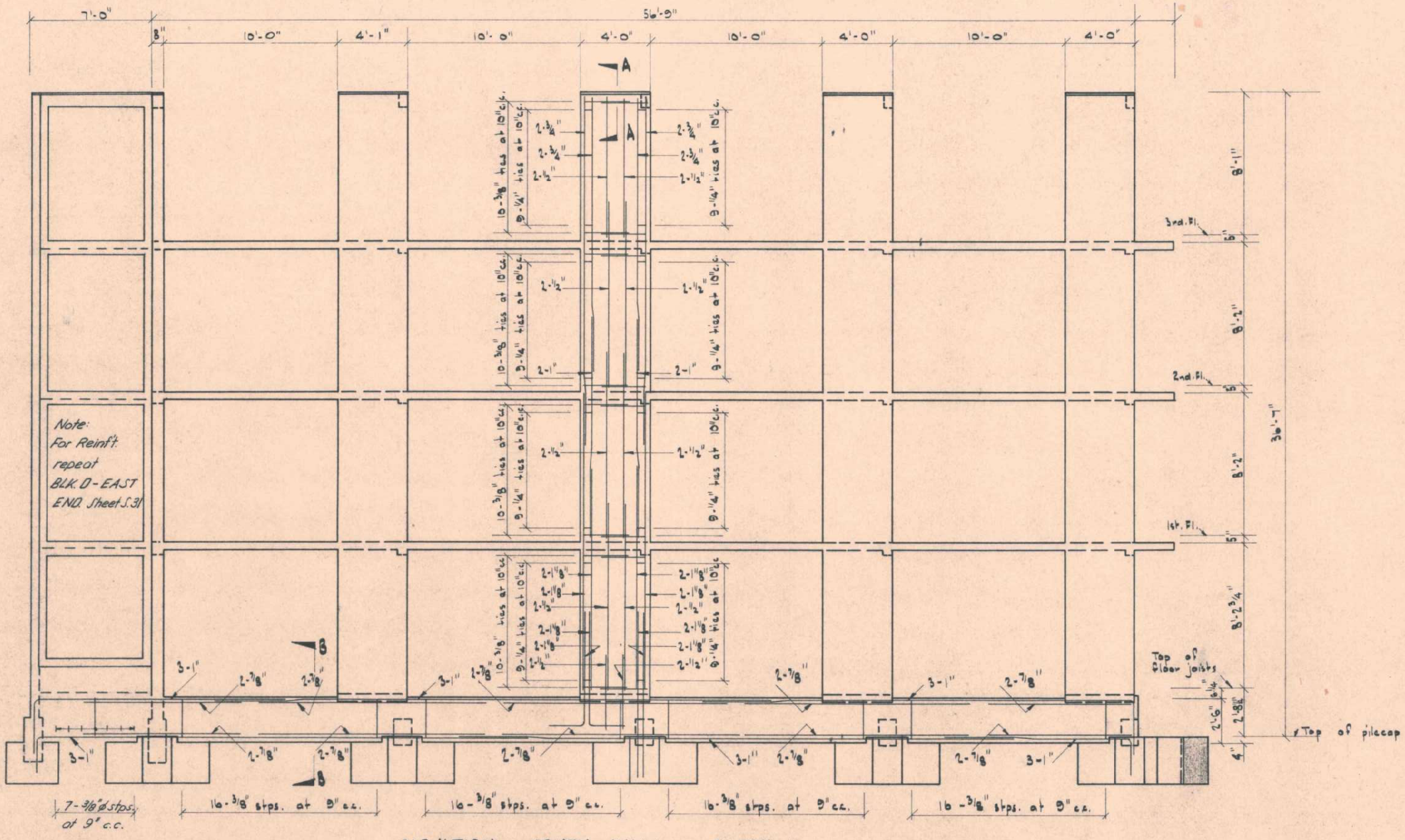
SECTION C - C

Typical for Wall



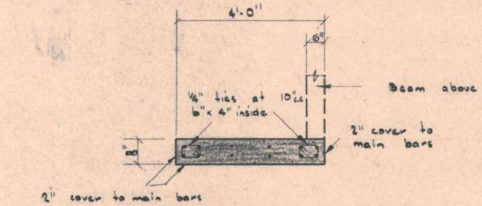
SECTION D-D

KOTUKU FLATS - KEMP ST., KILBIRNIE FOR THE WELLINGTON CITY CORPORATION.	INTERIOR TRANSVERSE WALL FOR ALL BLOCKS DRAWN: J.J.Q. TRACED: C.B.S. CHECKED: DATE: 20th. OCT. 1967 SCALES: 1/4", 1/2" = 1'-0"	STEWART G. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON. PH. 46321 WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	DWG. NO: 879/4 NO. OF SHEETS:

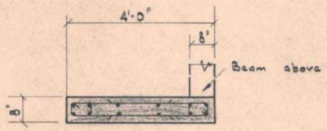


ELEVATION SOUTH WALL - BLOCK A.

Column reinforcing is similar for all columns in this wall.

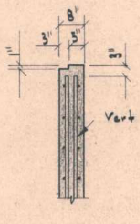


COLUMN SECTION
(To show 1/4" ties.)

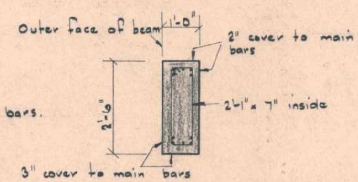


COLUMN SECTION AT END 8" WALL

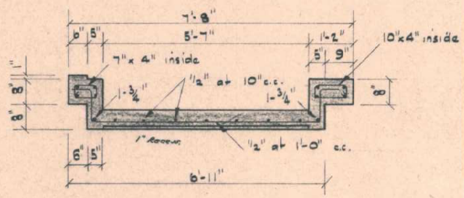
Note:- This section does not apply to Block A, but to Blocks B, C & D.



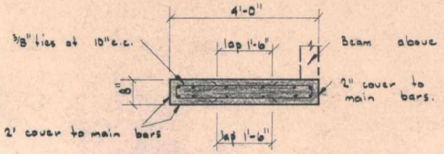
A - A



B - B

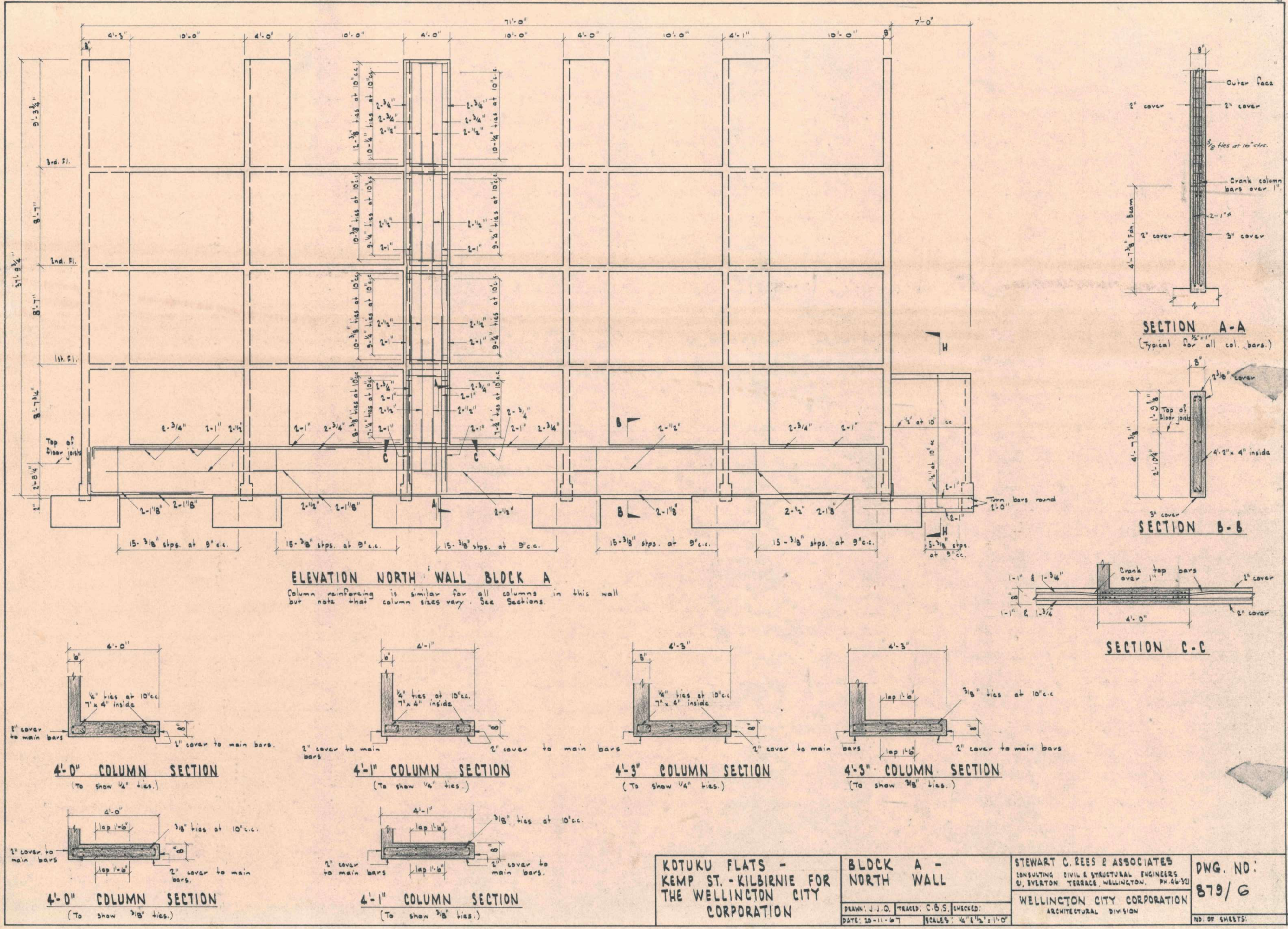


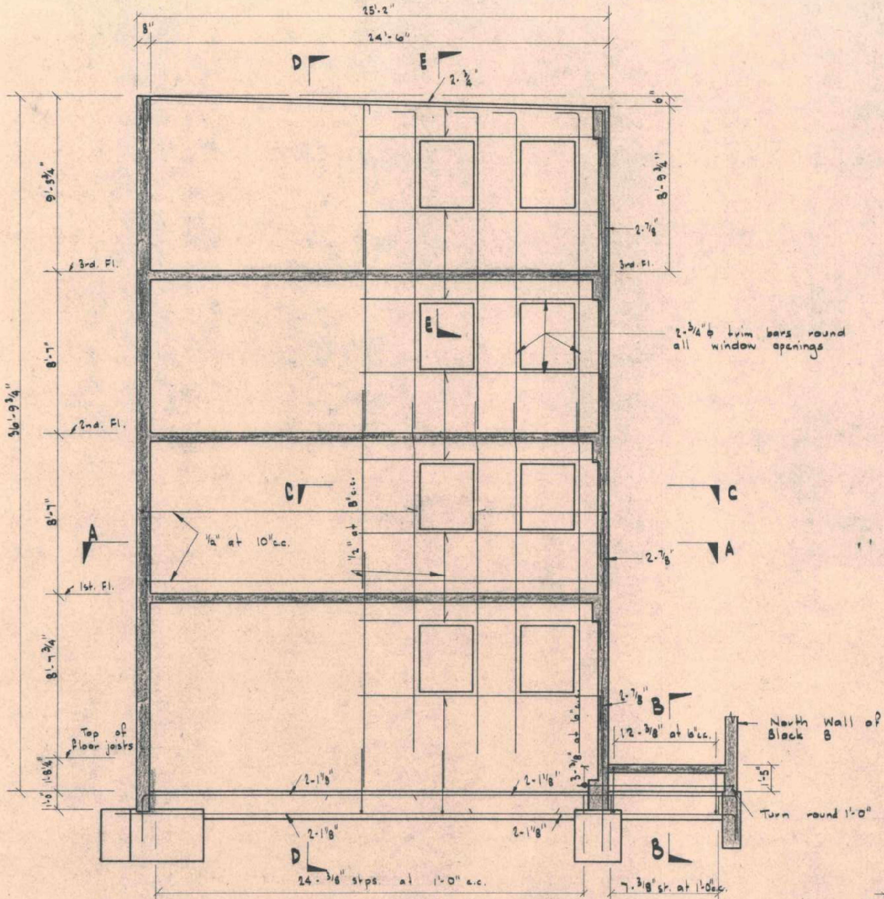
SECTION C - C



COLUMN SECTION
(To show 3/8" ties.)

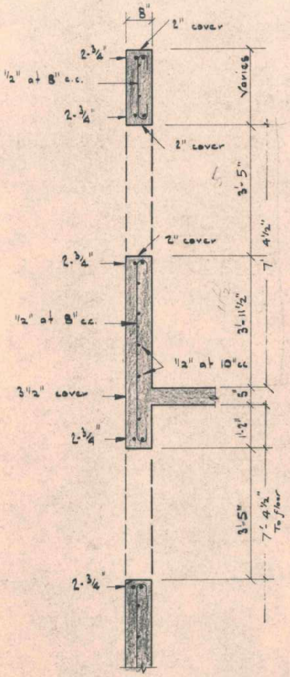
KOTUKU FLATS - KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK A - SOUTH WALL	STEWART C. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 2, EVERTON TERRACE, WELLINGTON. PH. 46321	DWG. NO. 879/5
	DRAWN: J.J.O. TRACED: C.B.S. CHECKED:	WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION.	
	DATE: 26-10-67 SCALES: 1/4", 1/2" = 1'-0"		NO. OF SHEETS


ELEVATION NORTH WALL BLOCK A
Column reinforcing is similar for all columns in this wall but note that column sizes vary. See Sections.
71'-0"
7'-0"
3rd. Fl.
2nd. Fl.
1st. Fl.
Top of floor joists
15-3/8" stps. at 9" c.c.
Turn bars round 2'-0"
SECTION A-A
(Typical for all col. bars.)
Outer face
2" cover
3/8 ties at 10" ctrs.
Crank column bars over 1".
3" cover
SECTION B-B
4'-2" x 4" inside
SECTION C-C
Crank top bars over 1"
4'-0" COLUMN SECTION
(To show 1/4" ties.)
4'-1" COLUMN SECTION
(To show 1/4" ties.)
4'-3" COLUMN SECTION
(To show 1/4" ties.)
4'-3" COLUMN SECTION
(To show 3/8" ties.)
4'-0" COLUMN SECTION
(To show 3/8" ties.)
4'-1" COLUMN SECTION
(To show 3/8" ties.)
2" cover to main bars
KOTUKU FLATS - KEMP ST. - KILBIRNIE FOR THE WELLINGTON CITY CORPORATION
BLOCK A - NORTH WALL
STEWART C. REES & ASSOCIATES
CONSULTING CIVIL & STRUCTURAL ENGINEERS
WELLINGTON CITY CORPORATION
ARCHITECTURAL DIVISION
DRAWN: J.J.O.
TRACED: C.B.S.
CHECKED:
DATE: 20-11-67
SCALES: 1/4" & 1/2" = 1'-0"
DWG. NO: 879/6
NO. OF SHEETS:

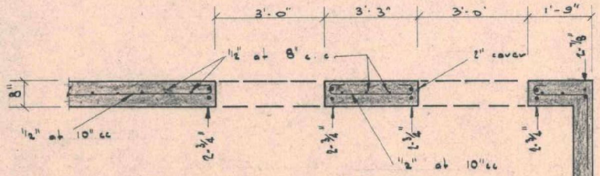


ELEVATION EAST WALL OF BLOCK A

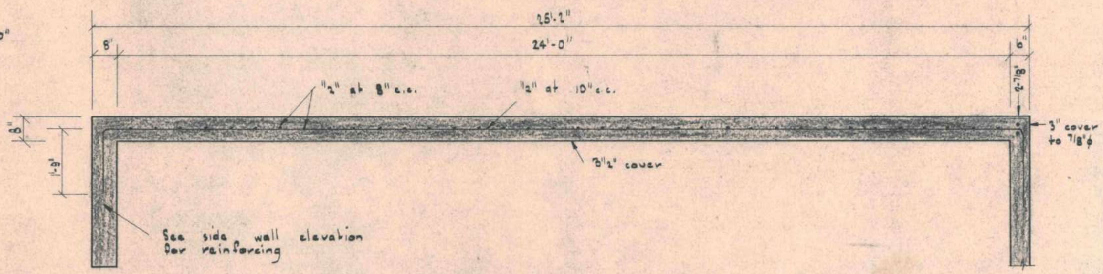
Wall is 8" thick reinforced with 1/2" at 8"c.c. vertically and 1/2" at 10"c.c. horizontally. Typical bars have been shown.
Section D-D is similar to corresponding section for Block C, West Wall



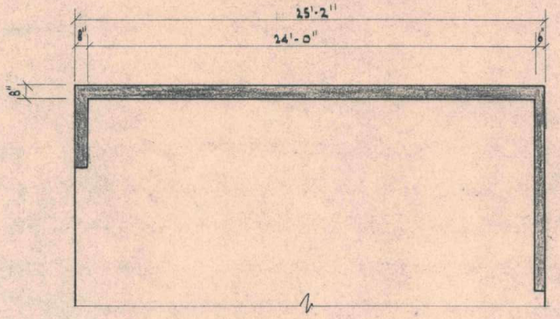
SECTION E-E



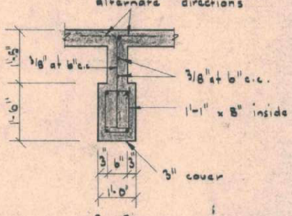
SECTION C-C



SECTION A-A
(Typical for wall.)

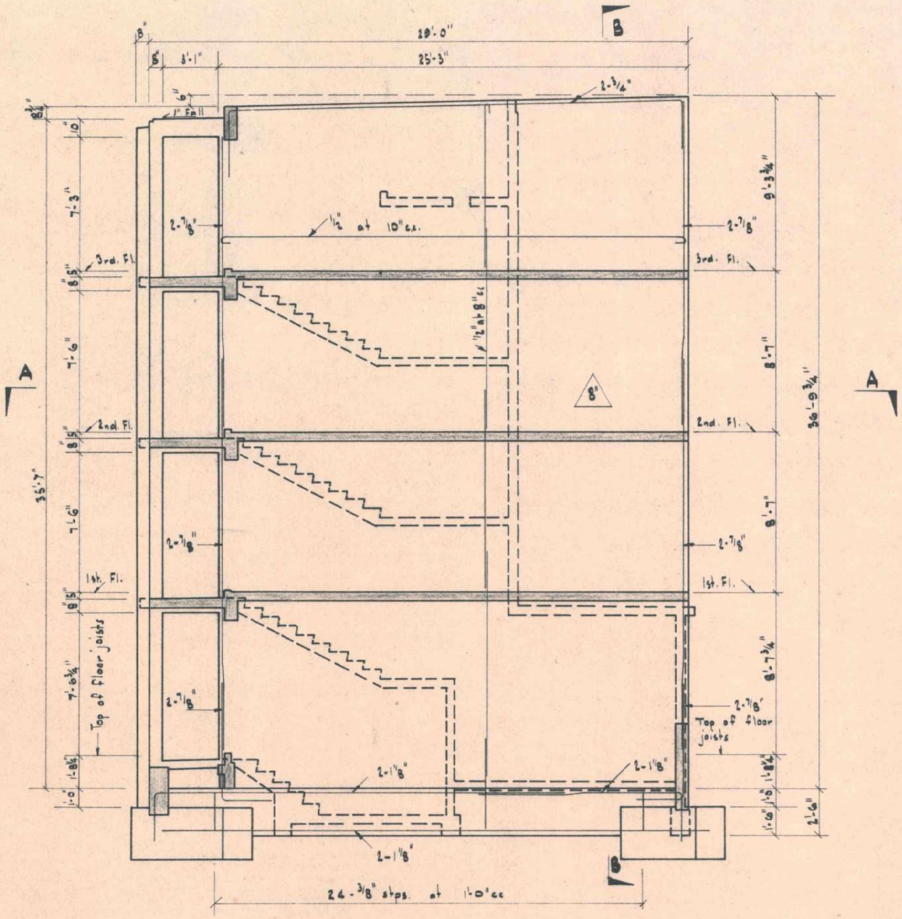


HORIZONTAL SECTION OF EAST WALL OF BLOCK A AT 1ST., 2ND, & 3RD. FLOOR LEVELS



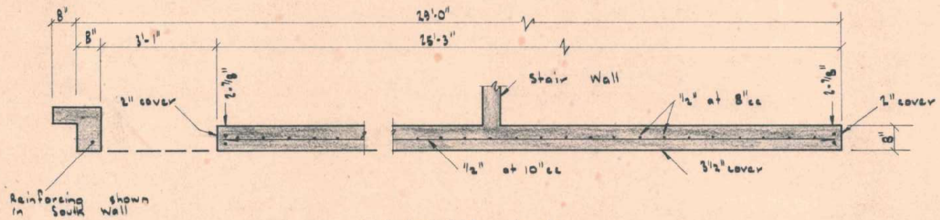
B-B

KOTUKU FLATS - KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK A - EAST WALL DRAWN: J.I.Q. TRACED: C.B.S. CHECKED: DATE: 25th. Oct. 1967 SCALES: 1/4" & 1/2" = 1'-0"	STEWART C. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON. PH: 46321 WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	DWG. NO: 879/7 NO. OF SHEETS:

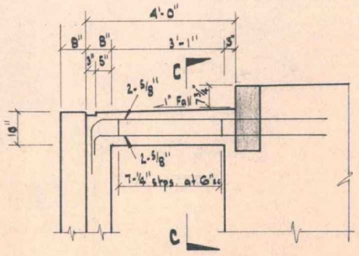


ELEVATION WEST WALL OF BLOCK A

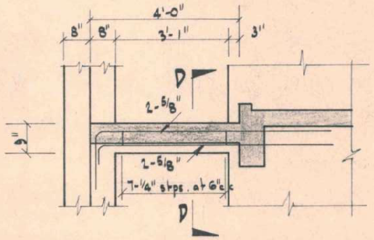
Wall is 8" thick reinforced with 1/2" at 8"cc vertically and 1/2" at 10"cc. horizontally. Typical bars only, have been shown.



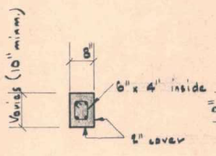
SECTION A-A



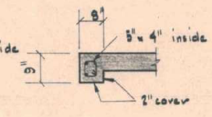
ELEVATION ROOF BEAM



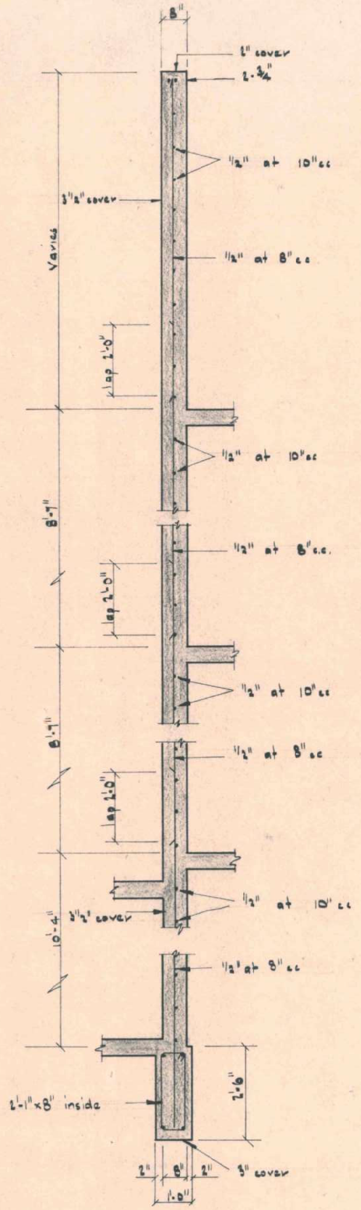
ELEVATION SLAB BEAM
(Typical for 1st, 2nd & 3rd. Floors.)



C - C

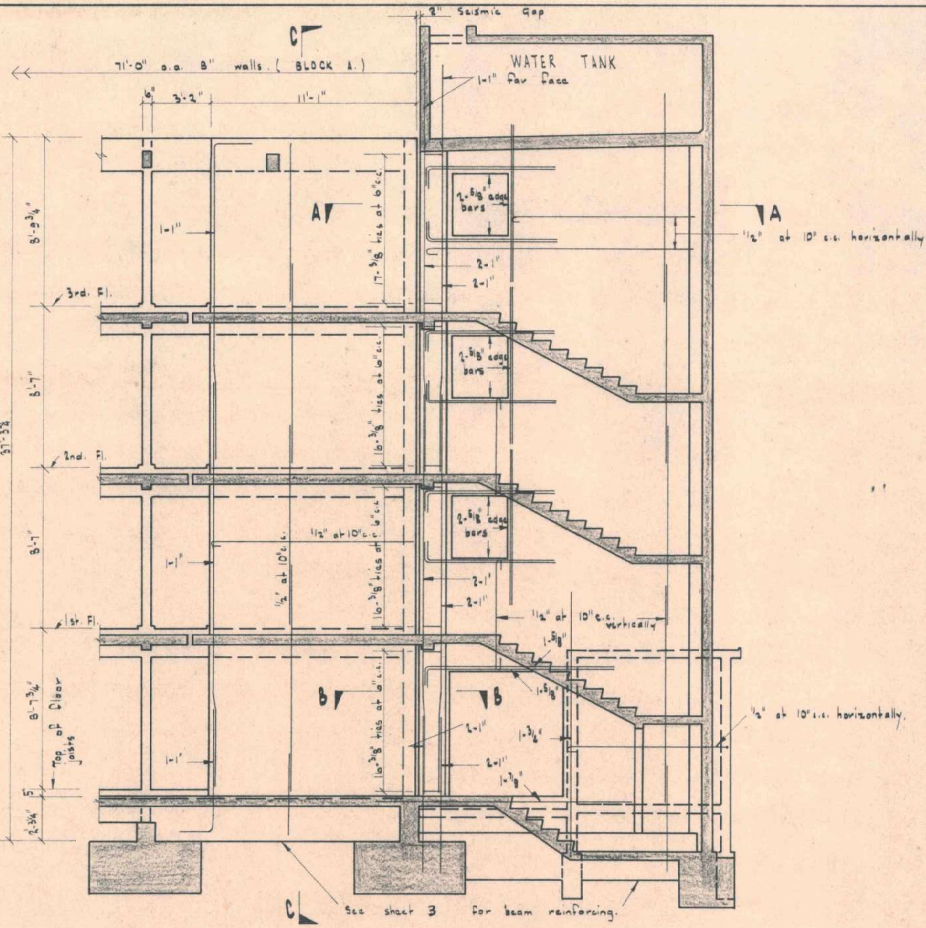


D - D



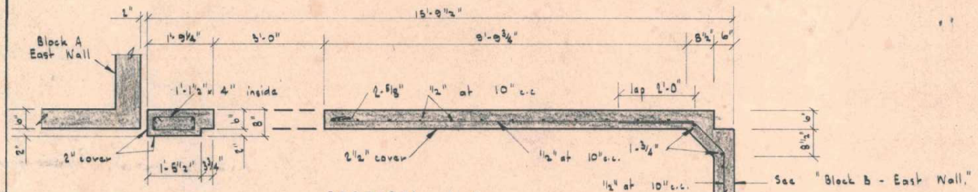
B - B

KOTUKU FLATS — KEMP ST.- KILBIRNIE FOR THE WELLINGTON CITY CORPORATION.	BLOCK A - WEST WALL DRAWN: J.J.Q. TRACED: CBS CHECKED: DATE: 19-3-69 SCALES: 1/4" & 1/2" : 1'-0"	STEWART G. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 11, EVERTON TERRACE, WELLINGTON PH. 46-321 WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	DWG NO: 879/8

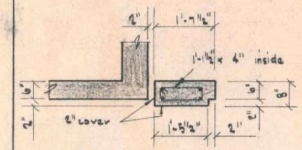


ELEVATION. - INTERIOR LONGITUDINAL WALL AT EAST END OF BLOCK A.

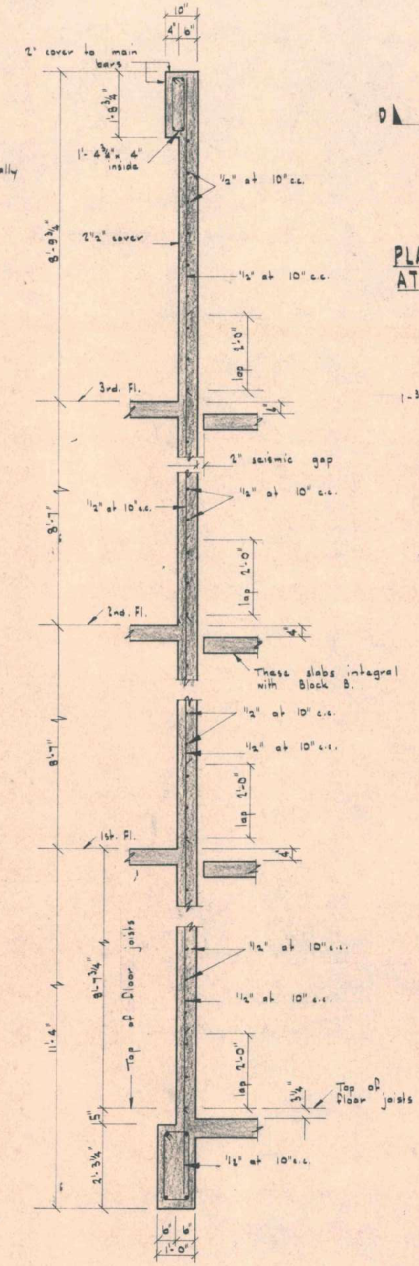
Wall is 6" thick reinforced with 1/2" at 10" c.c. vertically and 1/2" at 10" c.c. horizontally. Typical bars have been shown.



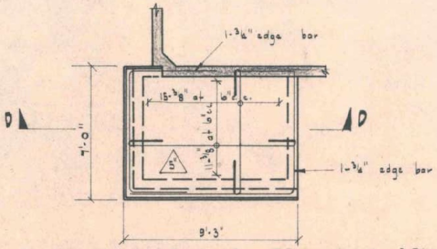
SECTION A-A



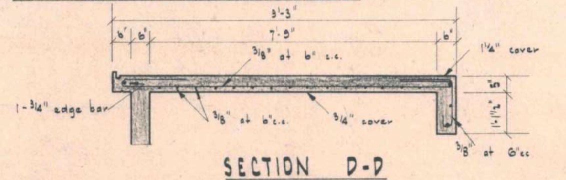
SECTION B-B



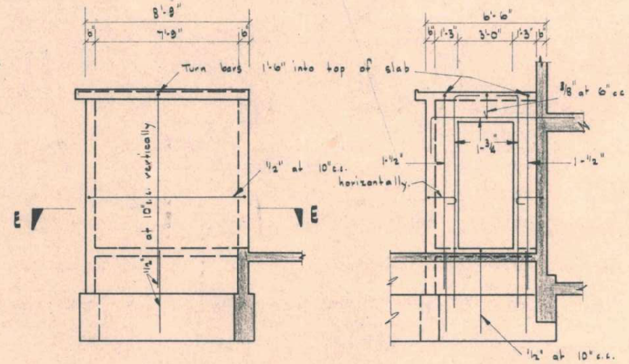
SECTION C-C



PLAN OF ROOF SLAB TO MILK BOX ROOM AT NORTH END OF BLOCK B.

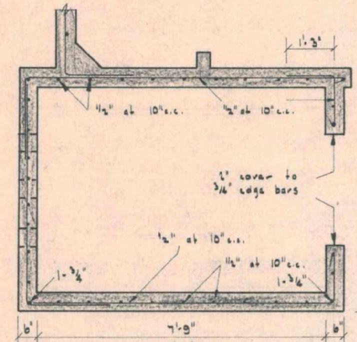


SECTION D-D



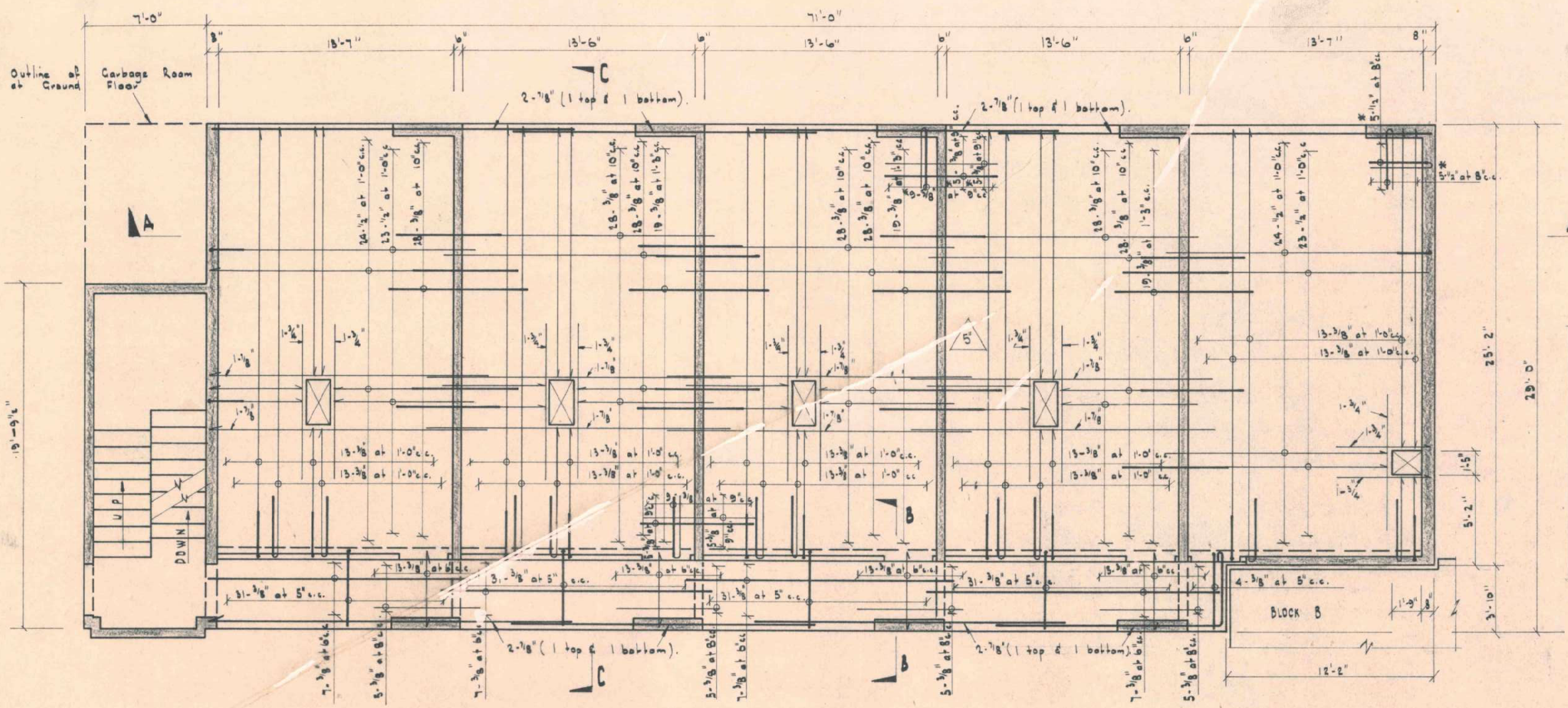
NORTH WALL MILK BOX ROOM

WEST WALL MILK BOX ROOM



SECTION E-E

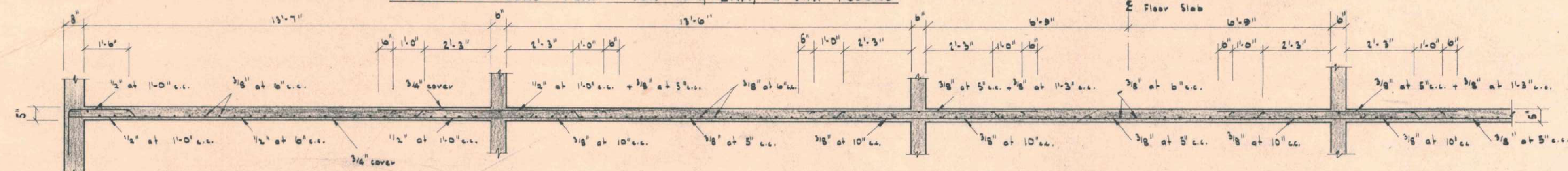
KOTUKU FLATS - KEMP STREET, KILBIRNIE FOR THE WELLINGTON CITY CORPORATION.	INTERIOR LONGITUDINAL WALL AT EAST END OF BLOCK A DRAWN: J.I.Q. TRACED: CBS CHECKED: SCALES: 1/4", 1/2" = 1'-0" DATE: 1-12-67	STEWART C. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON. PH. 46-321 WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	DWG. NO. 879/9 NO. OF SHEETS:



BLOCK A - SLAB PLAN FOR 1ST, 2ND, & 3RD. FLOORS

Bar Notation:
Bars in near face of slab have been shown thus ——
Bars in far face of slab have been shown thus ——

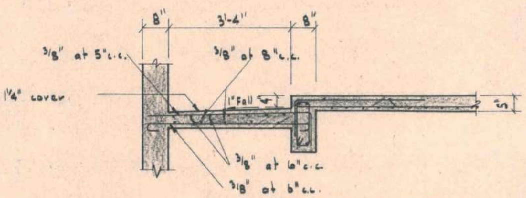
Torsion Steel:
Provide torsion reinforcement in slab at all corners and at each intersection of transverse walls and slab edges. Typical torsion reinforcement has been shown on slab plan and indicated by asterisks *



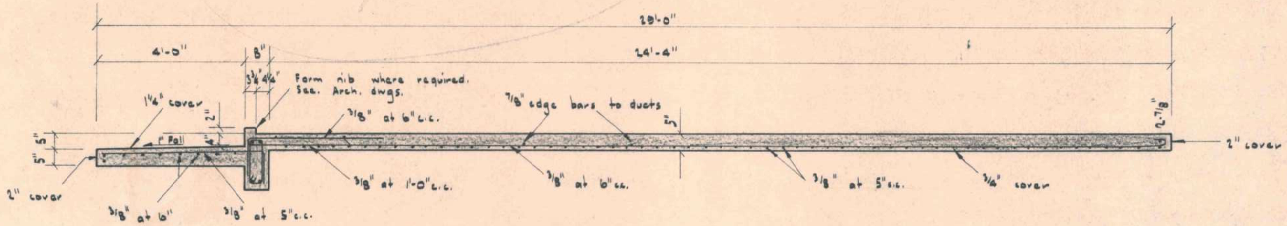
SECTION A-A

Reinforcing is symmetrical about ℄ Floor Slab.

Show distribution Rods on plan

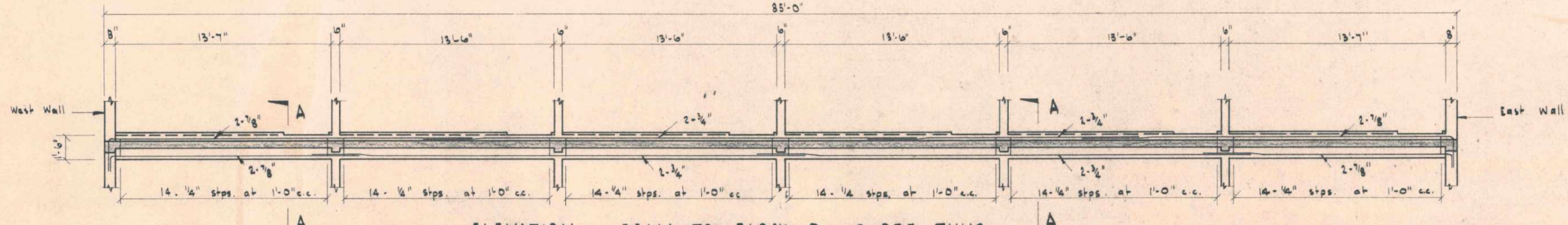


SECTION B-B

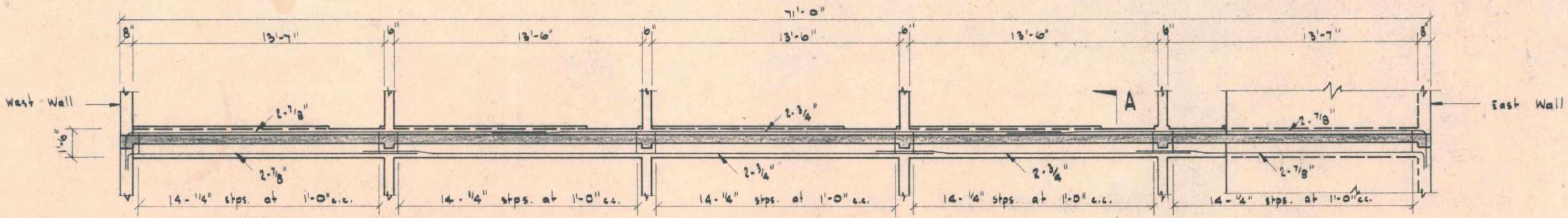


SECTION C-C

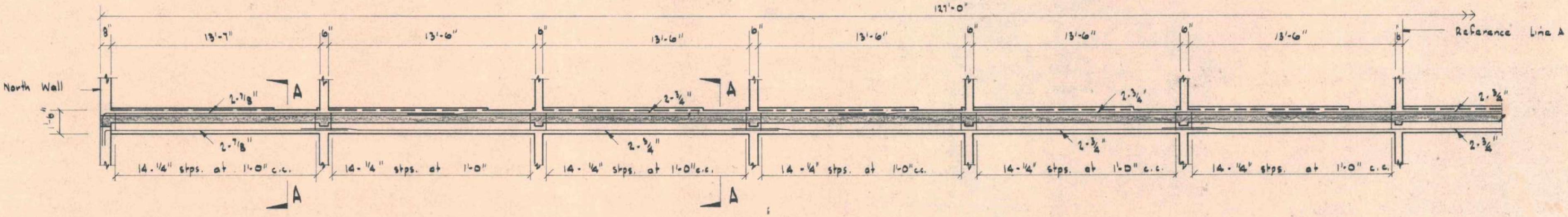
KOTUKU FLATS - KEMP ST., KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK A - SLAB PLAN & SECTIONS.	STEWART C. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON. PH. 46321	DWG. NO: 879/10
	DRAWN: J.J.Q. TRACED: CBS CHECKED:	WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	
	DATE: 30-10-67. SCALES: 1/4", 1/2" & 1'-0"		NO. OF SHEETS:

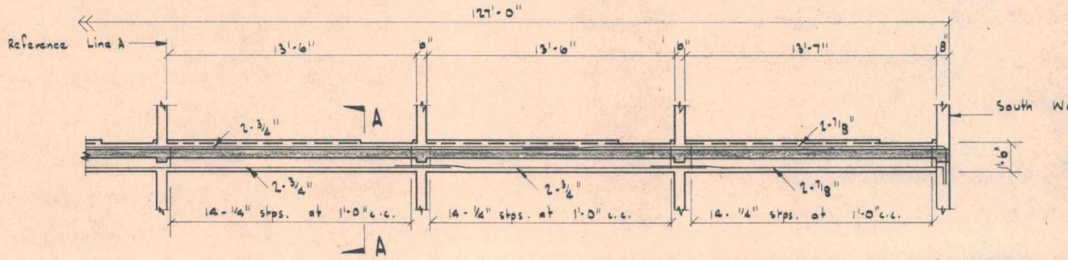


ELEVATION BEAM TO BLOCK D. – 3 OFF THUS.
ELEVATION BEAM TO BLOCK C. – 3 OFF THUS.

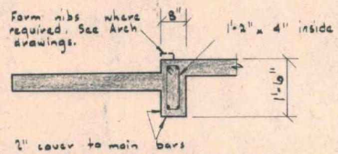


ELEVATION BEAM TO BLOCK A. – 3 OFF THUS



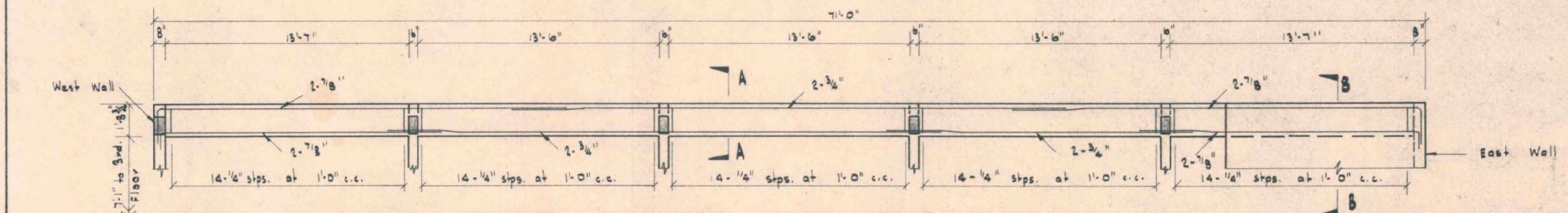


ELEVATION BEAM TO BLOCK B. – 3 OFF THUS.

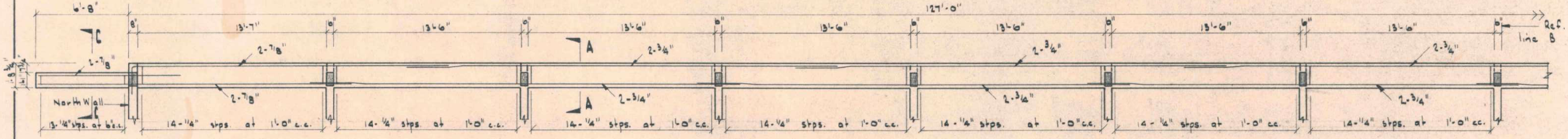


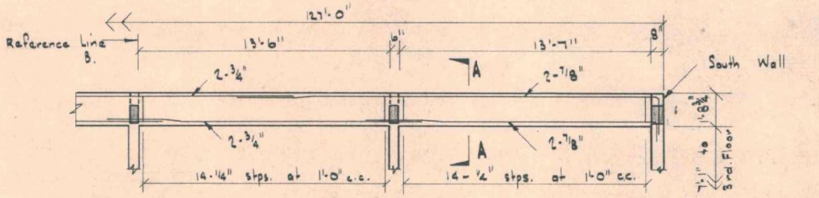
SECTION A-A
(Beam reinforcing only shown.)

KOTUKU FLATS – KEMP ST., KILBIRNIE FOR THE WELLINGTON CITY CORPORATION.	INTERIOR LONGITUDINAL BEAMS AT 1ST., 2ND., & 3RD. FLOORS DRAWN: J.J.O. TRACED: C.B.S. CHECKED: DATE: 27-10-67 SCALE: 1/4" 1/2" = 1'-0"	STEWART G. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON. PH. 46321 WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	DWG. NO: 879/11 NO. OF SHEETS:

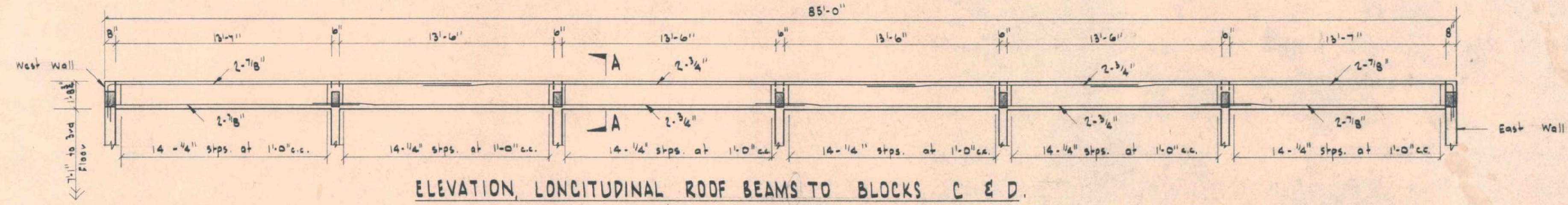


ELEVATION LONGITUDINAL ROOF BEAM TO BLOCK A

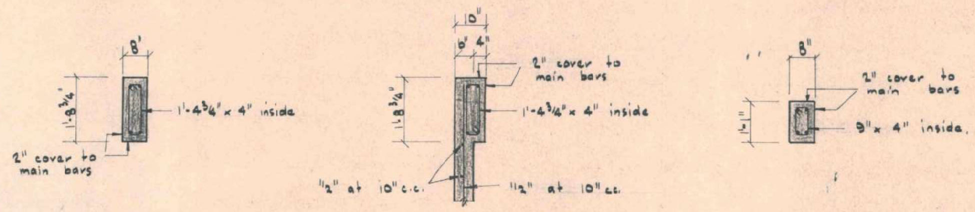




ELEVATION LONGITUDINAL ROOF BEAM TO BLOCK B

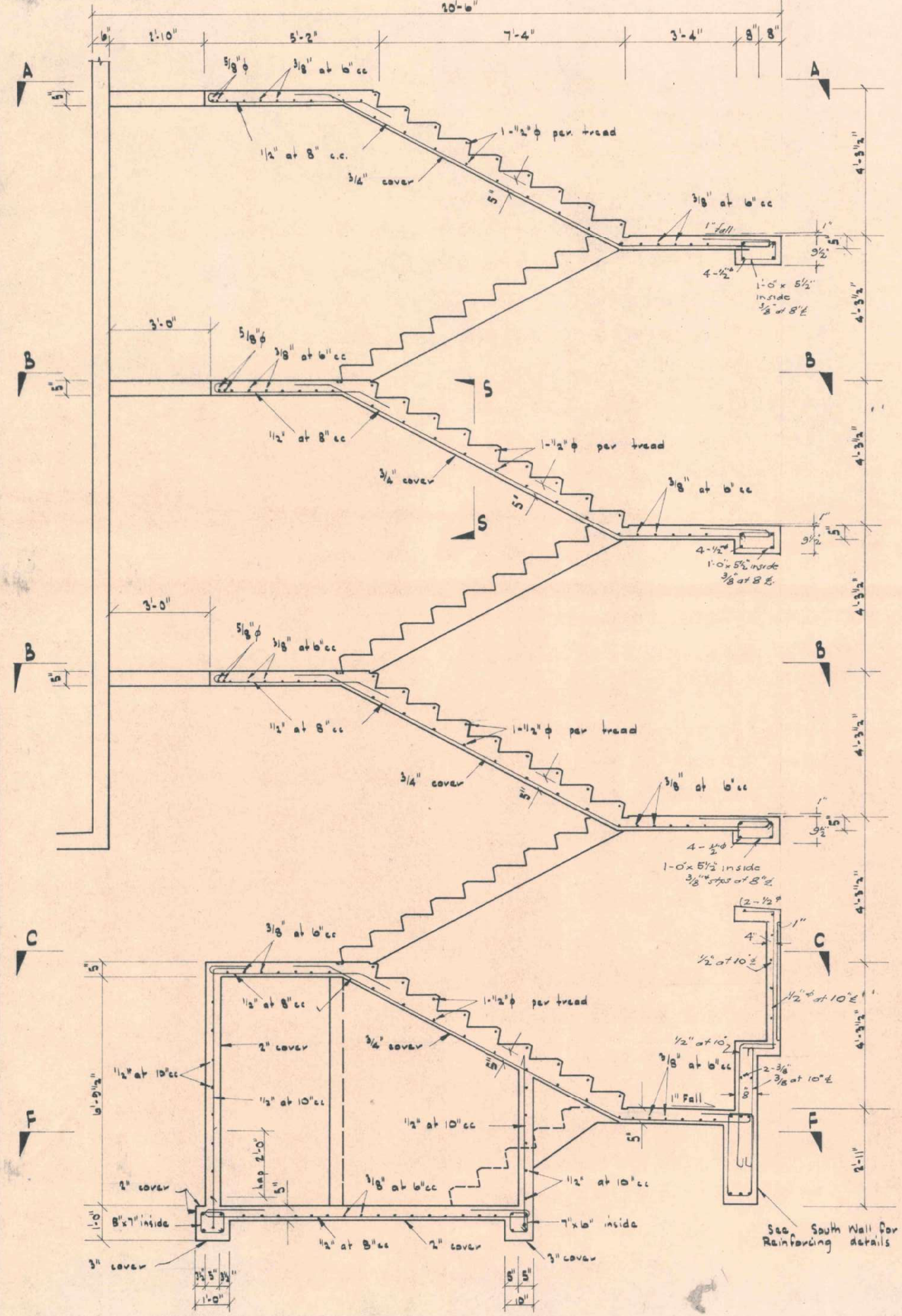


ELEVATION, LONGITUDINAL ROOF BEAMS TO BLOCKS C & D.

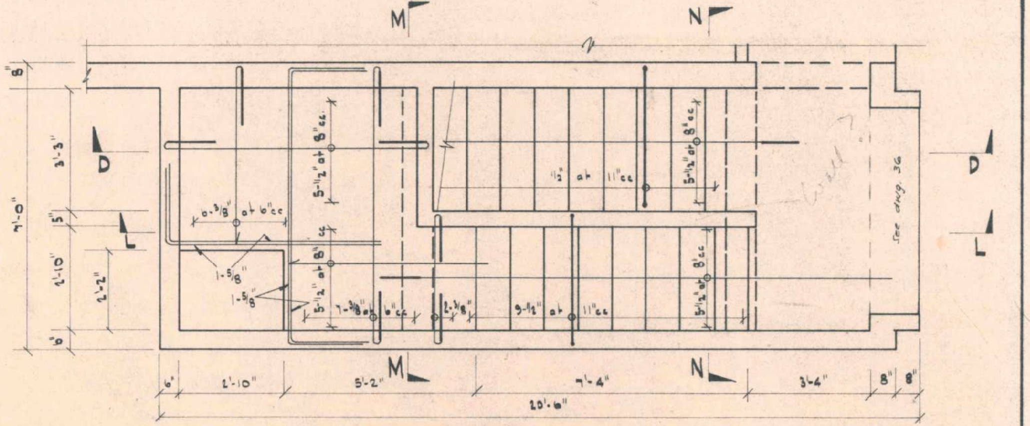


A-A B-B C-C

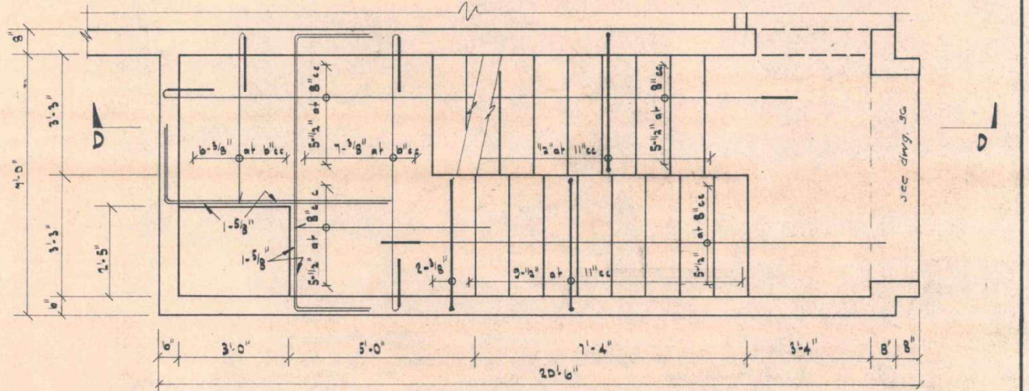
KOTUKU FLATS – KEMP ST., KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	LONGITUDINAL ROOF BEAMS TO BLOCKS A, B C & D	STEWART C. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 51 EVERTON TERRACE WELLINGTON PH 46321	DWG. NO. 879/12
	DRAWN: T.J.Q. TRACED: C.B.S. CHECKED: DATE: 22-11-67 SCALES: ⅛", ½" = 1'-0"	WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	NO. OF SHEETS:



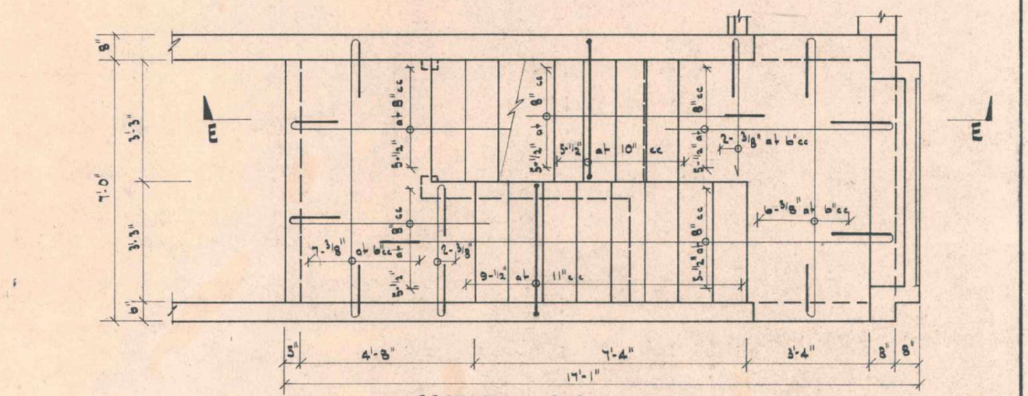
VERTICAL SECTION THROUGH STAIRS



SECTION A-A

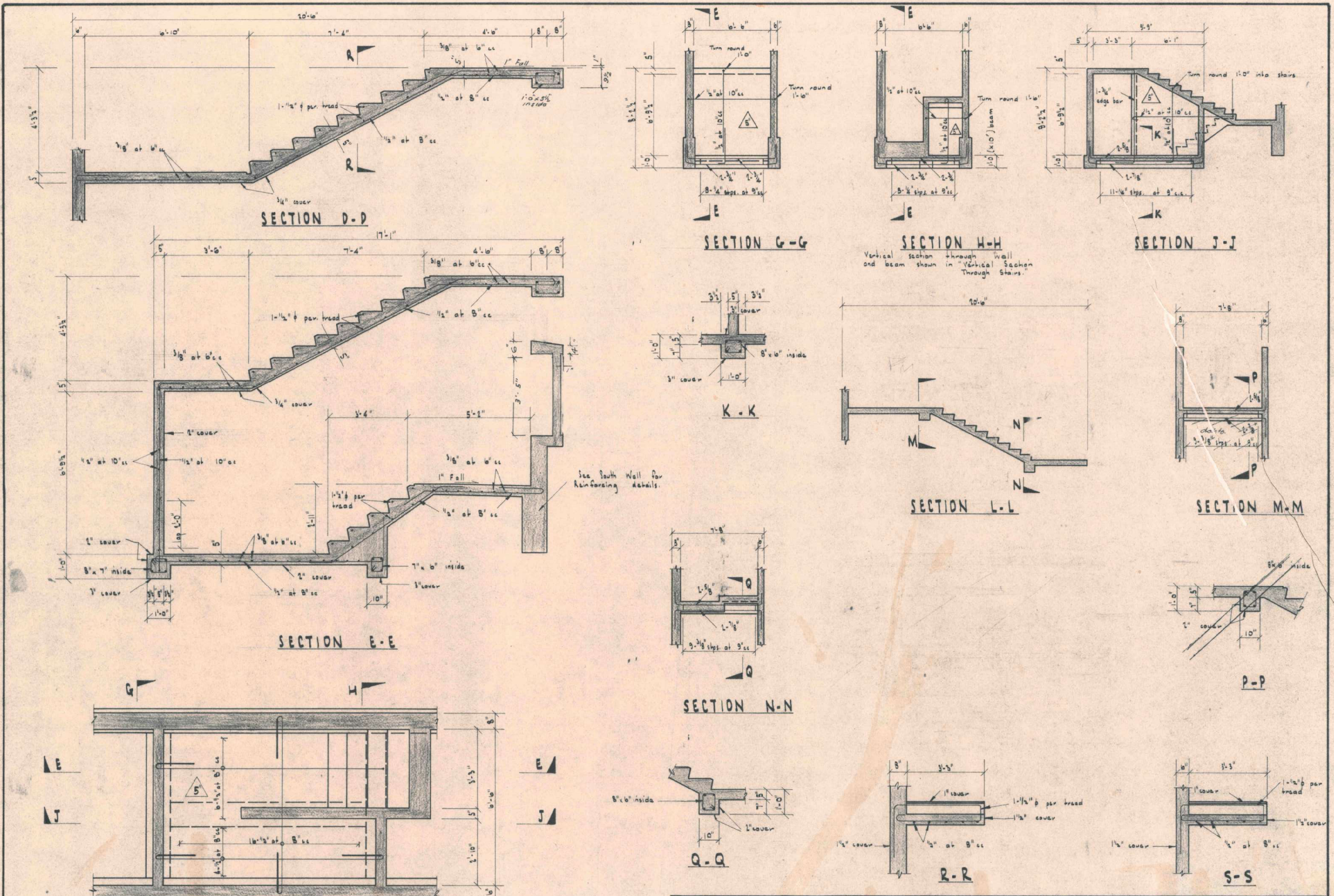


SECTION B-B



SECTION C-C

KOTUKU FLATS - KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK A - STAIRS AT WEST END DRAWN: JJQ · TRACED: CBS · CHECKED DATE: 1-2-68 · SCALES: 1/2" = 1'-0"	STEWART G. REES & ASSOC. CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON. PH. 46 321 WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	DWG NO: 879/13



KOTUKU FLATS - KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION

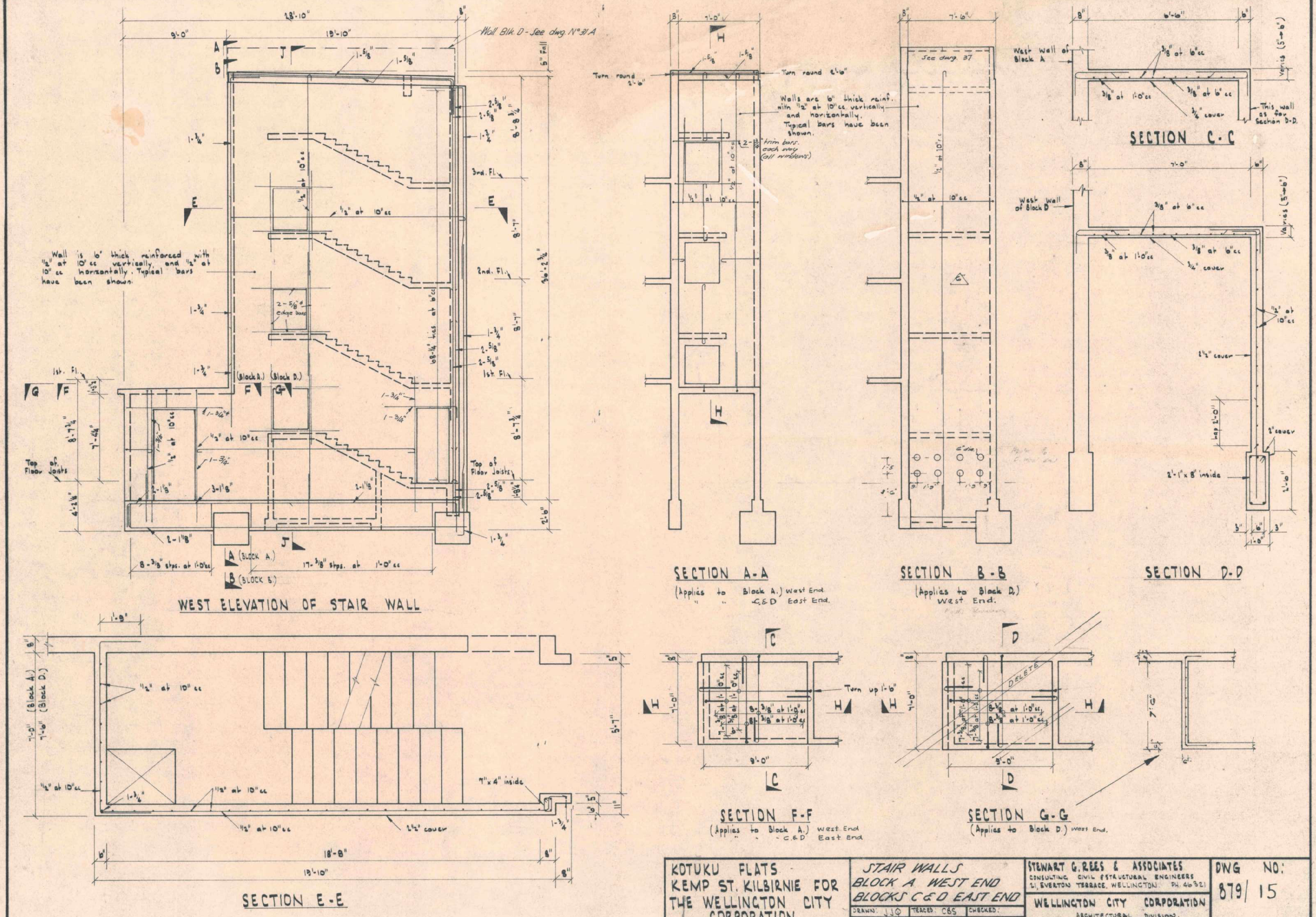
BLOCK A - STAIRS AT WEST END

STEWART G. REES & ASSOCIATES
CONSULTING CIVIL & STRUCTURAL ENGINEERS
IJ EVERTON TERRACE, WELLINGTON PH. 46-351

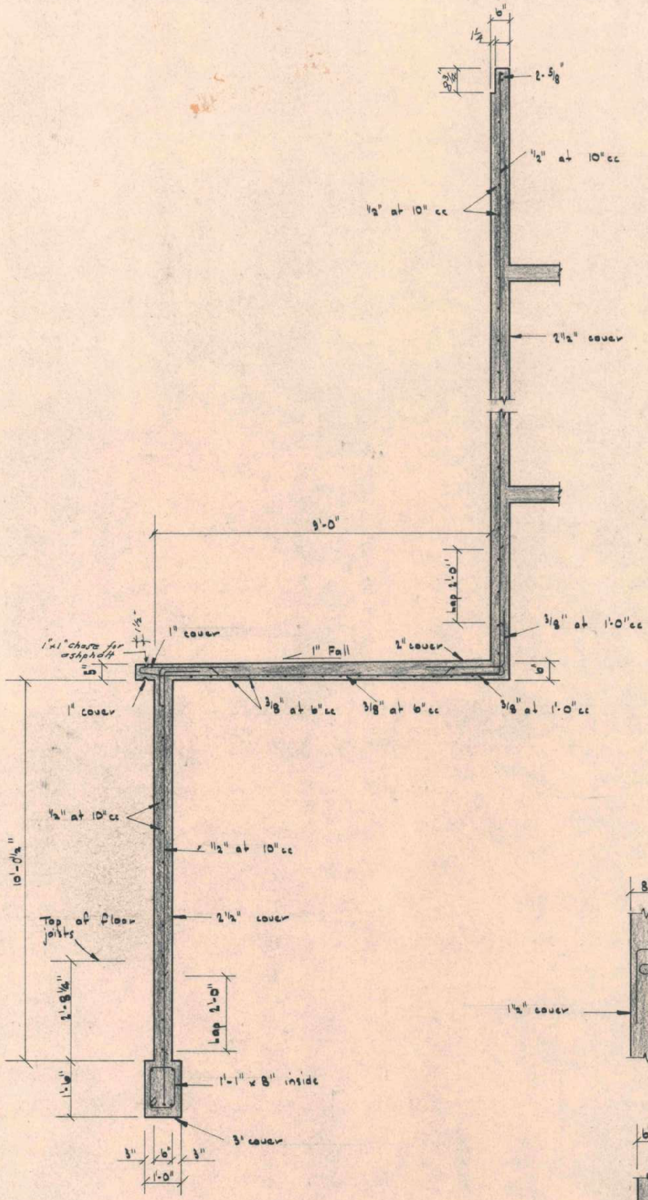
WELLINGTON CITY CORPORATION
ARCHITECTURAL DIVISION

DRAWN: J.I.O TRACED: CBS CHECKED:
DATE: 7-1-68 SCALES: ¼" & ½" = 1'-0"

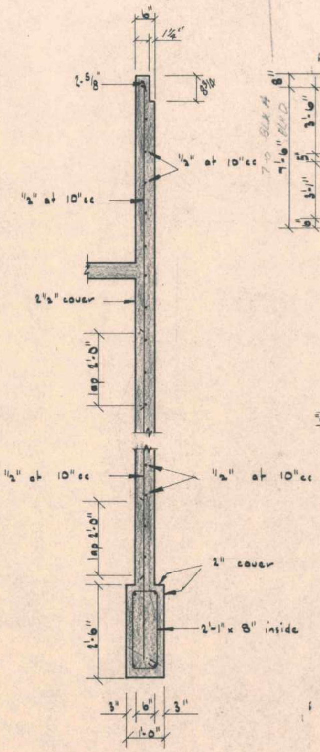
DWG. NO: 879/14



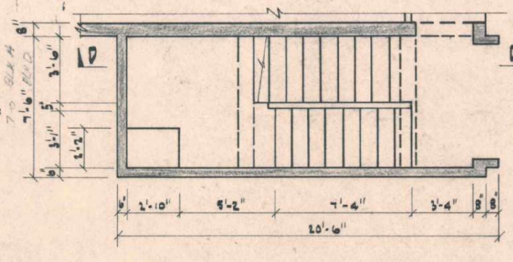
KOTUKU FLATS KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	STAIR WALLS BLOCK A WEST END BLOCKS C & D EAST END DRAWN: JJQ TRACED: CBS CHECKED: DATE: 7-2-68 SCALES: ¼", ½" = 1'-0"	STEWART G. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON. PH. 46321 WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION.	DWG NO: 879/15



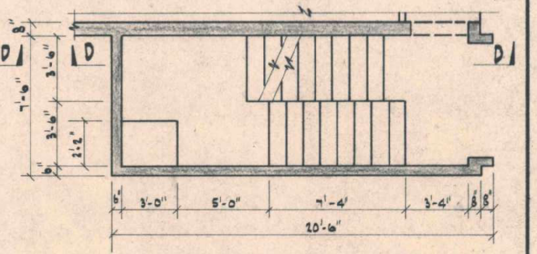
SECTION H-H



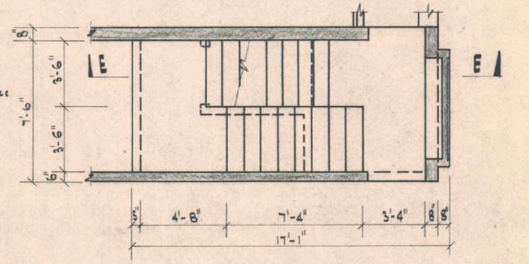
SECTION J-J



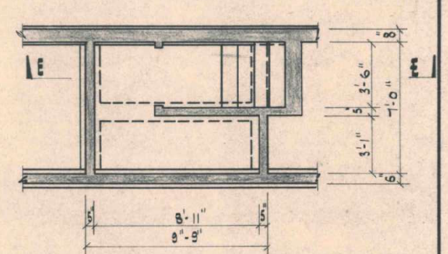
SECTION A1 - A1



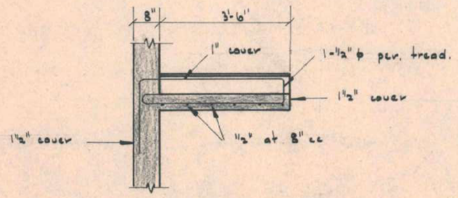
SECTION B1 - B1



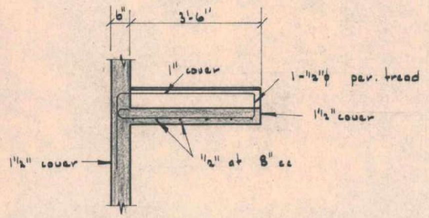
SECTION C1 - C1



SECTION F1 - F1



SECTION R1 - R1



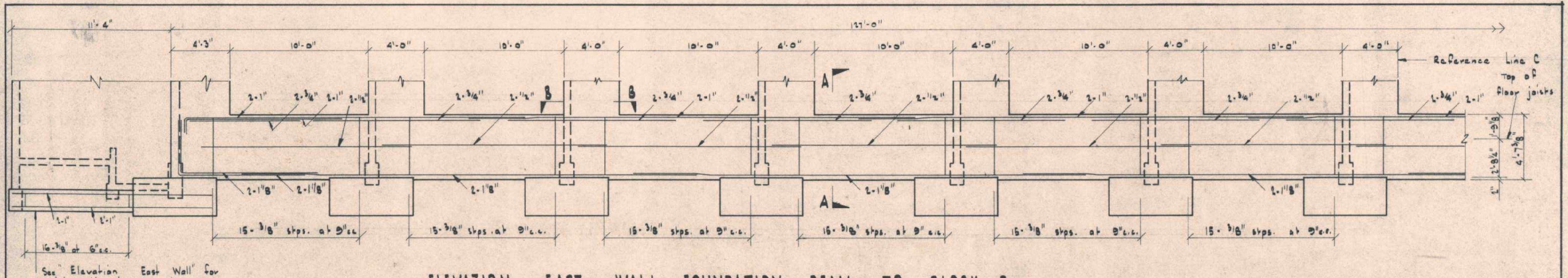
SECTION S1 - S1

BLOCK D – STAIRS AT WEST END.

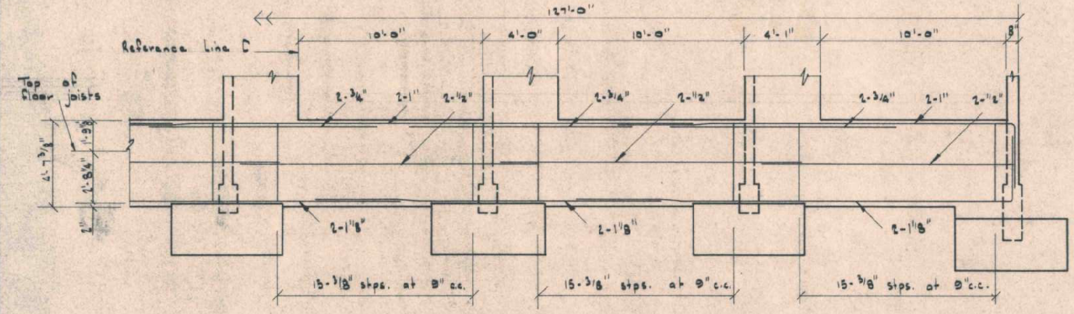
Stairs are similar to those at West end of Block A except that inside width of stair tower is 7'-0" instead of 6'-6" for Block A. This has been shown in Sections A1-A1, B1-B1, C1-C1, and F1-F1 which correspond to Sections A-A, B-B, C-C and F-F for Block A.

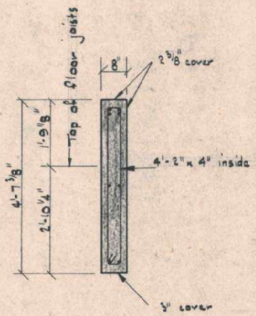
One extra reinforcing bar per stair flight is required and this has been shown in R1-R1 and S1-S1 corresponding to R-R and S-S for Block A.

KOTUKU FLATS – KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	SECTIONS TO STAIR WALLS AT WEST END OF BLOCKS A & D DRAWN: JJO TRACED: CBS CHECKED: DATE: 1-2-68 SCALES: 1/2" = 1'-0"	STEWART G. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON. PH. 46321 WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION.	DWG. NO. 879/16

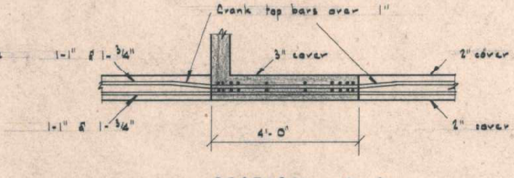


ELEVATION, EAST WALL FOUNDATION BEAM TO BLOCK B.



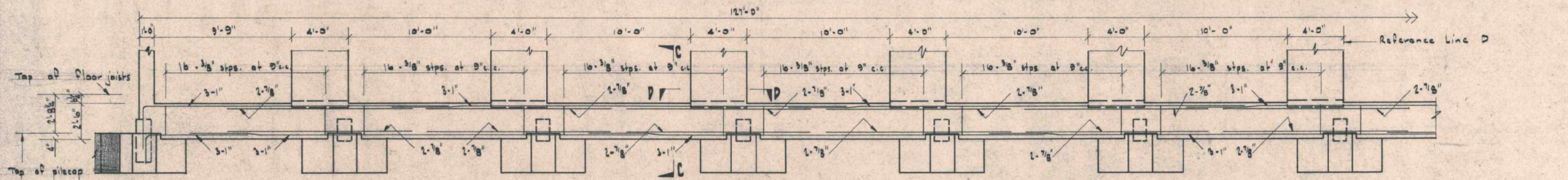


SECTION A-A

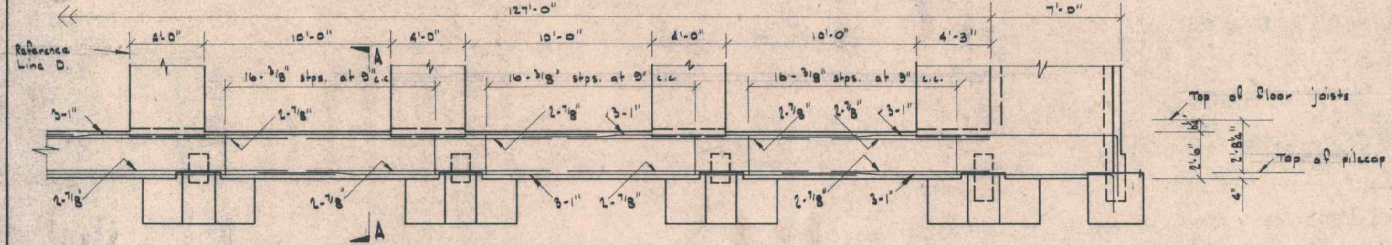


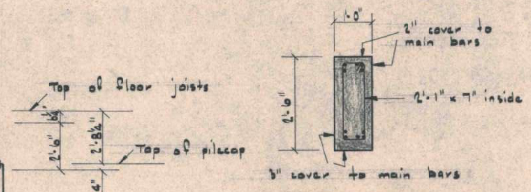
SECTION B-B

(Typical at all columns.)

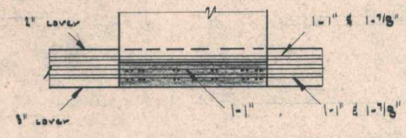


ELEVATION WEST WALL FOUNDATION BEAM TO BLOCK B.





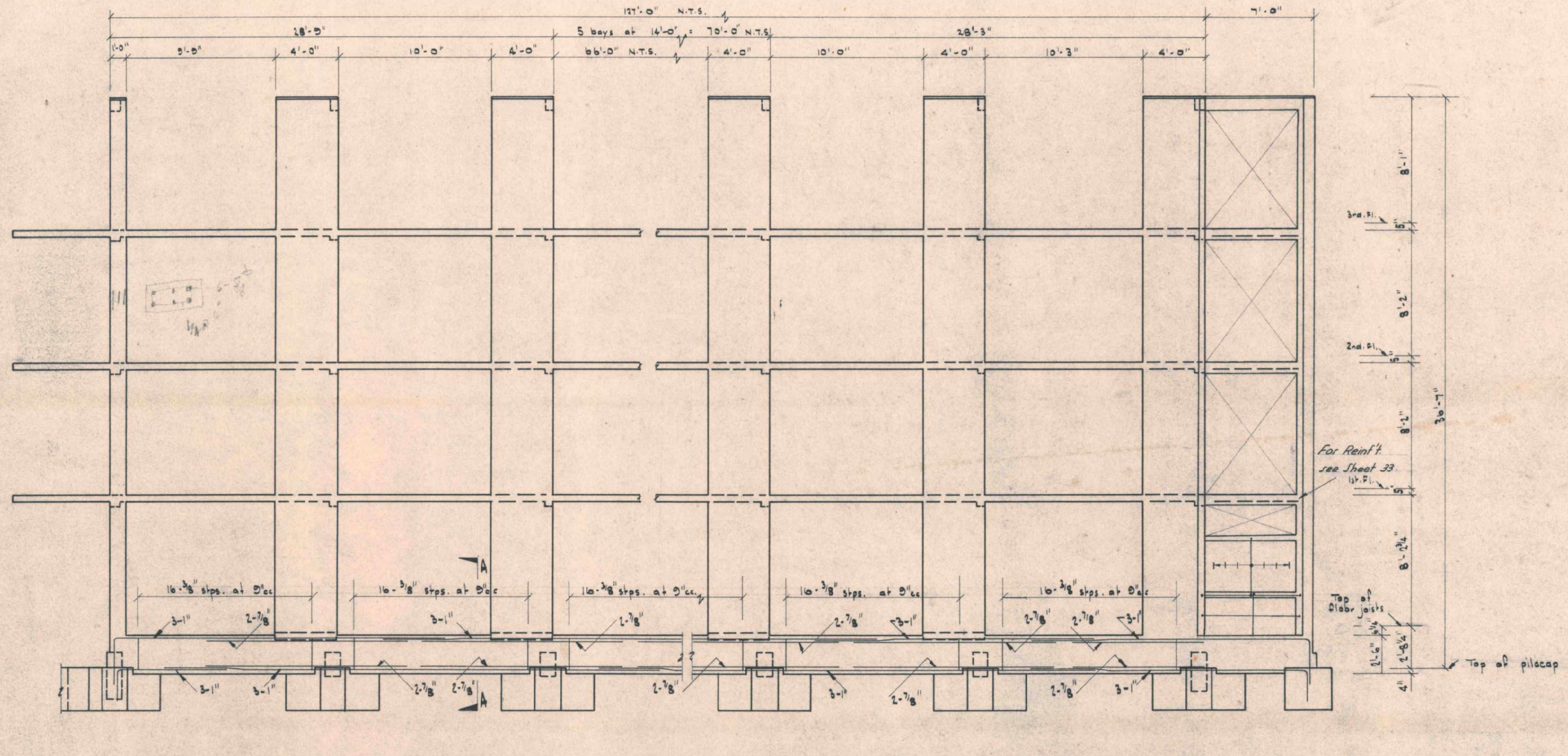
C-C



SECTION D-D

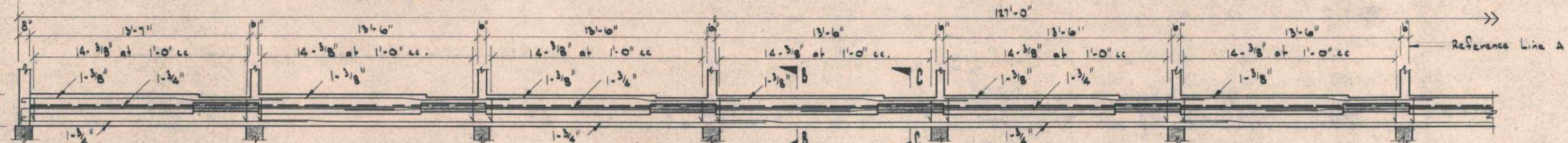
(Typical at all columns.)

KOTUKU FLATS - KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION.	BLOCK B - EAST & WEST WALL FOUNDATION BEAMS DRAWN: J.J.Q. TRACED: C.B.S. CHECKED: DATE: 21-11-67 SCALES: 1/4", 1/2" = 1'-0"	STEWART Q. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON PH. 46-321 WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	DWG. NO: 879/17 NO. OF SHEETS:

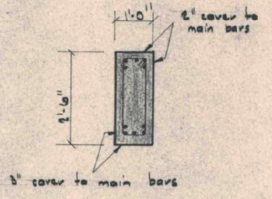


ELEVATION WEST WALL BLOCK B.

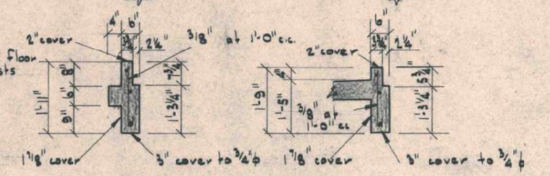
Column reinforcing is similar to that for columns in South Wall of Block A.



ELEVATION INTERIOR LONGITUDINAL BEAM

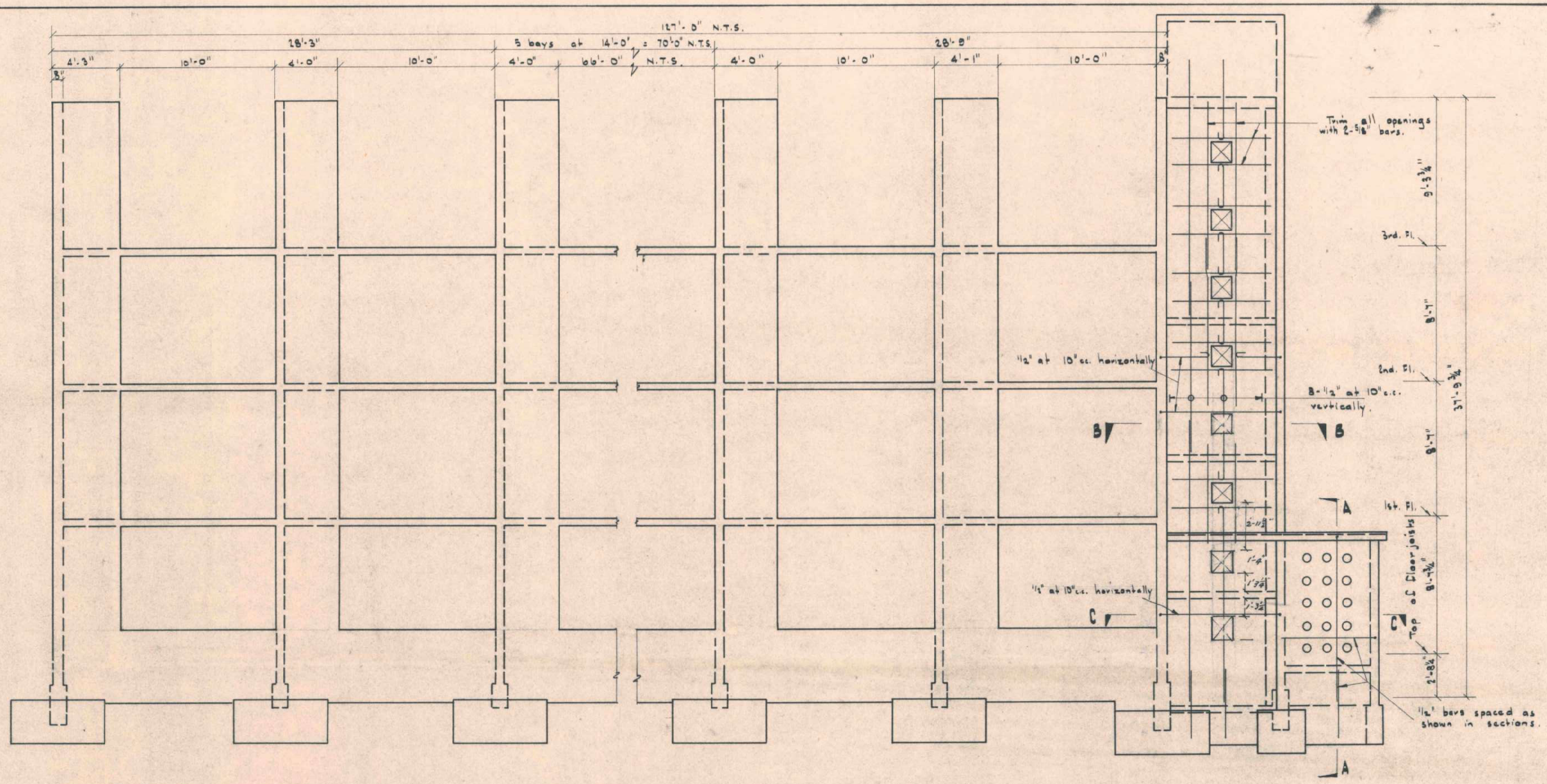


A-A



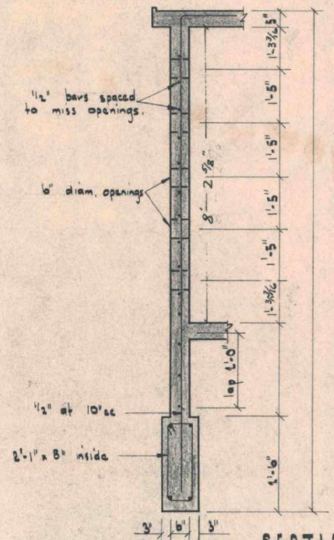
B-B C-C

KOTUKU FLATS – KEMP ST., KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK B – WEST WALL	STEWART C. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON. PH. 40321	DWG. NO. 879/ 18
	DRAWN: J.J.O. TRACED: CBS. CHECKED:	WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	
	DATE: 26.10.67 SCALES: 1/4", 1/2" = 1'-0"		NO. OF SHEETS:

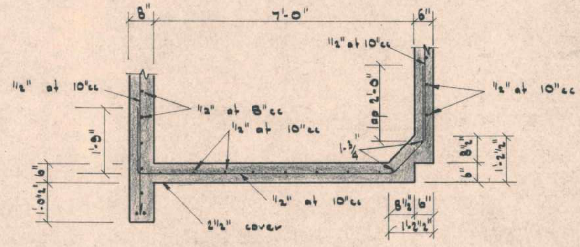


ELEVATION EAST WALL - BLOCK B.

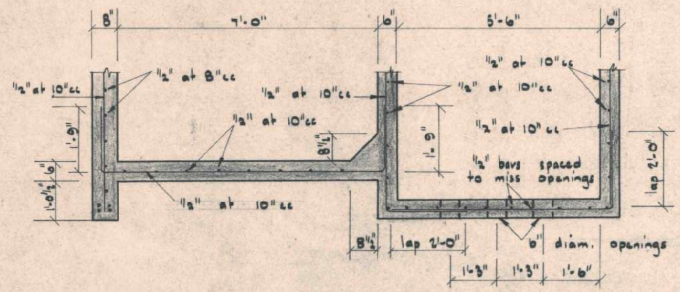
Column reinforcing is similar to that for corresponding columns in North Wall of Block A.



SECTION A-A

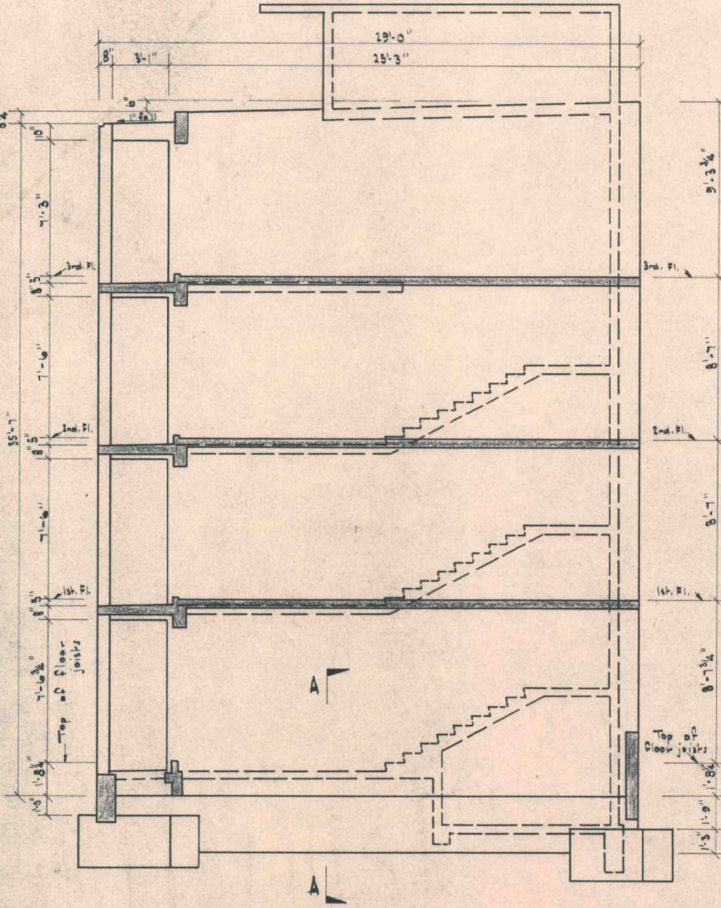


SECTION B-B



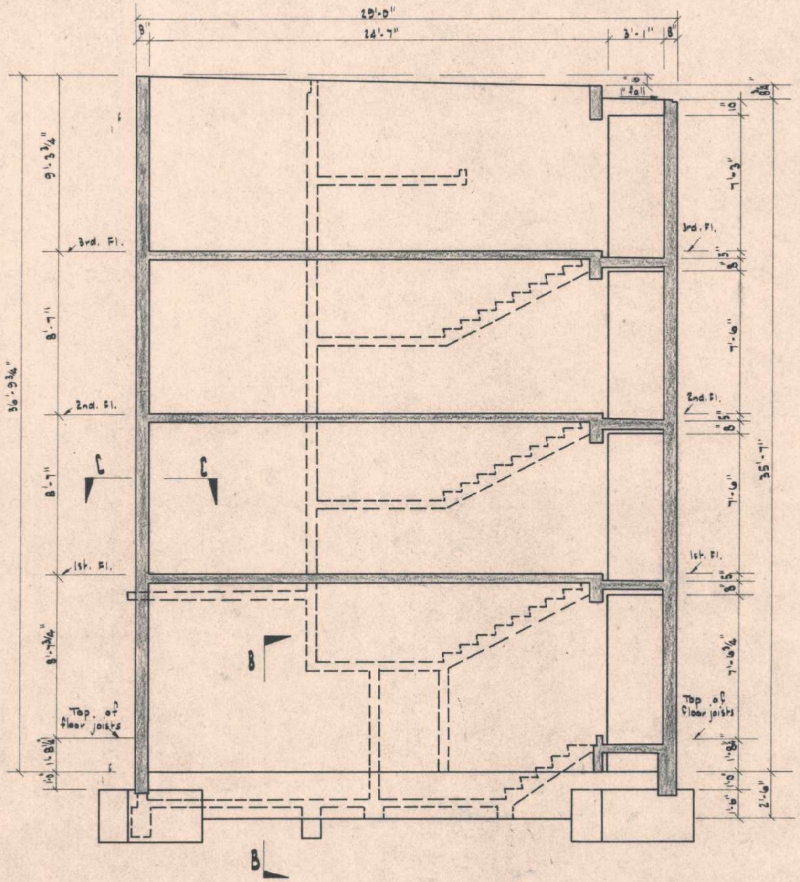
SECTION C-C

KOTUKU FLATS - KEMP ST., KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK B - EAST WALL	STEWART C. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON. PH. 46321	DWG. NO: 879/19
	DRAWN: J.J.Q. TRACED: C.B.S. CHECKED: DATE: 25.10.67 SCALES: 1/4", 1/2" = 1'-0"	WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	NO. OF SHEETS:



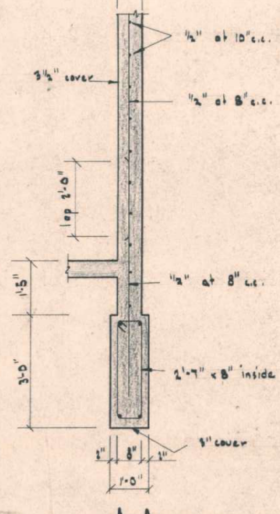
ELEVATION NORTH WALL OF BLOCK B

Wall is 8" thick. Reinforcing above Grd. Fl. level is similar to corresponding reinforcing in West Wall of Block C, except for Water Tank.

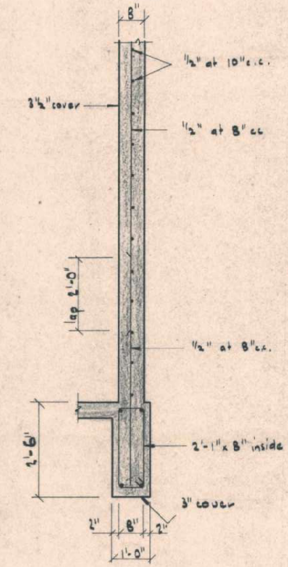


ELEVATION SOUTH WALL OF BLOCK B.

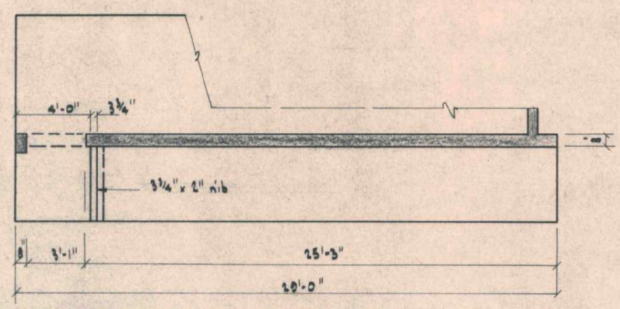
Wall is 8" thick. Reinforcing above Grd. Fl. level is similar to corresponding reinforcing in West Wall of Block C except that horizontal bars (1/2" at 10" c.c.) turn round 1'-9" into East Wall. (See C-C.)



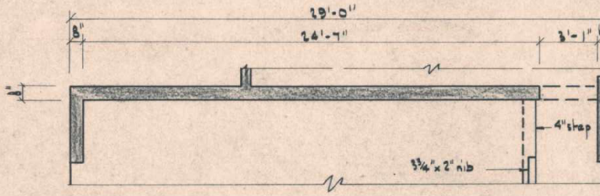
A-A



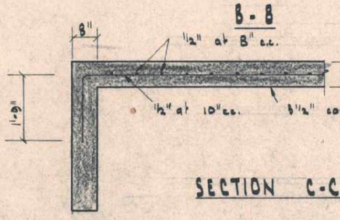
B-B



HORIZONTAL SECTION OF NORTH WALL AT 1ST. 2ND. & 3RD. FLOOR LEVELS.

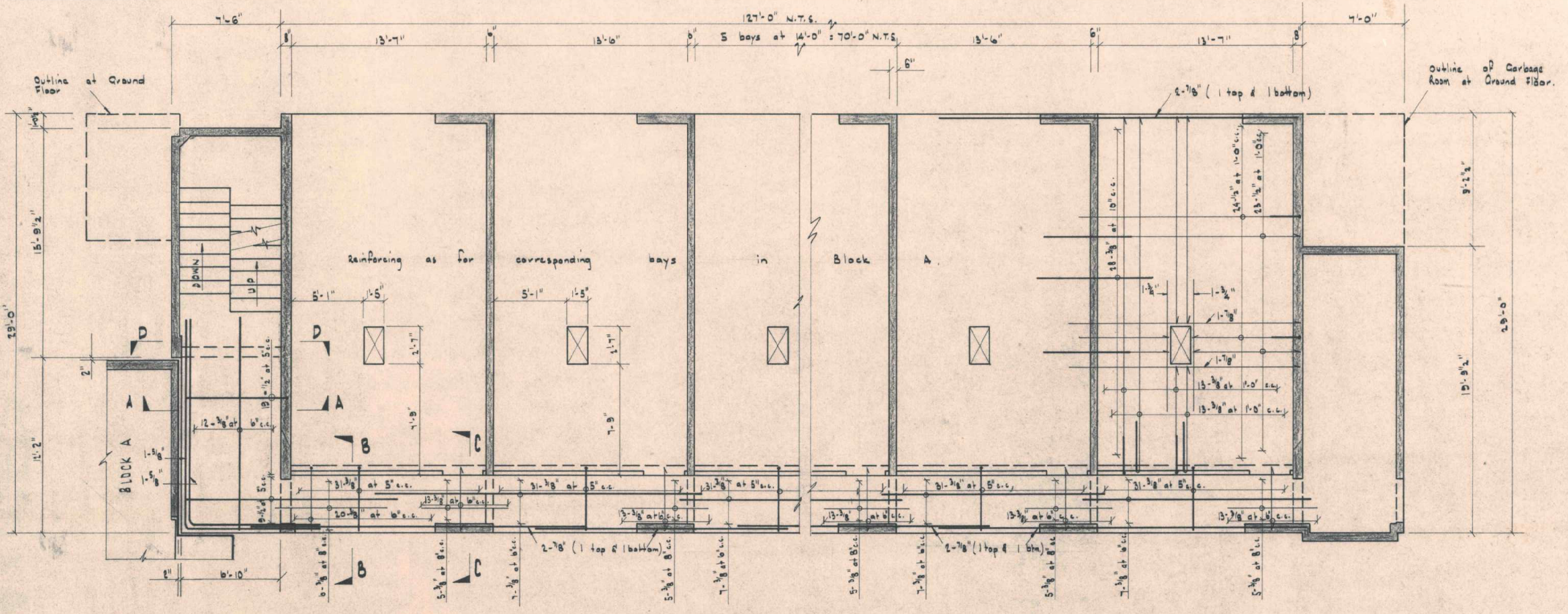


HORIZONTAL SECTION OF SOUTH WALL AT 1ST., 2ND., & 3RD. FLOOR LEVELS.

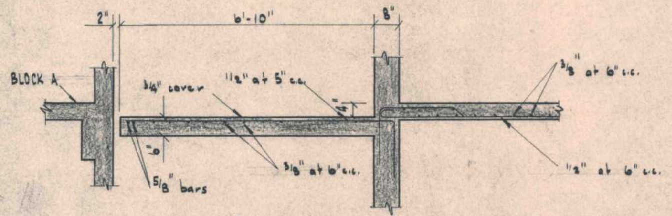


SECTION C-C

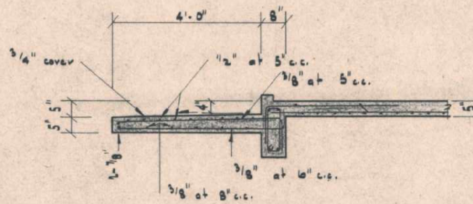
KOTUKU FLATS - KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK B - NORTH & SOUTH WALLS DRAWN: J.J.Q. TRACED: CBS CHECKED: DATE: 23-10-67 SCALES: 1/4", 1/2" = 1'-0"	STEWART C. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON. PH. 46-321 WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	DWG. NO: 879/20 NO. OF SHEETS:



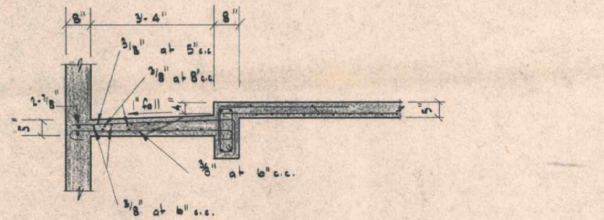
BLOCK B - SLAB PLAN FOR 1ST., 2ND. & 3RD. FLOORS.



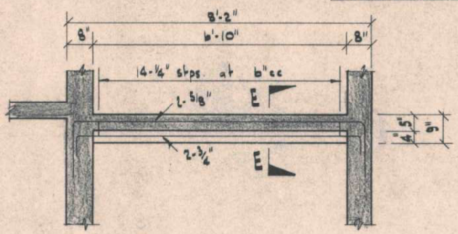
SECTION A-A



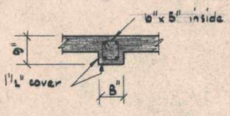
SECTION B-B



SECTION C-C



SECTION D-D



SECTION E-E

Bar Notation:

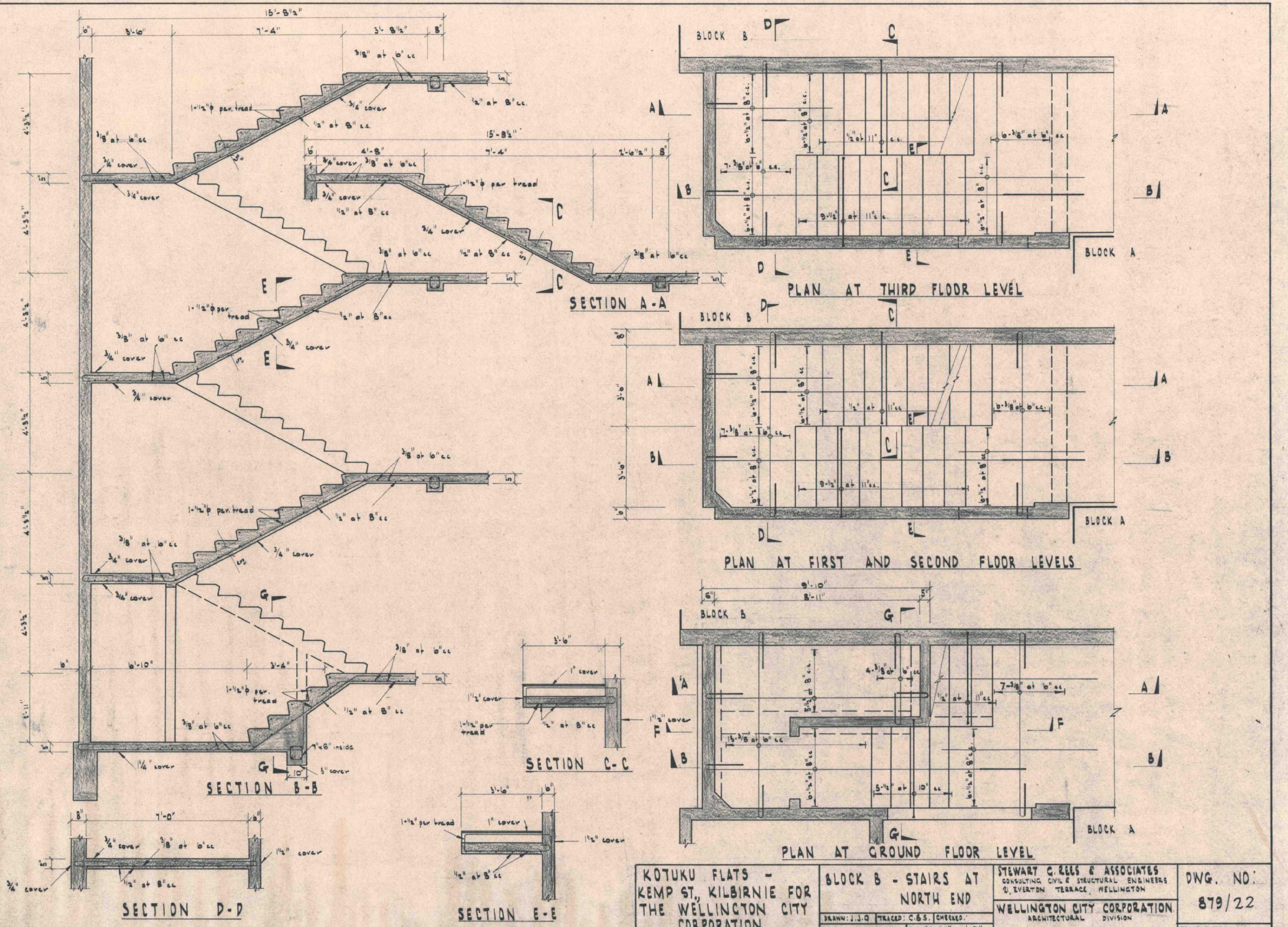
Bars in near face of slab have been shown thus

Bars in far face of slab have been shown thus

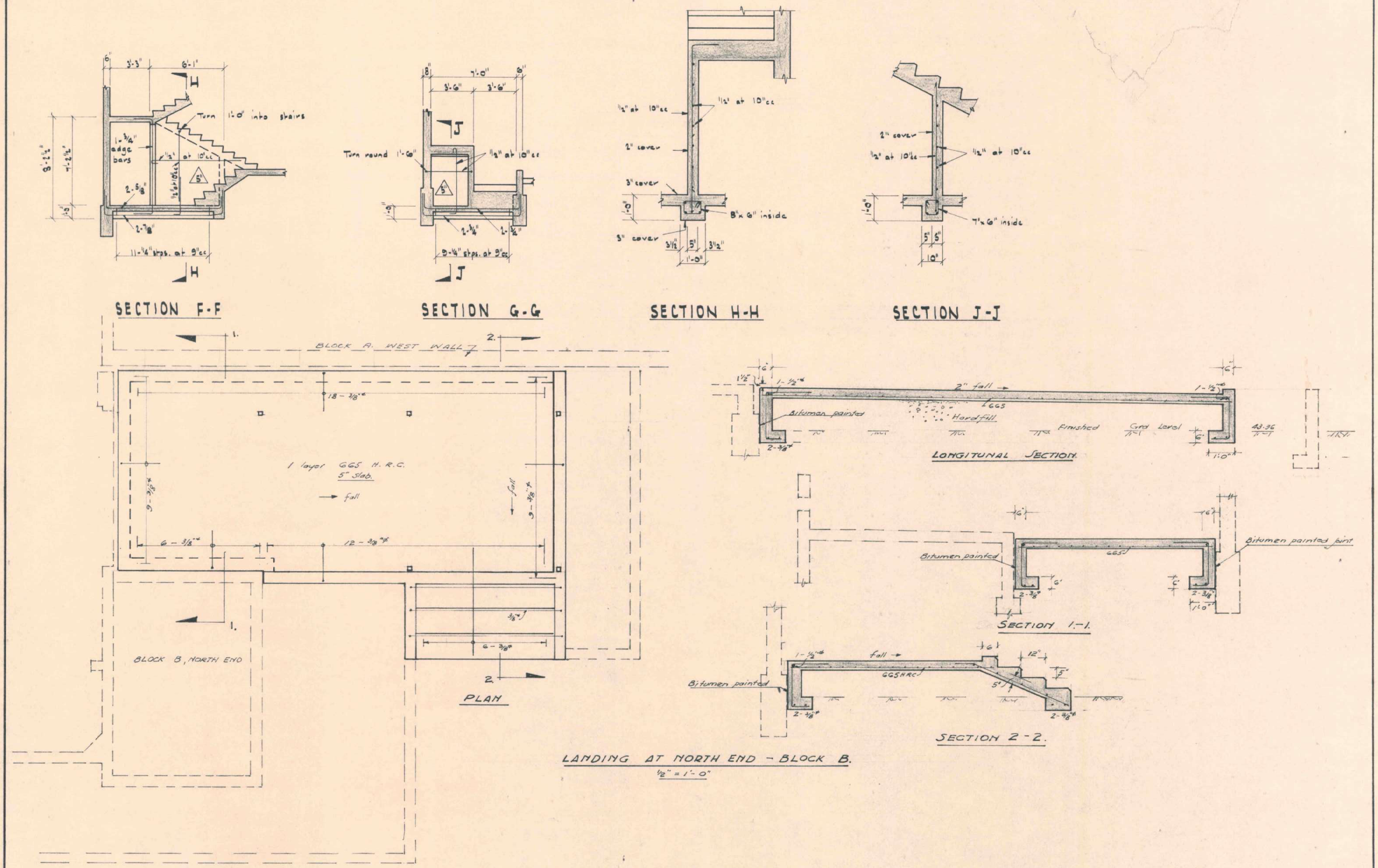
Torsion Steel:

Provide torsion reinforcement in slab at all corners and at each intersection of transverse walls and slab edges. Torsion reinforcement shall be as for block A.

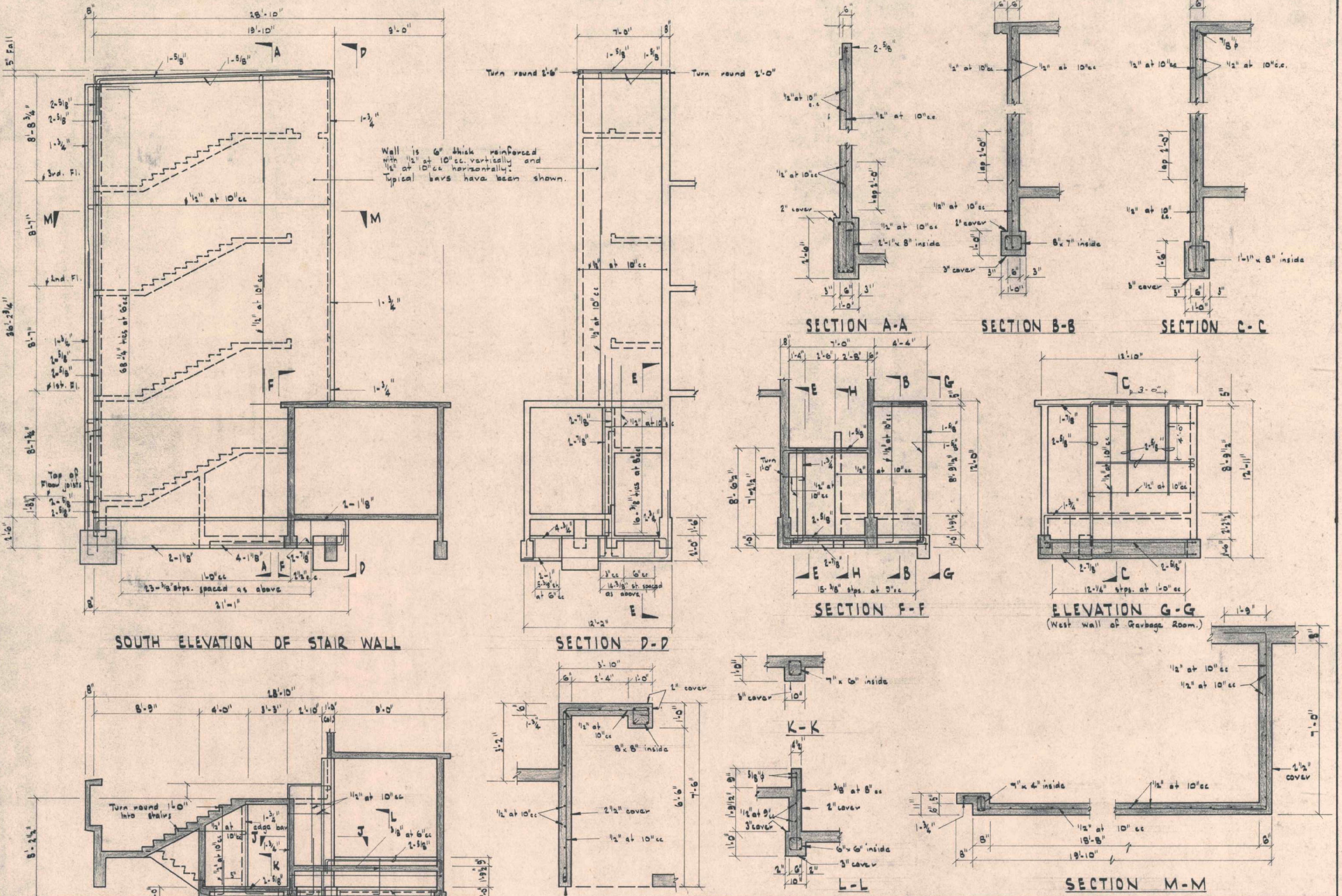
KOTUKU FLATS - KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK B - SLAB PLAN & SECTIONS DRAWN: I.I.Q. TRACED: CBS CHECKED: DATE: 1-11-67 SCALES: 1/8", 1/2" = 1'-0"	STEWART G. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON. PH. 46321 WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	DWG. NO: 879/21 NO. OF SHEETS:



KOTUKU FLATS - KEMP ST., KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK B - STAIRS AT NORTH END	STEWART C. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 12, EVERTON TERRACE, WELLINGTON	DWG. NO: 879/22
	DRAWN: J.J.O TRACED: C.G.S. CHECKED:	WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	
	DATE: 11-12-67 SCALES: ½" = 1'-0"		NO. OF SHEETS:



KOTUKU FLATS - KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK B - STAIRS AT NORTH END	STEWART C. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 2, EVERTON TERRACE, WELLINGTON	DWG. NO.
	DRAWN: JJQ | TRACED: CBS | CHECKED: SGR 8.10.68 DATE: 22.3.68 | SCALES	WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	879/23



KOTUKU FLATS - KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION.

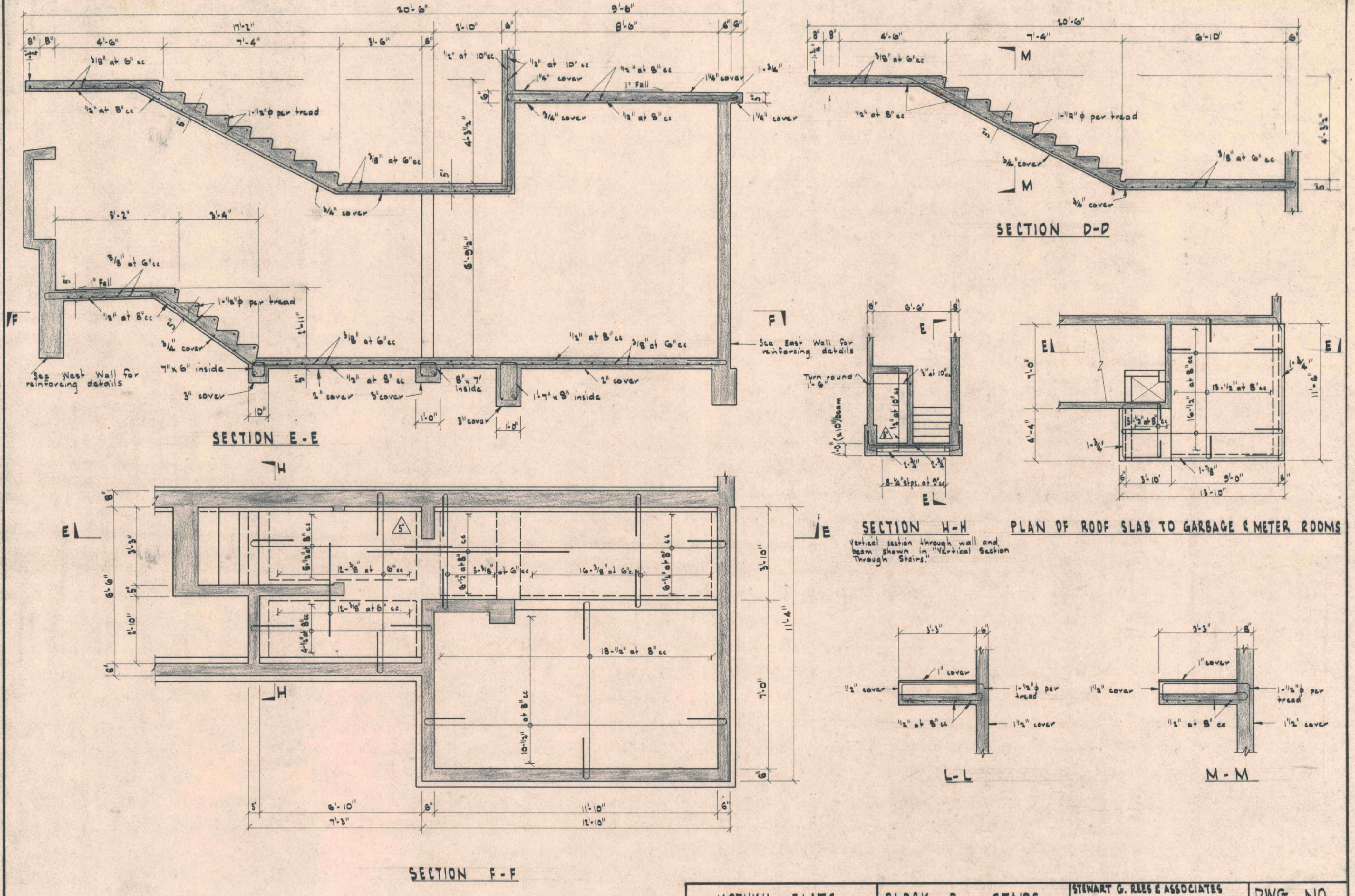
BLOCK B. - STAIR WALLS AT SOUTH END

DRAWN: JJF TRACED: CBS CHECKED:
DATE: 20-3-68 SCALES: 1/8", 1/2" = 1'-0"

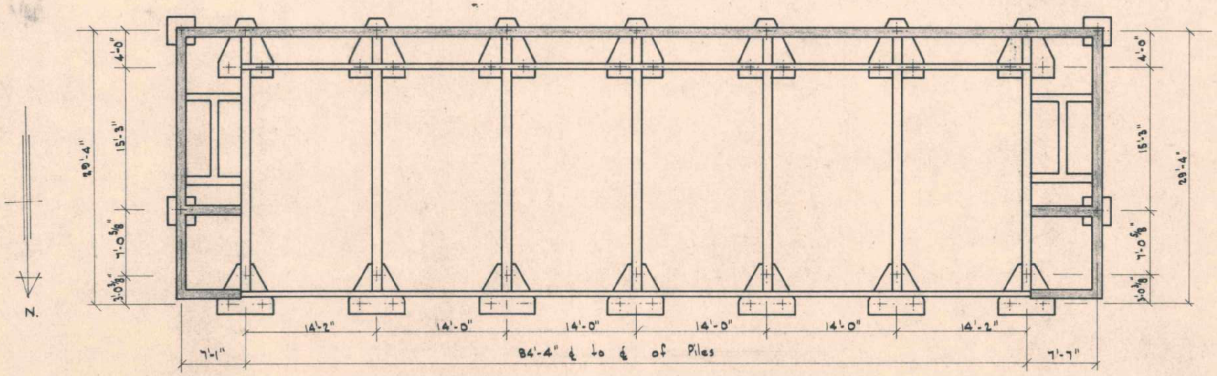
STEWART C. REES & ASSOCIATES
CONSULTING CIVIL & STRUCTURAL ENGINEERS
21, EVERTON TERRACE, WELLINGTON

WELLINGTON CITY CORPORATION
ARCHITECTURAL DIVISION

DWG. NO. 879/25

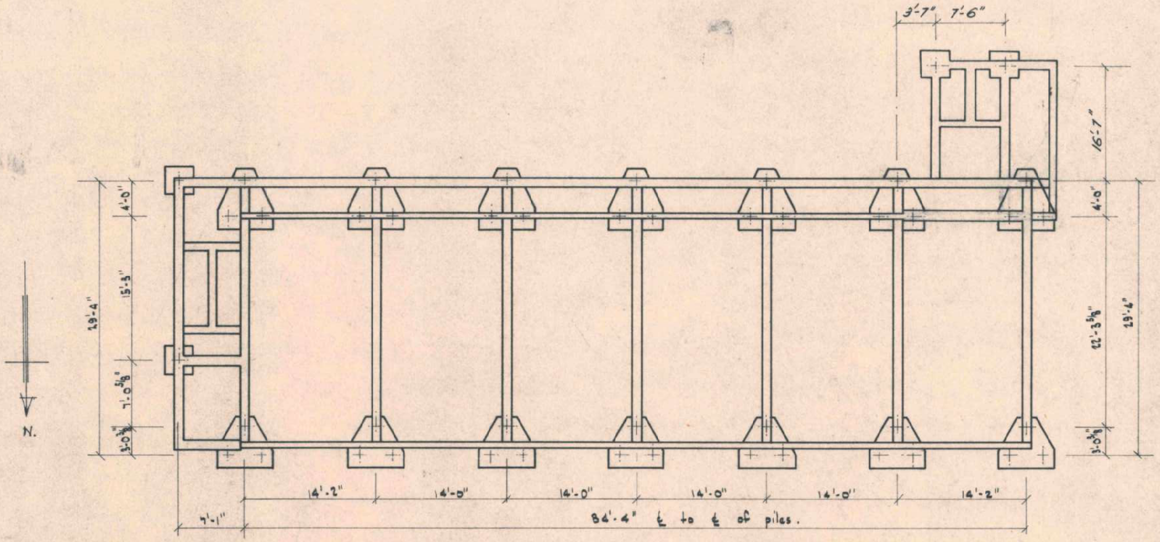


KOTUKU FLATS - KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK B - STAIRS AT SOUTH END	STEWART G. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON	DWG. NO.
	DRAWN: JJQ | TRACED: CBS | CHECKED:	WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	879/26
	DATE: 20-3-68 | SCALES: ¼", ½" : 1'-0"		



FOUNDATION PLAN - BLOCK D

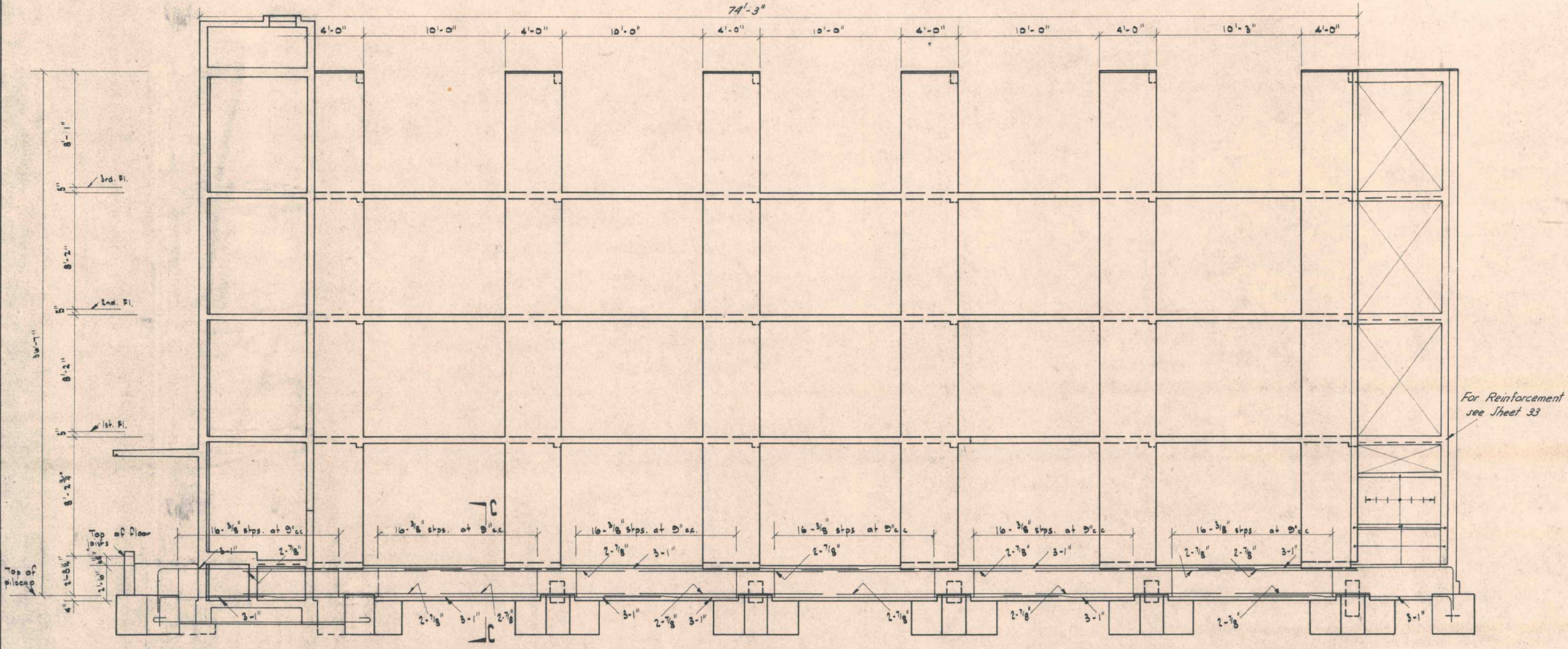
Scale: 1/8" = 1'-0"



FOUNDATION PLAN - BLOCK C

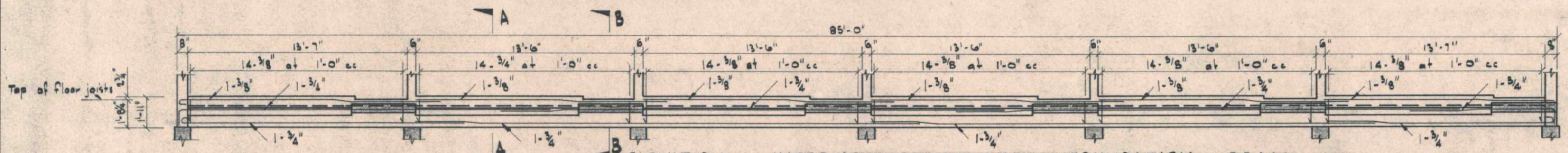
Scale : 1/8" = 1'-0"

KOTUKU FLATS - KEMP STREET KILBIRNIE FOR THE WELLINGTON CITY CORPORATION.	BLOCKS C & D - FOUNDATION PLAN DRAWN: TRACED: CHECKED: DATE: SCALES:	STEWART G. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON. PH. 46-321 WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	DWG. NO. 879/27

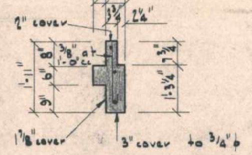


ELEVATION SOUTH WALL - BLOCK C

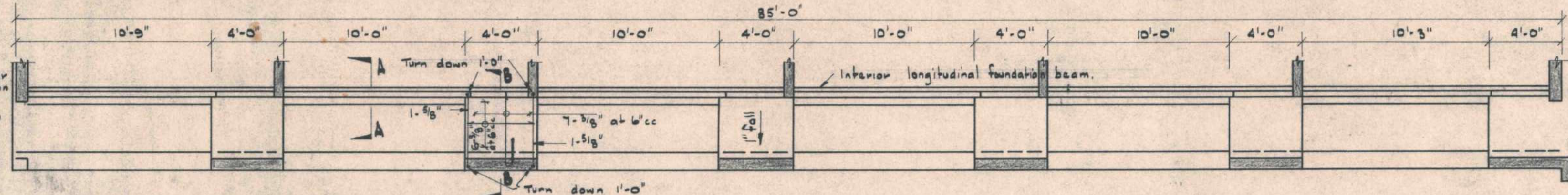
Column reinforcing is similar to that for columns in South Wall of Block A.



ELEVATION INTERIOR LONGITUDINAL FOUNDATION BEAM.

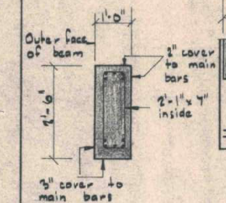


A - A

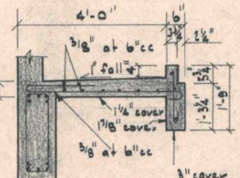


PLAN SOUTH WALL FOUNDATION BEAMS

Balcony slab reinforcing has been shown for one bay only. Other balcony slabs are reinforced similarly.

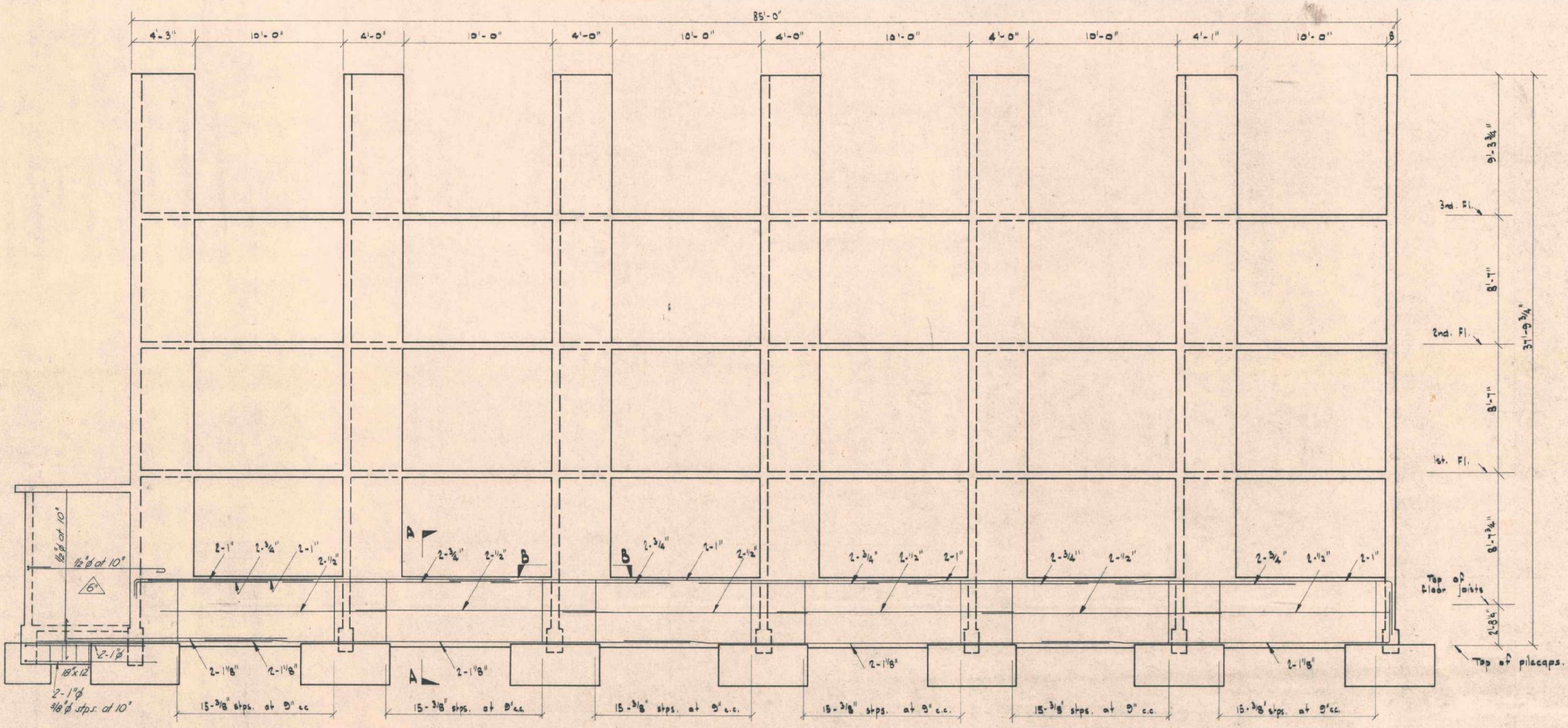


C - C



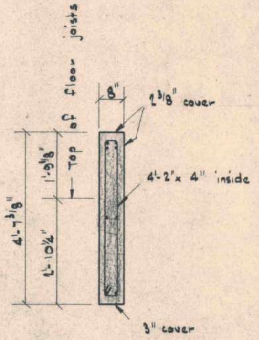
B - B

KOTUKU FLATS - KEMP ST., KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK C - SOUTH WALL	STEWART C. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 2, EVERTON TERRACE, WELLINGTON. PH. 46321	DWG. NO. 879/28
	DRAWN: J.J.O. TRACED: C.B.S. CHECKED: DATE: 26-10-67 SCALES:	WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	NO. OF SHEETS:

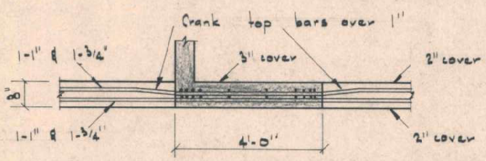


ELEVATION NORTH WALL BLOCKS C & D.

Column reinforcing is similar to that for corresponding columns in North Wall of Block A.



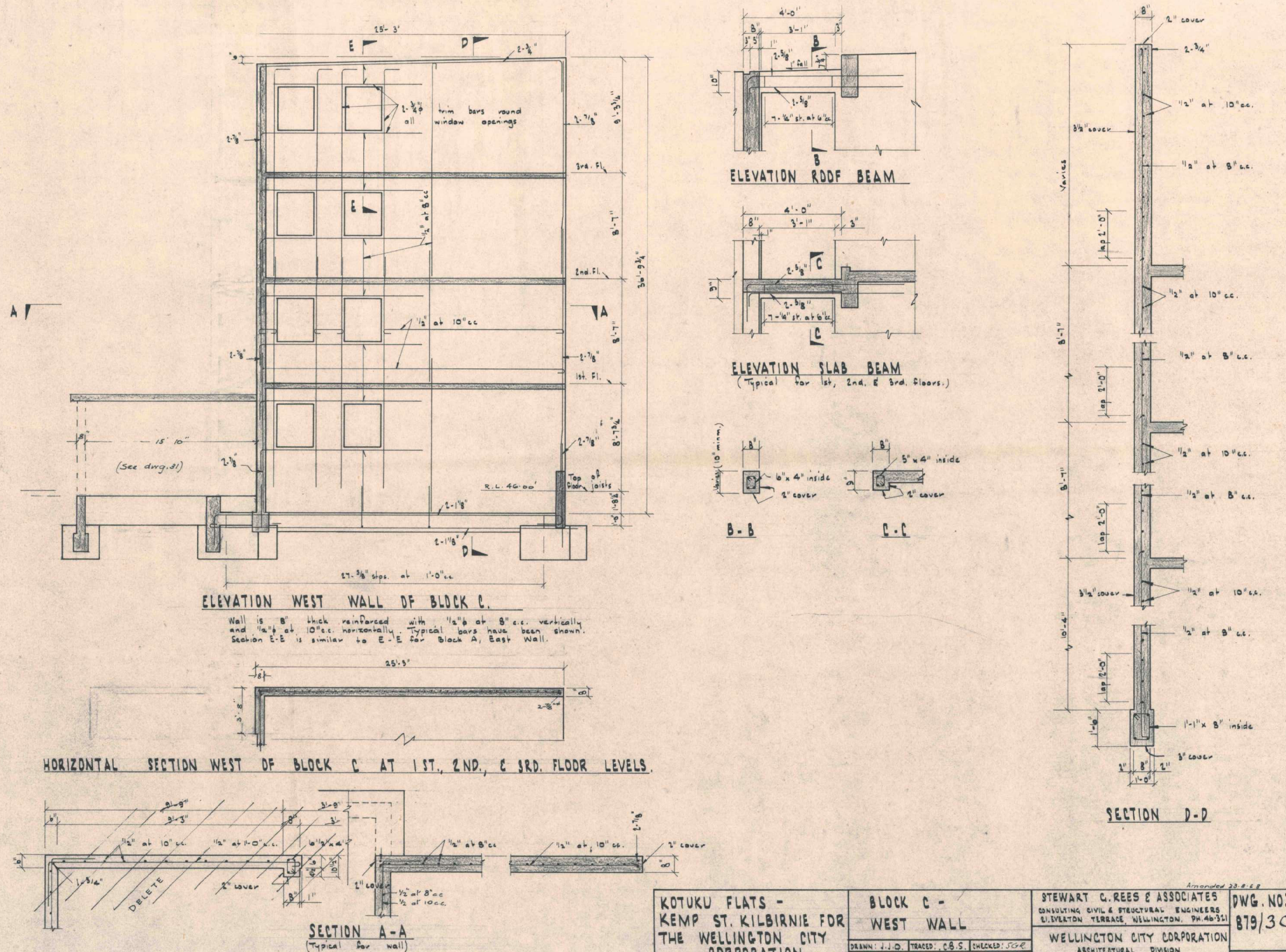
SECTION A-A



SECTION B-B

(Typical at all columns.)

KOTUKU FLATS - KEMP ST., KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCKS C & D. - NORTH WALL DRAWN: J.J.Q. TRACED: CBS CHECKED: DATE: 27-10-67 SCALES: ¼", ½"=1'-0"	STEWART C. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON. PH.46332 WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	DWG. NO: 879/29 NO: OF SHEETS:



Amended 23.8.68

KOTUKU FLATS -
KEMP ST. KILBIRNIE FOR
THE WELLINGTON CITY
CORPORATION

BLOCK C -
WEST WALL

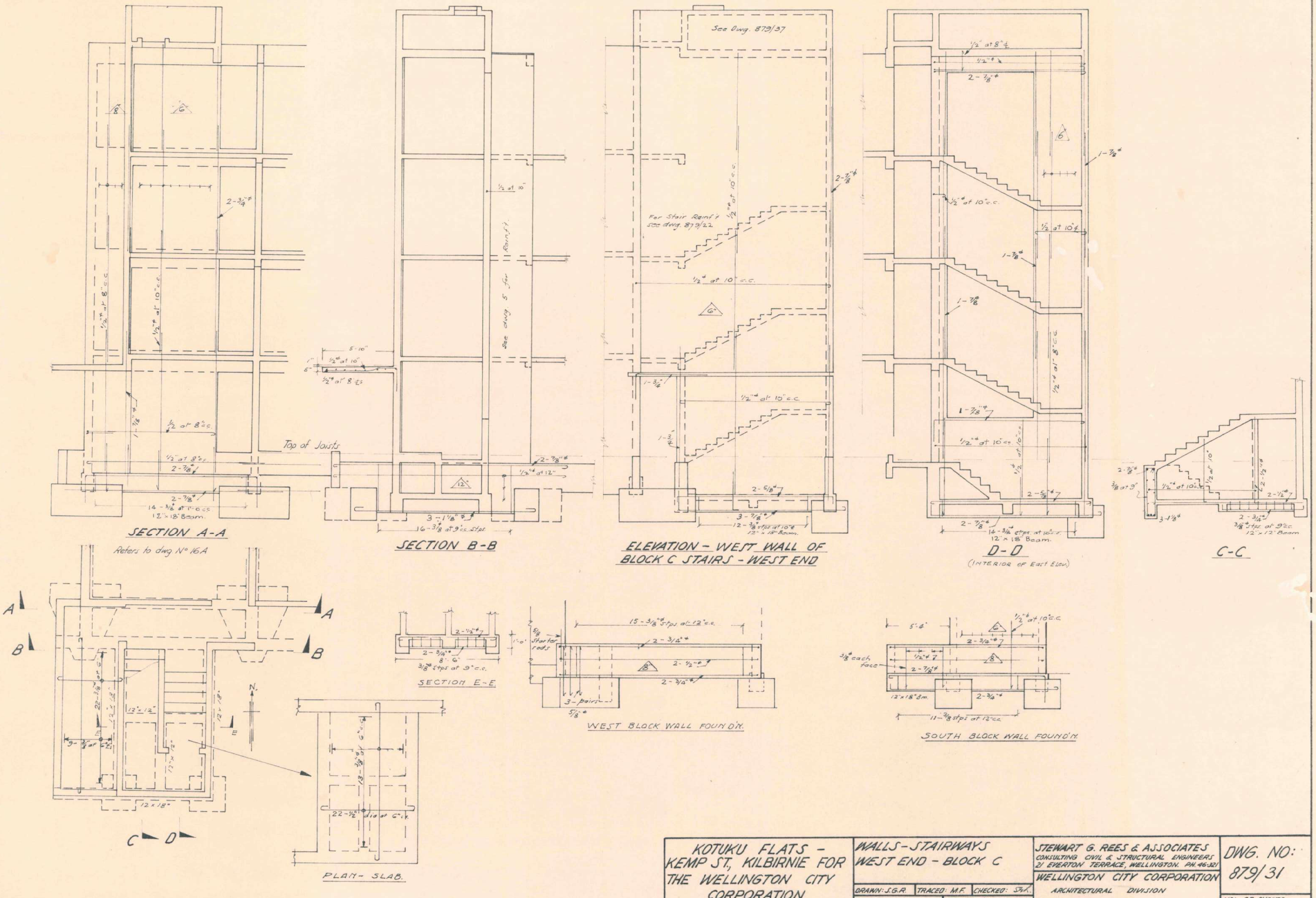
DRAWN: J.J.O. TRACED: C.B.S. CHECKED: SGR
DATE: 20th. OCT. 1967 SCALES: ¼", ½" = 1'-0"

STEWART C. REES & ASSOCIATES
CONSULTING CIVIL & STRUCTURAL ENGINEERS
21, EVERTON TERRACE, WELLINGTON. PH. 46-321

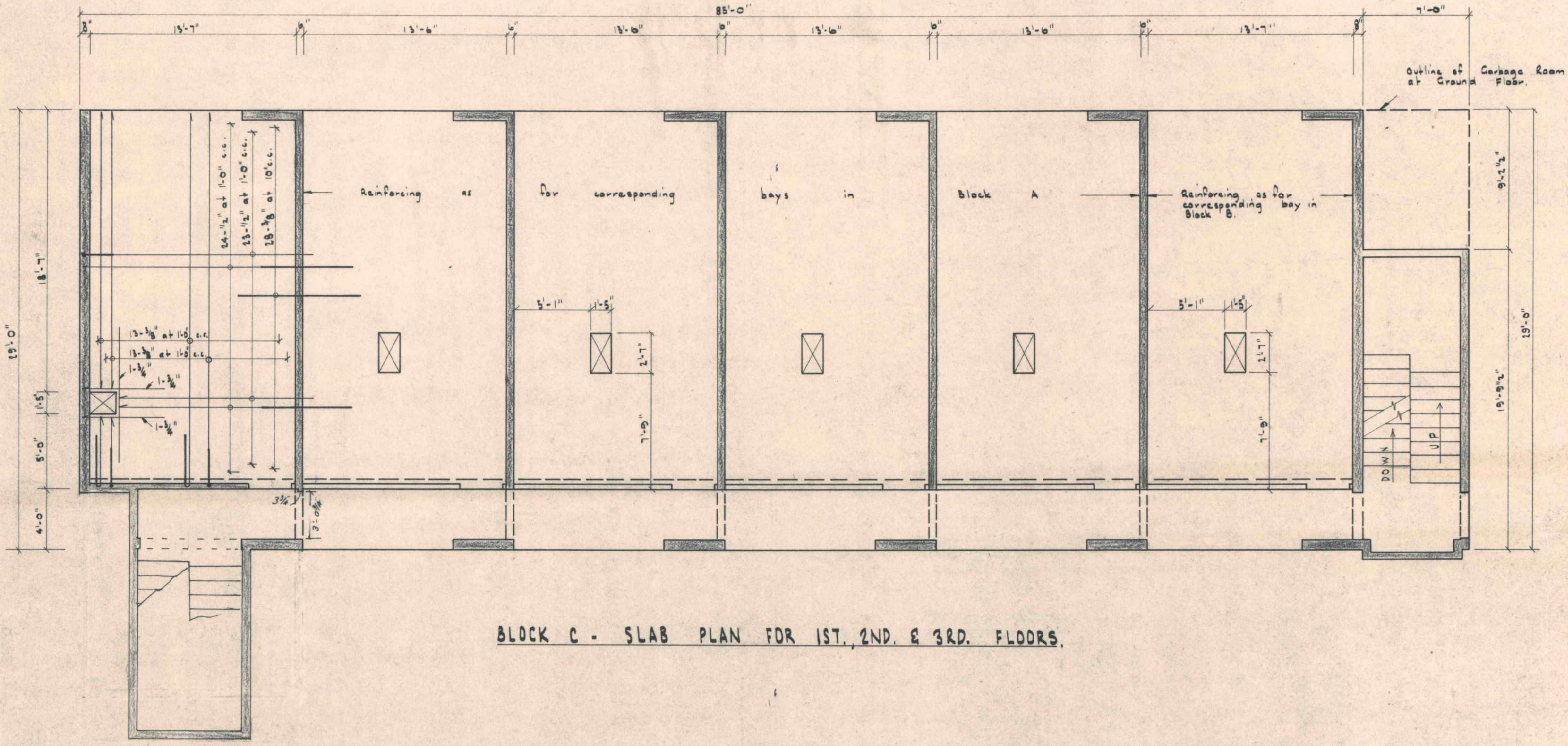
WELLINGTON CITY CORPORATION
ARCHITECTURAL DIVISION

DWG. NO: 879/30

NO. OF SHEETS:



KOTUKU FLATS - KEMP ST, KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	WALLS - STAIRWAYS WEST END - BLOCK C	STEWART G. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21 EVERTON TERRACE, WELLINGTON. PH. 46-321	DWG. NO: 879/31
	DRAWN: S.G.R. TRACED: M.F. CHECKED: S.G.R.	WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	
	DATE: 23-8-68. SCALES: 1/8" = 1'		NO: OF SHEETS:



BLOCK C - SLAB PLAN FOR 1ST, 2ND. & 3RD. FLOORS.

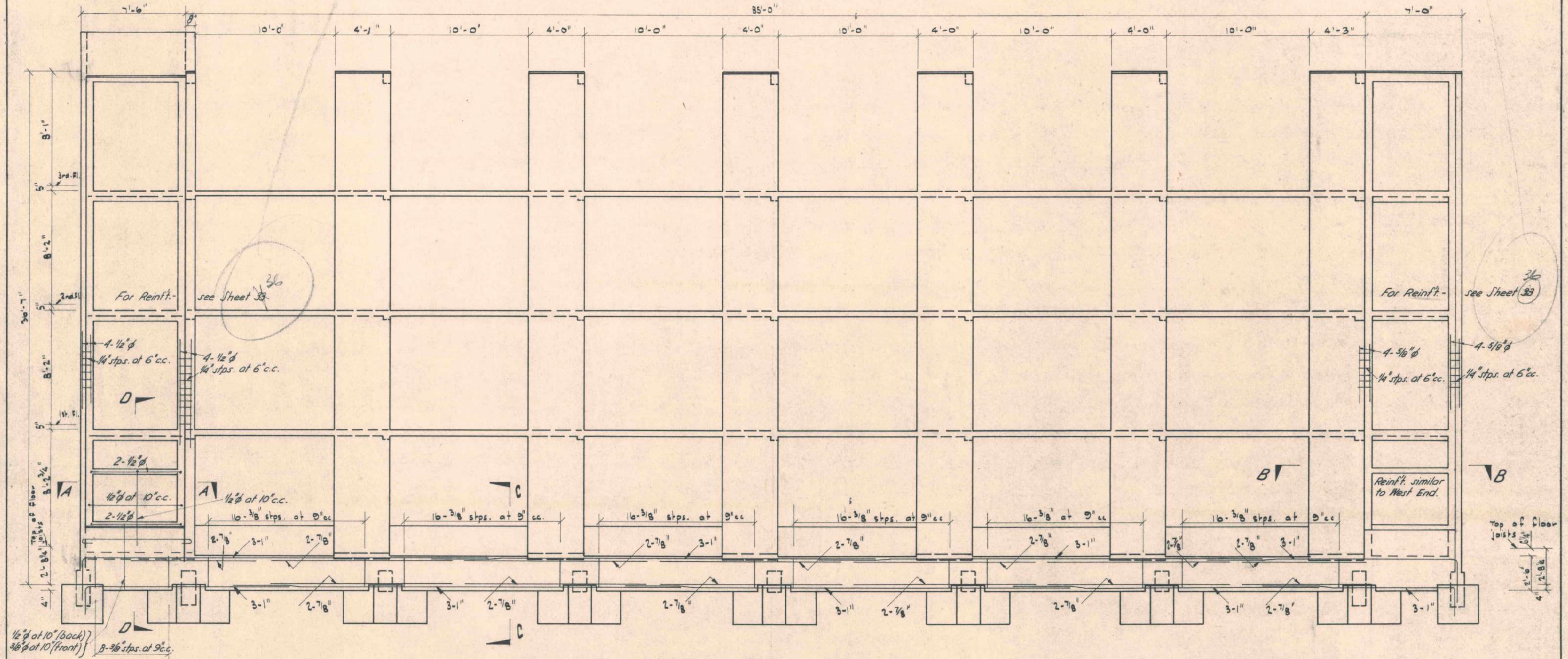
Bar Notation

Bars in near face of slab have been shown thus ———
Bars in far face of slab have been shown thus - - - -

Torsion Steel

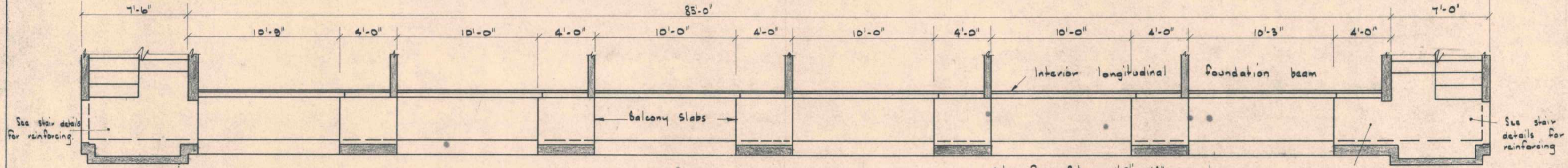
Provide torsion reinforcement in slab at all corners and at each intersection of transverse walls and slab edges. Torsion reinforcement shall be as for Block A.

KOTUKU FLATS — KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK C - SLAB PLAN	STEWART G. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON. PH 46-321	DWG. NO: 879/32
	DRAWN: J.J.D. TRACED: CBS CHECKED:	WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	
	DATE: 31-10-67 SCALES ¼", ½" = 1'-0"		NO. OF SHEETS:



ELEVATION SOUTH WALL - BLOCK D.

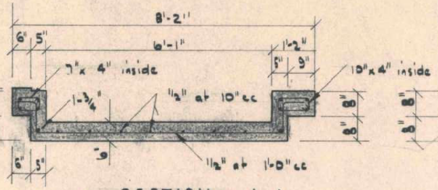
Column reinforcing is similar to that for Columns in South Wall of Block A.



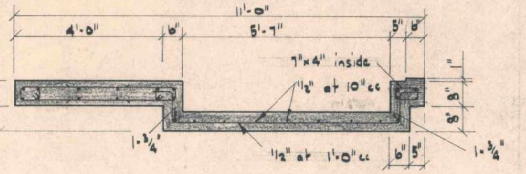
PLAN, SOUTH WALL FOUNDATION BEAMS

Interior longitudinal foundation beam as for Block C.
Balcony slabs as for Block C.

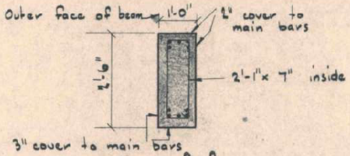
As corresponding slab for Block B.



SECTION A-A

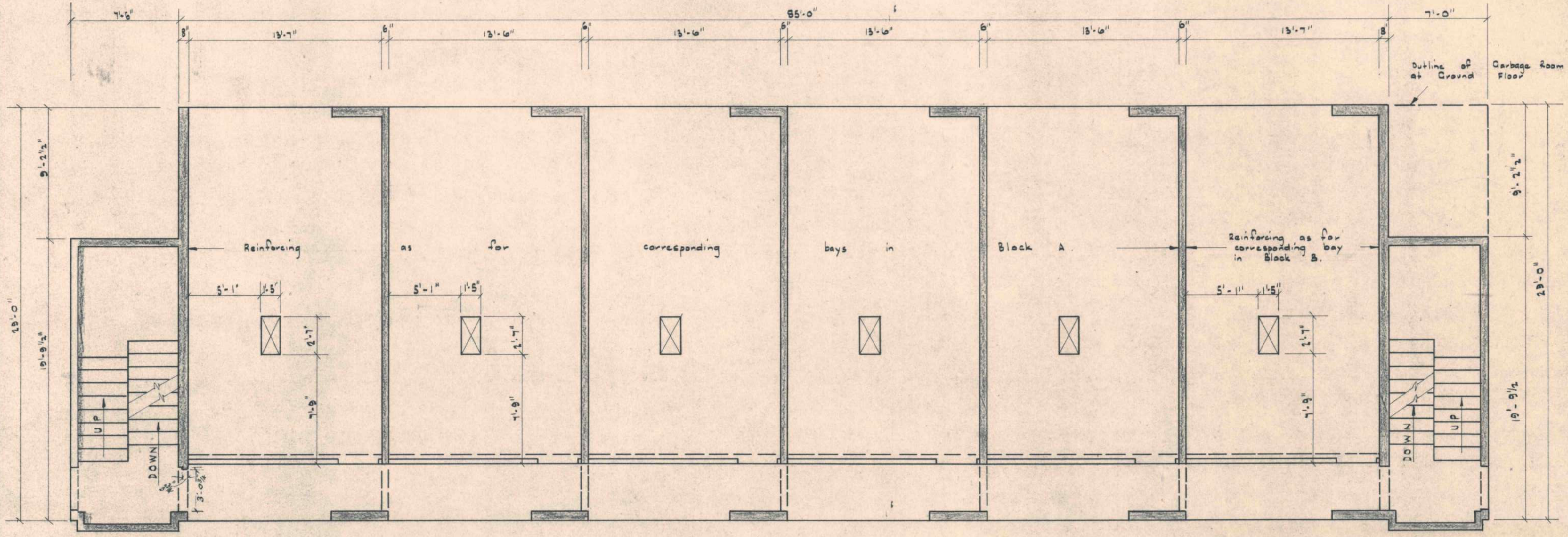


SECTION B-B



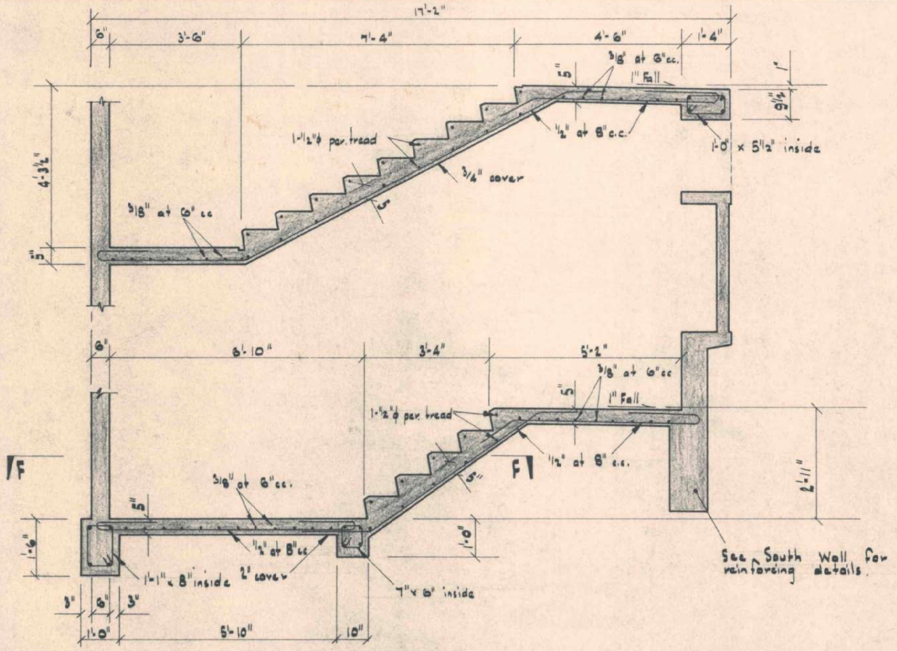
C-C

KOTUKU FLATS - KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK D - SOUTH WALL DRAWN: J.J.O. TRACED: C.B.S. CHECKED: DATE: SCALES: 1/4", 1/2" = 1'-0"	STEWART G. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 2, EVERTON TERRACE, WELLINGTON. PH. 40321 WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	DWG. NO: 879/33 NO. OF SHEETS:



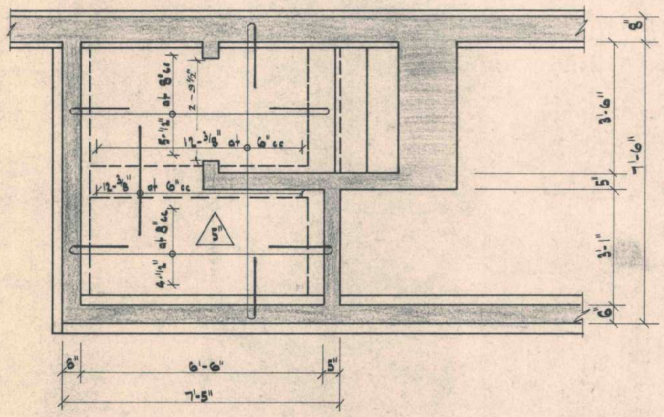
BLOCK D. - SLAB PLAN FOR 1ST, 2ND. & 3RD FLOORS.

KOTUKU FLATS - KEMP ST., KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK D - SLAB PLAN DRAWN: J.J.O. TRACED: C.B.S. CHECKED: SCALES: ¼", ½" = 1'-0" DATE: 2-11-67	STEWART G. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON. PH. 46321 WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION.	DWG. NO. 879/34 NO. OF SHEETS:

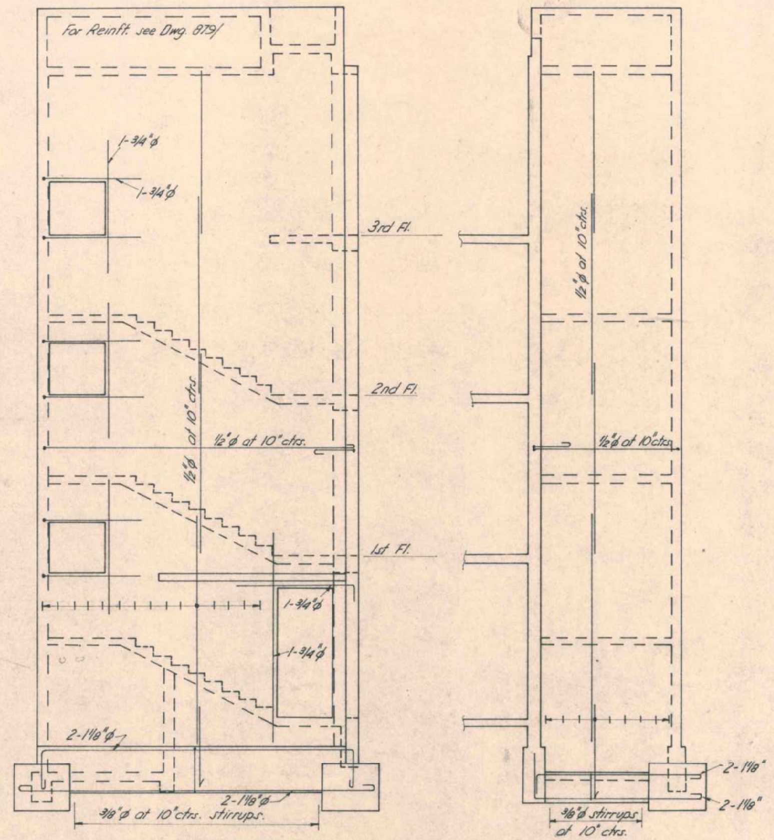


SECTION E-E

10 holes



SECTION F-F



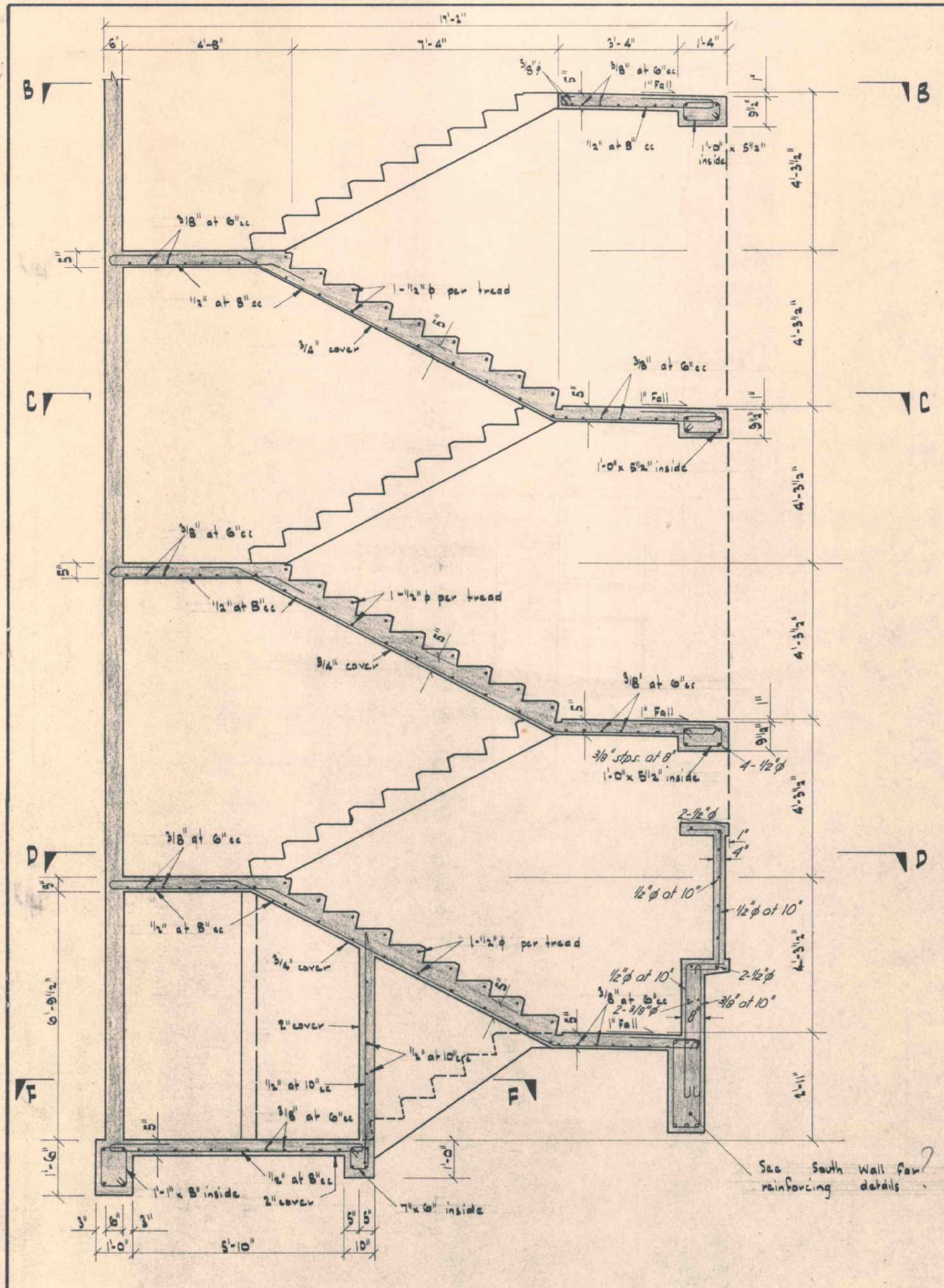
WEST ELEVATION

NORTH ELEVATION

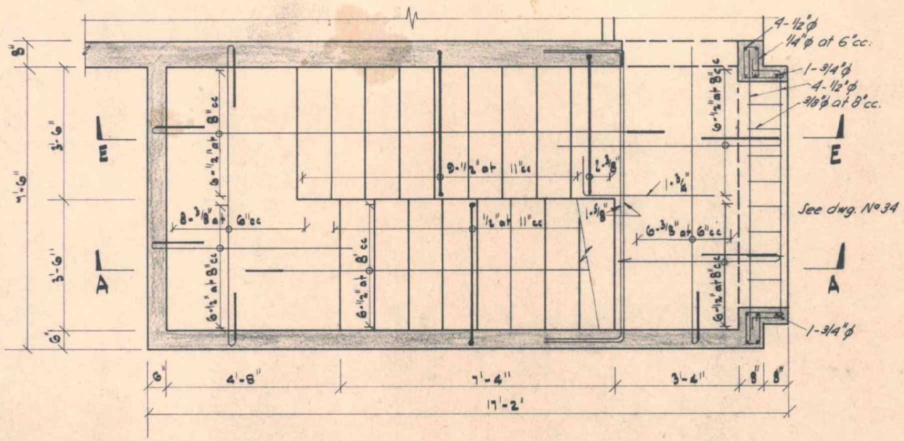
BLOCK D - WEST END

Scale: 1/4" = 1'-0"

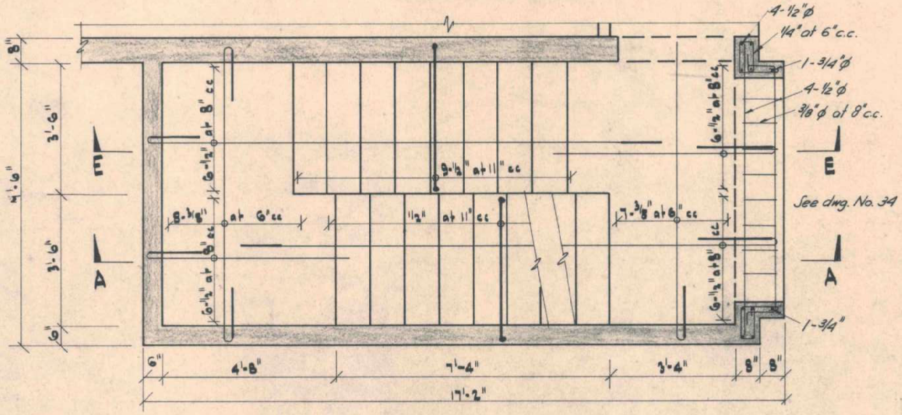
KOTUKU FLATS - KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK D - STAIRS AT WEST END DRAWN: JJO TRACED: CBS CHECKED: DATE: 22-3-68 SCALES: 1/2" = 1'-0"	STEWART G. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21, EVERTON TERRACE, WELLINGTON. WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	DWG. NO. 879/35



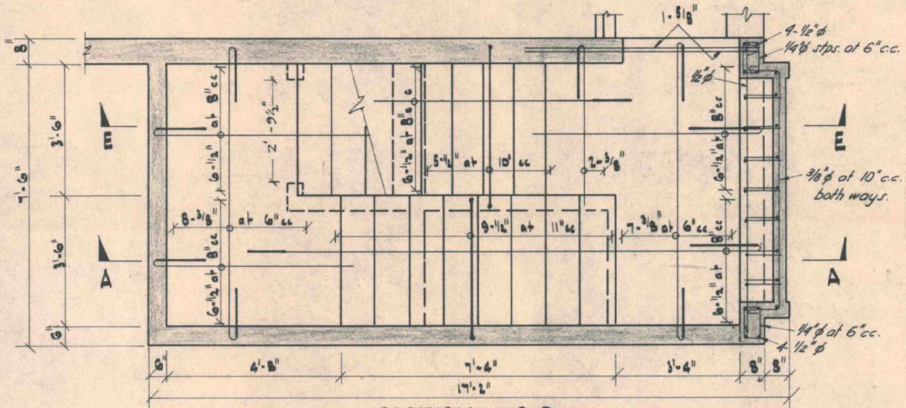
VERTICAL SECTION THROUGH STAIRS (SECTION A-A).



SECTION B-B

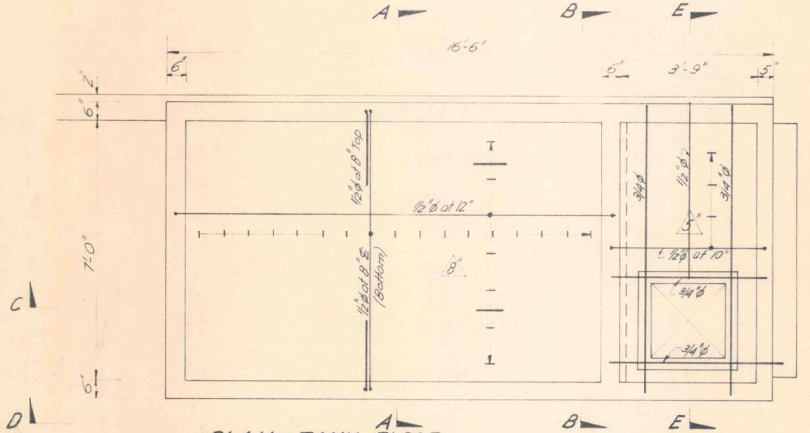


SECTION C-C

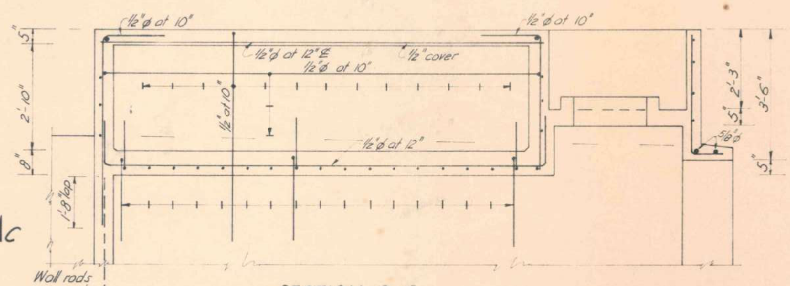


SECTION D-D

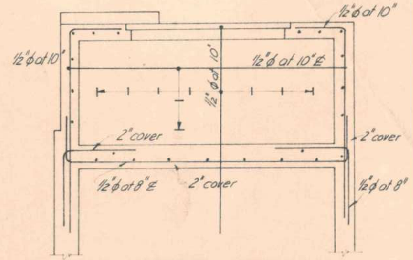
KOTUKU FLATS — KEMP ST. KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK D. — STAIRS AT WEST END DRAWN: JJQ TRACED: CGS CHECKED: DATE: 22-3-68 SCALES: 1/2" & 1/2" = 1'-0"	STEWART C. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 2, EVERTON TERRACE, WELLINGTON WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION.	DWG. NO. 879/36



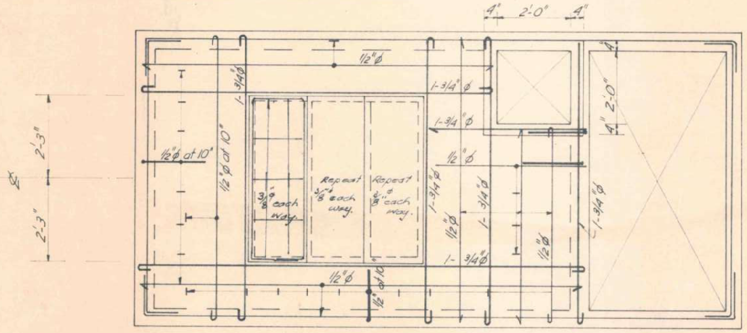
PLAN - TANK FLOOR



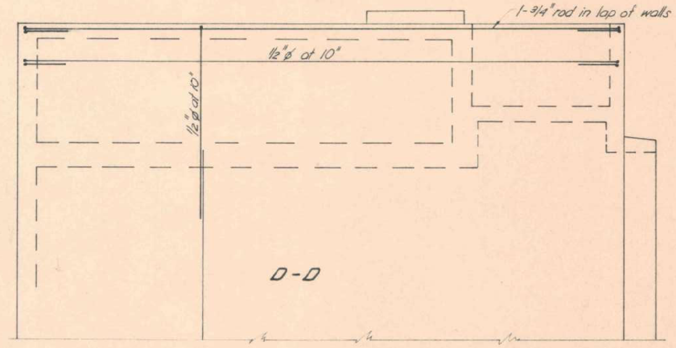
SECTION C-C



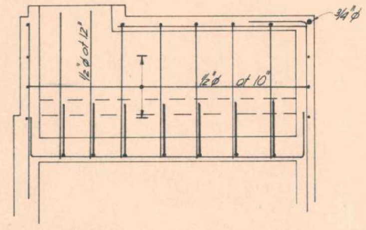
SECTION A-A



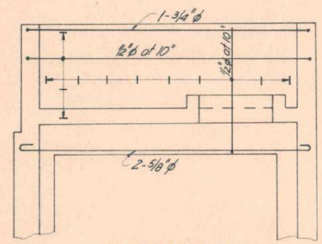
PLAN - TOP SLAB



ELEVATION - WEST WALL AT D-D



SECTION B-B



SECTION E-E

10.10.48

KOTUKU FLATS - KEMP ST, KILBIRNIE FOR THE WELLINGTON CITY CORPORATION	BLOCK D - WEST END DETAILS - WATER TANK DRAWN: S.G.R. TRACED: M.F. CHECKED: S.G.R. DATE: SCALES:	STEWART G. REES & ASSOCIATES CONSULTING CIVIL & STRUCTURAL ENGINEERS 21 EVERTON TERRACE, WELLINGTON, PH. 46-321 WELLINGTON CITY CORPORATION ARCHITECTURAL DIVISION	DWG. NO: 879/37 No OF SHEETS:

247/1-44 + ~~[illegible]~~ 879/1-37

This is the Plan No......referred to in the Specification annexed to Contract made the ......day of..............19.69.between the Wellington City Council and..O.V.L. Builders Ltd

Deputy Town Clerk

O. V.-L. BUILDERS LTD.

Contractor

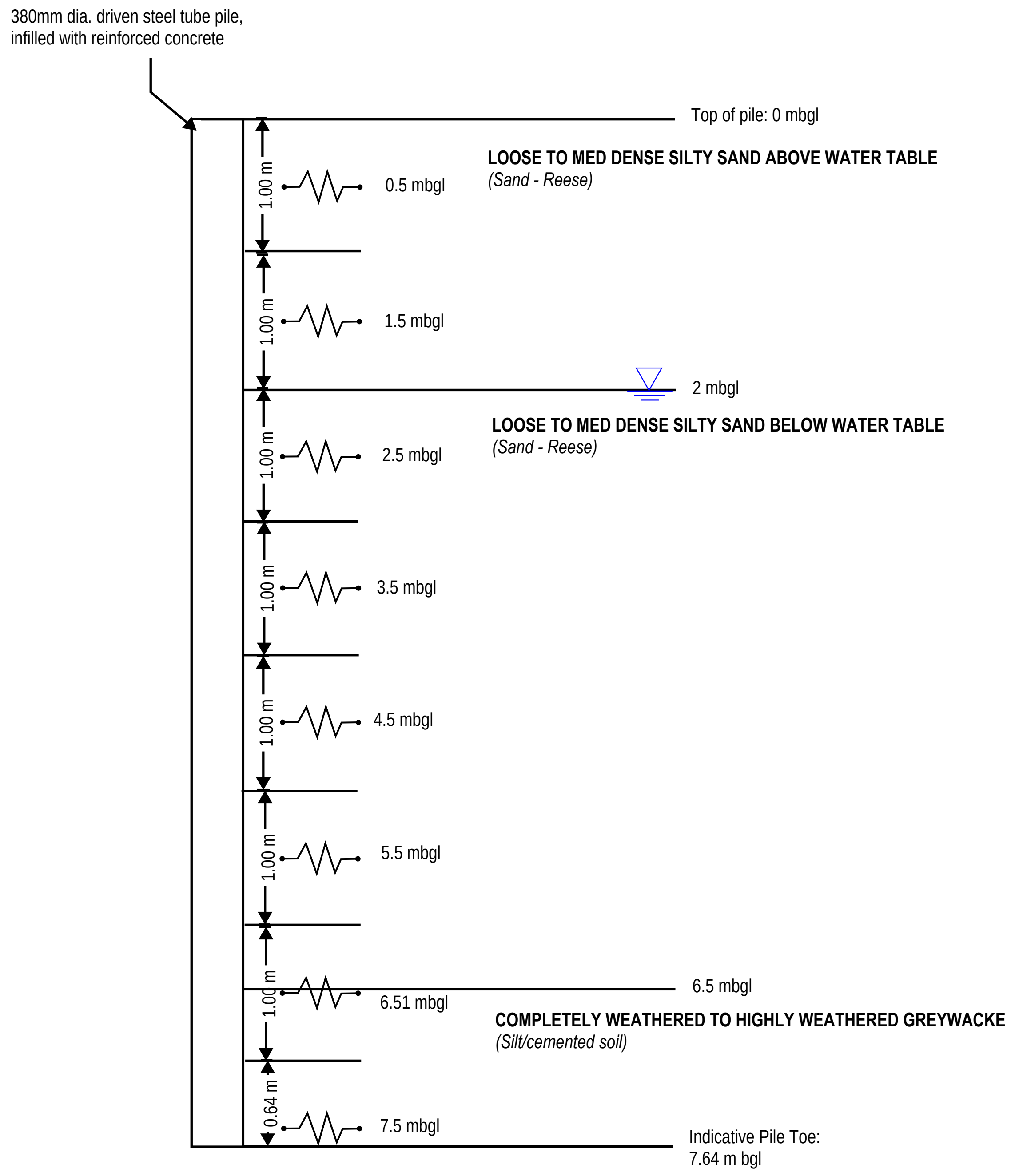
Director

[Listed]
[193]

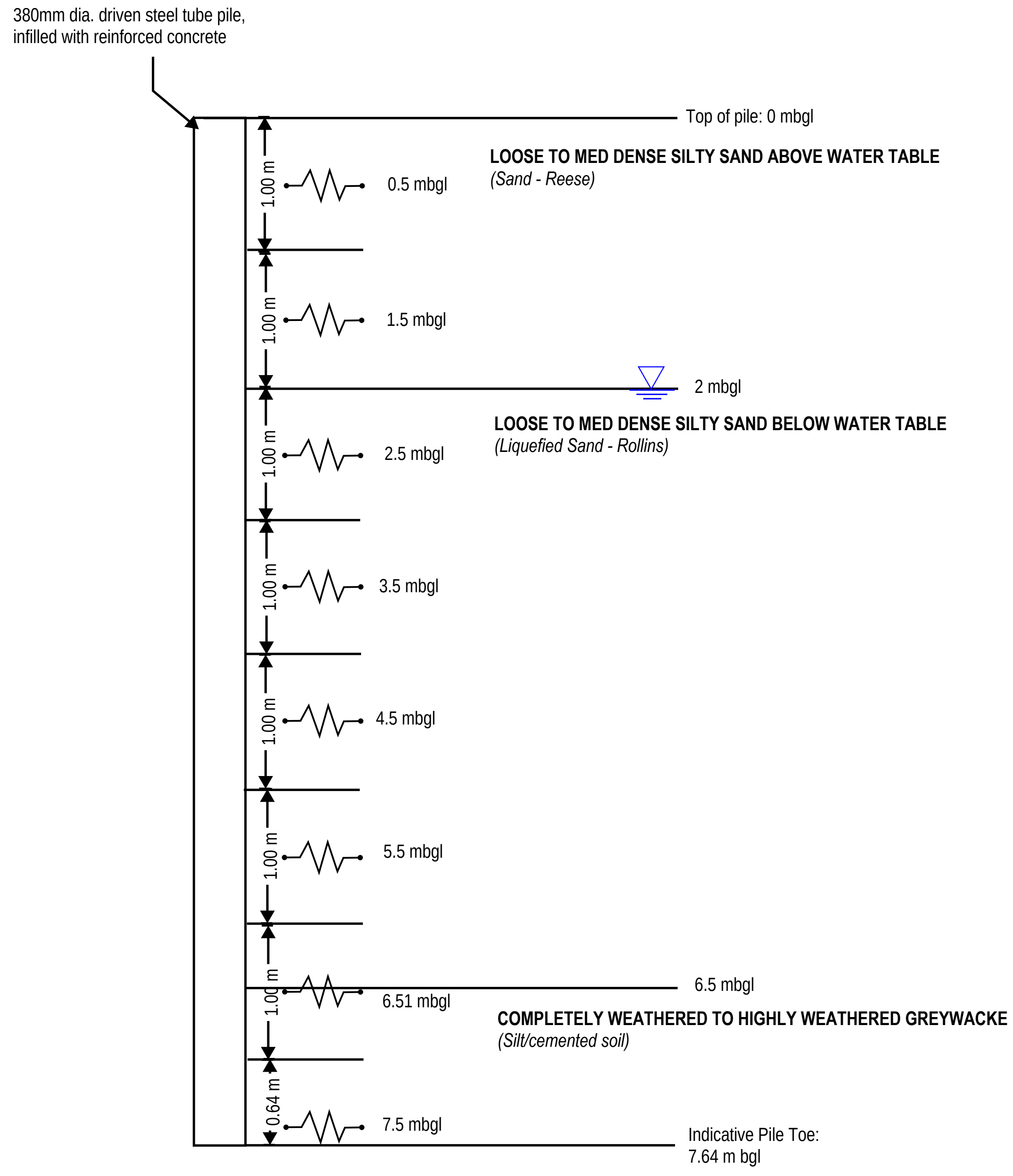
T.C

C

Appendix C – Lateral Spring Stiffness



- / -
STATIC CASE
NTS



- / -
SEISMIC CASE
NTS

www.beca.com

No.	Revision	By	Chk	Appd	Date

Drawing Originator: Beca

Original Scale (A1)	Design		
	Drawn		
Reduced Scale (A3)	Dsg Verifier		
	Dwg Check		
	* Refer to Revision 1 for Original Signature		

Client: WELLINGTON CITY COUNCIL

Project: KEMP STREET DSA

Title: LATERAL SPRINGS PILE

Discipline: GEOTECHNICAL

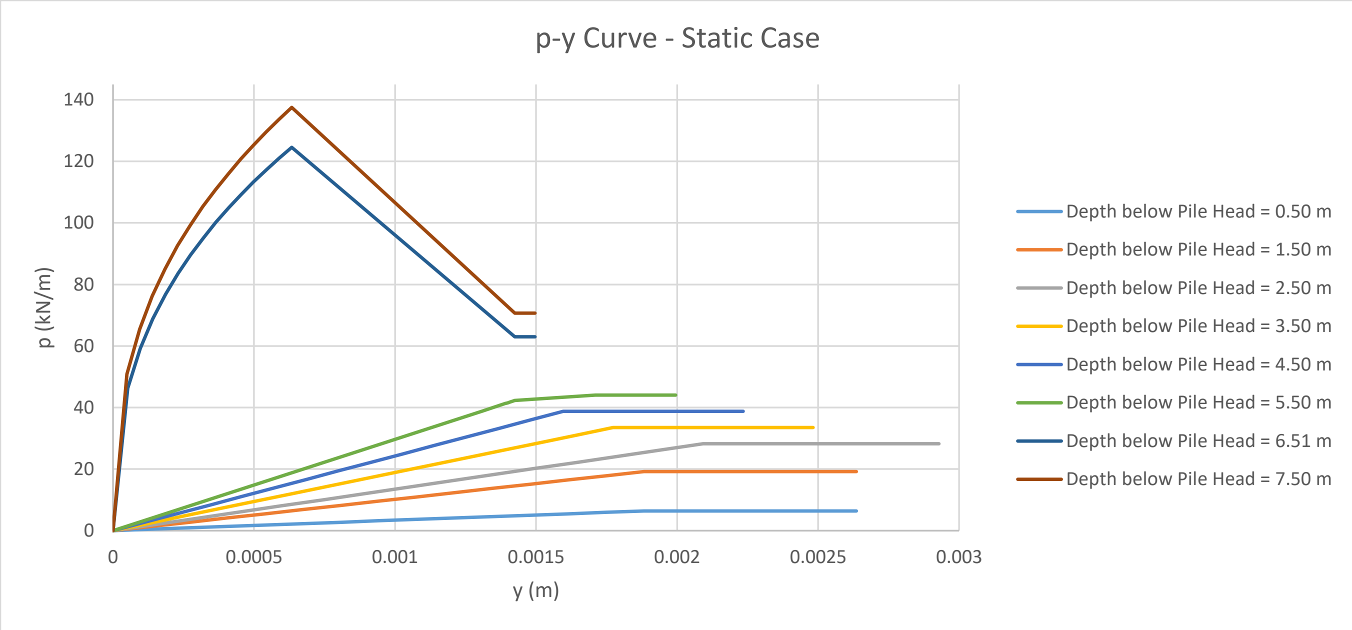
Drawing No.: 5275599-SK-GE-001

Rev.: A

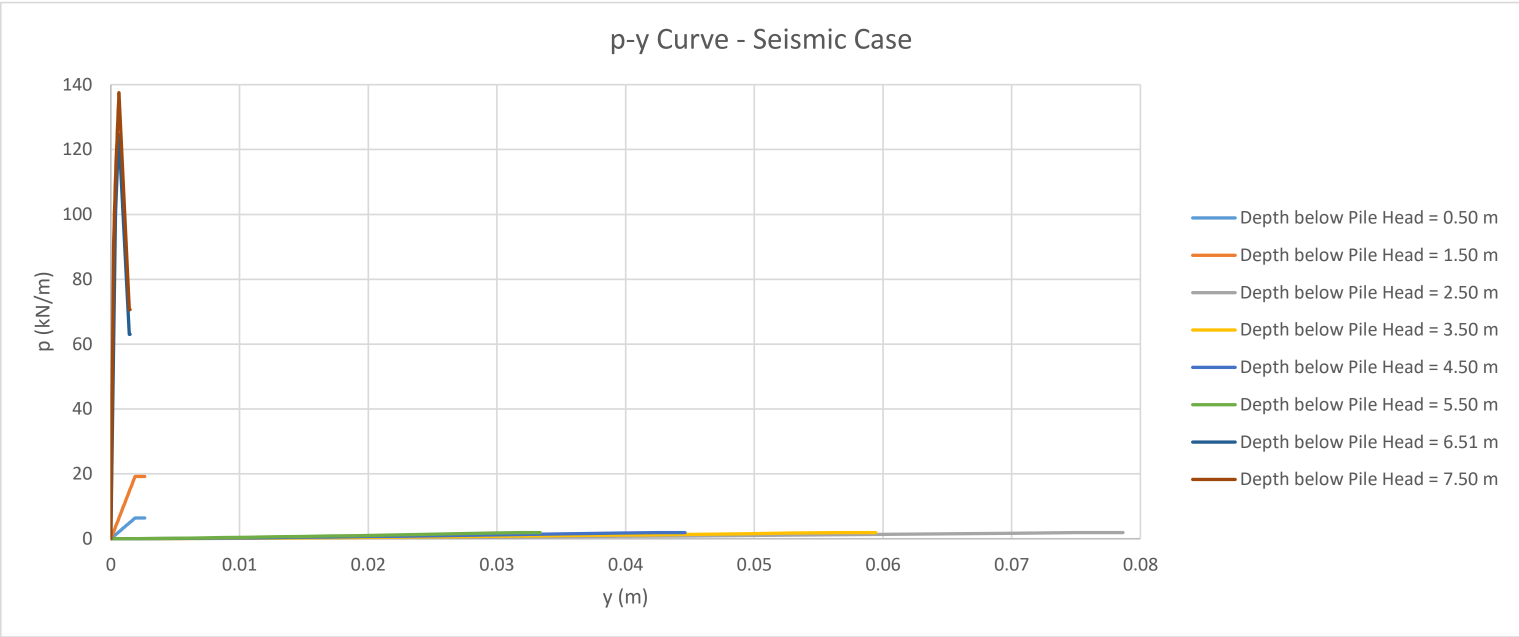
BLUEBEAM

DO NOT SCALE

IF IN DOUBT ASK.



Spring 1 = 0.5m		**Spring 2 = 1.5m**		**Spring 3 = 2.5m**		**Spring 4 = 3.5m**		**Spring 5 = 4.5m**		**Spring 6 = 5.5m**		**Spring 7 = 6.51m**		**Spring 8 = 7.5m**	
y (m)	p (kN/m)	y (m)	p (kN/m)	y (m)	p (kN/m)	y (m)	p (kN/m)	y (m)	p (kN/m)	y (m)	p (kN/m)	y (m)	p (kN/m)	y (m)	p (kN/m)
0	0	0	0	0	0	0	0	0	0	0	0	0.00E+00	0	0	0
0.000134	0.457232	0.000134	1.371697	0.000149	2.017202	0.000127	2.393746	0.000114	2.770291	0.001313	38.99167	5.17E-05	46.28538	4.92E-05	50.88712
0.000269	0.914465	0.000269	2.743395	0.000299	4.034404	0.000253	4.787493	0.000228	5.540581	0.001321	39.24789	9.64E-05	59.21258	9.41E-05	65.50523
0.000403	1.371697	0.000403	4.115092	0.000448	6.051606	0.00038	7.181239	0.000342	8.310872	0.00133	39.5041	1.41E-04	68.83446	0.000139	76.24741
0.000538	1.82893	0.000538	5.486789	0.000598	8.068808	0.000507	9.574985	0.000456	11.08116	0.001339	39.76032	1.86E-04	76.74315	0.000184	85.02316
0.000672	2.286162	0.000672	6.858487	0.000747	10.08601	0.000633	11.96873	0.00057	13.85145	0.001347	40.01654	2.31E-04	83.56766	0.0002289	92.5673
0.000807	2.743395	0.000807	8.230184	0.000897	12.10321	0.00076	14.36248	0.000684	16.62174	0.001356	40.27276	2.75E-04	89.63076	0.0002738	99.25194
0.000941	3.200627	0.000941	9.601881	0.001046	14.12041	0.000887	16.75622	0.000798	19.39203	0.001365	40.52898	3.20E-04	95.12326	0.0003188	105.2953
0.001076	3.65786	0.001076	10.97358	0.001195	16.13762	0.001013	19.14997	0.000912	22.16233	0.001373	40.78519	3.65E-04	100.1687	0.0003637	110.8379
0.00121	4.115092	0.00121	12.34528	0.001345	18.15482	0.00114	21.54372	0.001026	24.93262	0.001382	41.04141	0.00040963	104.8524	0.0004087	115.9762
0.001345	4.572324	0.001345	13.71697	0.001494	20.17202	0.001267	23.93746	0.00114	27.70291	0.00139	41.29763	0.00045437	109.2358	0.0004536	120.7799
0.001479	5.029557	0.001479	15.08867	0.001644	22.18922	0.001393	26.33121	0.001254	30.4732	0.001399	41.55385	0.00049911	113.3653	0.0004985	125.3008
0.001614	5.486789	0.001614	16.46037	0.001793	24.20642	0.00152	28.72496	0.001368	33.24349	0.001408	41.81006	0.00054385	117.2764	0.0005435	129.579
0.001748	5.944022	0.001748	17.83207	0.001942	26.22363	0.001646	31.1187	0.001482	36.01378	0.001416	42.06628	0.00058859	120.9974	0.0005884	133.6462
0.001883	6.401254	0.001883	19.20376	0.002092	28.24083	0.001773	33.51245	0.001596	38.78407	0.001425	42.3225	0.00063333	124.551	0.0006333	137.5277
0.002259	6.401254	0.002259	19.20376	0.00251	28.24083	0.002128	33.51245	0.001915	38.78407	0.00171	44.05569	0.001425	63.03793	0.001425	70.65093
0.002636	6.401254	0.002636	19.20376	0.002929	28.24083	0.002482	33.51245	0.002234	38.78407	0.001995	44.05569	0.00149625	63.03793	0.0014963	70.65093



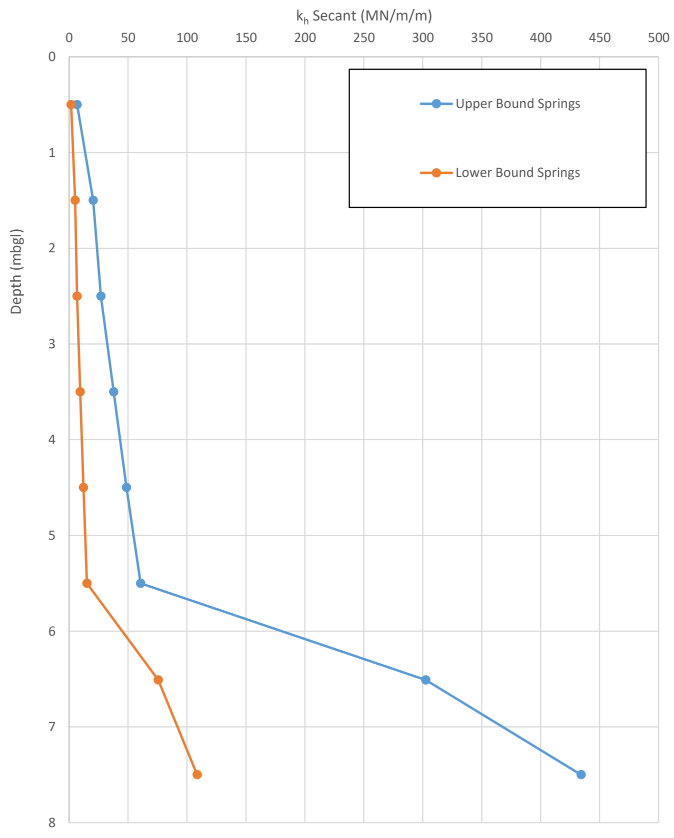
Spring 1 = 0.5m		Spring 2 = 1.5m		Spring 3 = 2.5m		Spring 4 = 3.5m		Spring 5 = 4.5m		Spring 6 = 5.5m		Spring 7 = 6.51m		Spring 8 = 7.5m	
y (m)	p (kN/m)	y (m)	p (kN/m)	y (m)	p (kN/m)	y (m)	p (kN/m)	y (m)	p (kN/m)	y (m)	p (kN/m)	y (m)	p (kN/m)	y (m)	p (kN/m)
0	0	0	0	0	0	0	0	0	0	0	0	0.00E+00	0	0	0
0.000134	0.457232	0.000134	1.371697	0.004993	0.032307	0.003774	0.040389	0.002833	0.048653	0.002119	0.057006	3.63E-04	99.92215	0.000219	91.01004
0.000269	0.914465	0.000269	2.743395	0.009987	0.091664	0.007547	0.108231	0.005666	0.124308	0.004237	0.139862	3.83E-04	102.1511	0.000251	95.94513
0.000403	1.371697	0.000403	4.115092	0.01498	0.168707	0.011321	0.192649	0.008499	0.215185	0.006356	0.236433	4.04E-04	104.308	0.000283	100.5107
0.000538	1.82893	0.000538	5.486789	0.019974	0.26008	0.015095	0.290027	0.011332	0.317611	0.008475	0.343149	4.25E-04	106.3986	0.000315	104.7718
0.000672	2.286162	0.000672	6.858487	0.024967	0.36384	0.018868	0.398338	0.014165	0.429584	0.010593	0.458104	4.46E-04	108.4282	0.000347	108.7769
0.000807	2.743395	0.000807	8.230184	0.02996	0.478676	0.022642	0.516242	0.016998	0.549802	0.012712	0.580083	4.67E-04	110.4013	0.000378	112.5627
0.000941	3.200627	0.000941	9.601881	0.034954	0.603622	0.026416	0.642772	0.019831	0.677342	0.01483	0.708231	4.88E-04	112.3217	0.00041	116.1585
0.001076	3.65786	0.001076	10.97358	0.039947	0.73793	0.030189	0.777187	0.022664	0.811504	0.016949	0.841907	5.08E-04	114.1932	0.000442	119.5875
0.00121	4.115092	0.00121	12.34528	0.044941	0.881	0.033963	0.9189	0.025497	0.951738	0.019068	0.980613	0.0005292	116.0189	0.000474	122.8686
0.001345	4.572324	0.001345	13.71697	0.049934	1.032332	0.037736	1.067428	0.02833	1.097597	0.021186	1.123947	0.00055	117.8016	0.000506	126.0176
0.001479	5.029557	0.001479	15.08867	0.054927	1.191505	0.04151	1.222369	0.031163	1.248708	0.023305	1.271576	0.0005709	119.5439	0.000538	129.0476
0.001614	5.486789	0.001614	16.46037	0.059921	1.358156	0.045284	1.383376	0.033996	1.404759	0.025424	1.42322	0.0005917	121.2482	0.00057	131.9698
0.001748	5.944022	0.001748	17.83207	0.064914	1.53197	0.049057	1.550153	0.036828	1.565476	0.027542	1.578639	0.0006125	122.9166	0.000601	134.7937
0.001883	6.401254	0.001883	19.20376	0.069908	1.712668	0.052831	1.722438	0.039661	1.730626	0.029661	1.737626	0.0006333	124.551	0.000633	137.5277
0.002259	6.401254	0.002259	19.20376	0.074901	1.9	0.056605	1.9	0.042494	1.9	0.03178	1.9	0.001425	63.03793	0.001425	70.65093
0.002636	6.401254	0.002636	19.20376	0.078646	1.9	0.059435	1.9	0.044619	1.9	0.033369	1.9	0.0014963	63.03793	0.001496	70.65093

Elevation 3.00 mRL Pile Diameter 0.38 m

Lateral Pile Design Values

STATIC Case

		Lower Bound Springs			Upper Bound Springs		
Depth (mbgl)	Elevation at spring location (mRL)	Ultimate Lateral Resistance (kN/m length of pile)	Pile Deflection at ultimate capacity (mm)	k_h Secant Stiffness (MN/m/m)	Ultimate Lateral Resistance (kN/m length of pile)	Pile Deflection at ultimate capacity (mm)	kh Secant Stiffness (MN/m/m)
0.5	2.5	3	2	1.7	13	2	6.8
1.5	1.5	10	2	5.1	38	2	20.4
2.5	0.5	14	2	6.8	56	2	27.0
3.5	-0.5	17	2	9.4	67	2	37.8
4.5	-1.5	19	2	12.2	78	2	48.6
5.5	-2.5	22	1	15.2	88	1	60.6
6.5	-3.5	32	0	76	126	0	303
7.5	-4.5	35	0	108.6	141	0	434.3

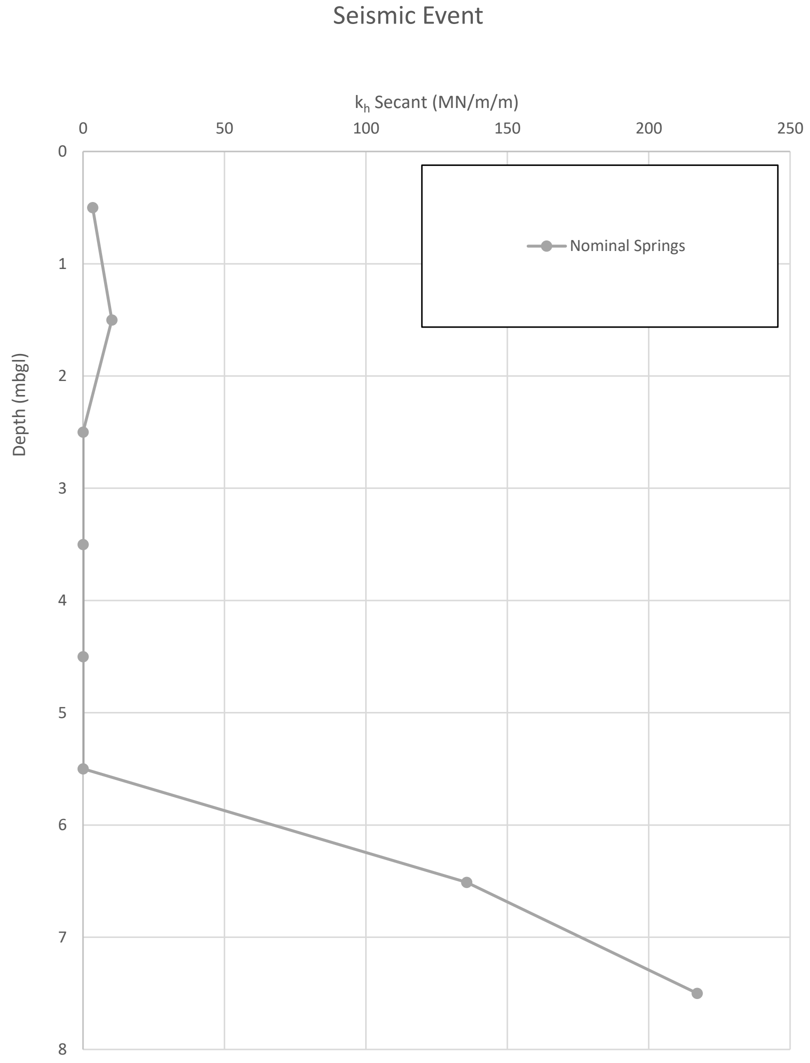


Elevation	3	mRL	Pile Diameter	0.38 m

Lateral Pile Design Values

SEISMIC case with liquefiable layer

		'Design / Major Earthquake Event'		
Depth (mbgl)	Elevation at spring location (mRL)	Ultimate Lateral Resistance (kN/m length of pile)	Pile Deflection at ultimate capacity (mm)	k_h Secant Stiffness (MN/m/m)
0.5	2.5	6	2	3.4
1.5	1.5	19	2	10.2
2.5	0.5	2	94	0.0
3.5	-0.5	2	68	0.0
4.5	-1.5	2	51	0.0
5.5	-2.5	2	38	0.0
6.5	-3.5	63	0	136
7.5	-4.5	71	0	217.1



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