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Hornby Courts Block B
PRO 1580-002
Detailed Engineering Evaluation
Quantitative Report
FINAL Version (1.0)

2 Goulding Avenue, Hornby

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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Detailed Engineering Evaluation
Quantitative Report
FINAL Version

2 Goulding Avenue, Hornby

Christchurch City Council

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Date
31st May 2013

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Hornby Courts Block B

PRO 1580-002

Detailed Engineering Evaluation

Quantitative Report - SUMMARY

FINAL Version (1.0)

2 Goulding Avenue, Hornby

Background

This is a summary of the quantitative assessment report for the Hornby Courts Block B building, and is based in general on the Detailed Engineering Evaluation Procedure document (draft) issued by the Structural Advisory Group on 19 July 2011, visual inspections on 18th January 2012 and available drawings itemised in Section 5.2 herein.

Key Damage Observed

Key damage observed includes:

- Minor cracking to plasterboard wall linings throughout.
- Minor spalling and cracking to the construction joint between landing slab and staircase.

Building Capacity Assessment

Following the quantitative assessment, the building has been assessed as achieving greater than 100% NBS. As the building strength is greater than 67% NBS and is therefore not considered as Earthquake Prone or Earthquake Risk in accordance with NZSEE guidelines.

Recommendation

As the building has achieved greater than 67% NBS no further assessment to this building is recommended. In addition general access is allowed.

1. Background

GHD has been engaged by Christchurch City Council (CCC) to undertake a detailed engineering evaluation of Hournby Courts Block B.

This report is a quantitative assessment of the building structure, and is based in general on the Detailed Engineering Evaluation Procedure document (draft) issued by the Structural Advisory Group on 19 July 2011.

2. Compliance

This section contains a brief summary of the requirements of the various statutes and authorities that control activities in relation to buildings in Christchurch at present.

2.1 Canterbury Earthquake Recovery Authority (CERA)

CERA was established on 28 March 2011 to take control of the recovery of Christchurch using powers established by the Canterbury Earthquake Recovery Act enacted on 18 April 2011. This act gives the Chief Executive Officer of CERA wide powers in relation to building safety, demolition and repair. Two relevant sections are:

Section 38 – Works

This section outlines a process in which the chief executive can give notice that a building is to be demolished and if the owner does not carry out the demolition, the chief executive can commission the demolition and recover the costs from the owner or by placing a charge on the owners' land.

Section 51 – Requiring Structural Survey

This section enables the chief executive to require a building owner, insurer or mortgagee carry out a full structural survey before the building is re-occupied.

We understand that CERA will require a detailed engineering evaluation to be carried out for all buildings (other than those exempt from the Earthquake Prone Building definition in the Building Act). It is anticipated that CERA will adopt the Detailed Engineering Evaluation Procedure document (draft) issued by the Structural Advisory Group on 19 July 2011. This document sets out a methodology for both qualitative and quantitative assessments.

The qualitative assessment is a desk-top and site inspection assessment. It is based on a thorough visual inspection of the building coupled with a review of available documentation such as drawings and specifications. The quantitative assessment involves analytical calculation of the buildings strength and may require non-destructive or destructive material testing, geotechnical testing and intrusive investigation.

It is anticipated that factors determining the extent of evaluation and strengthening level required will include:

- The importance level and occupancy of the building
- The placard status and amount of damage
- The age and structural type of the building
- Consideration of any critical structural weaknesses
- The extent of any earthquake damage

2.2 Building Act

Several sections of the Building Act are relevant when considering structural requirements:

Section 112 – Alterations

This section requires that an existing building complies with the relevant sections of the Building Code to at least the extent that it did prior to any alteration. This effectively means that a building cannot be weakened as a result of an alteration (including partial demolition).

Section 115 – Change of Use

This section requires that the territorial authority (in this case Christchurch City Council (CCC)) be satisfied that the building with a new use complies with the relevant sections of the Building Code 'as near as is reasonably practicable'. Regarding seismic capacity 'as near as reasonably practicable' has previously been interpreted by CCC as achieving a minimum of 67% NBS however where practical achieving 100% NBS is desirable. The New Zealand Society for Earthquake Engineering (NZSEE) recommend a minimum of 67% NBS.

2.2.1 Section 121 – Dangerous Buildings

The definition of dangerous building in the Act was extended by the Canterbury Earthquake (Building Act) Order 2010, and it now defines a building as dangerous if:

- In the ordinary course of events (excluding the occurrence of an earthquake), the building is likely to cause injury or death or damage to other property; or
- In the event of fire, injury or death to any persons in the building or on other property is likely because of fire hazard or the occupancy of the building; or
- There is a risk that the building could collapse or otherwise cause injury or death as a result of earthquake shaking that is less than a 'moderate earthquake' (refer to Section 122 below); or
- There is a risk that other property could collapse or otherwise cause injury or death; or
- A territorial authority has not been able to undertake an inspection to determine whether the building is dangerous.

Section 122 – Earthquake Prone Buildings

This section defines a building as earthquake prone if its ultimate capacity would be exceeded in a 'moderate earthquake' and it would be likely to collapse causing injury or death, or damage to other property. A moderate earthquake is defined by the building regulations as one that would generate ground shaking 33% of the shaking used to design an equivalent new building.

Section 124 – Powers of Territorial Authorities

This section gives the territorial authority the power to require strengthening work within specified timeframes or to close and prevent occupancy to any building defined as dangerous or earthquake prone.

Section 131 – Earthquake Prone Building Policy

This section requires the territorial authority to adopt a specific policy for earthquake prone, dangerous and insanitary buildings.

2.3 Christchurch City Council Policy

Christchurch City Council adopted their Earthquake Prone, Dangerous and Insanitary Building Policy in 2006. This policy was amended immediately following the Darfield Earthquake of the 4th September 2010.

The 2010 amendment includes the following:

- A process for identifying, categorising and prioritising Earthquake Prone Buildings, commencing on 1 July 2012;
- A strengthening target level of 67% of a new building for buildings that are Earthquake Prone;
- A timeframe of 15-30 years for Earthquake Prone Buildings to be strengthened; and,
- Repair works for buildings damaged by earthquakes will be required to comply with the above.

The council has stated their willingness to consider retrofit proposals on a case by case basis, considering the economic impact of such a retrofit.

We anticipate that any building with a capacity of less than 33% NBS (including consideration of critical structural weaknesses) will need to be strengthened to a target of 67% NBS of new building standard as recommended by the Policy.

If strengthening works are undertaken, a building consent will be required. A requirement of the consent will require upgrade of the building to comply ‘as near as is reasonably practicable’ with:

- The accessibility requirements of the Building Code.
- The fire requirements of the Building Code. This is likely to require a fire report to be submitted with the building consent application.

2.4 Building Code

The building code outlines performance standards for buildings and the Building Act requires that all new buildings comply with this code. Compliance Documents published by The Department of Building and Housing can be used to demonstrate compliance with the Building Code.

After the February Earthquake, on 19 May 2011, Compliance Document B1: Structure was amended to include increased seismic design requirements for Canterbury as follows:

- Hazard Factor increased from 0.22 to 0.3 (36% increase in the basic seismic design load)
- Serviceability Return Period Factor increased from 0.25 to 0.33 (80% increase in the serviceability design loads when combined with the Hazard Factor increase)

The increase in the above factors has resulted in a reduction in the level of compliance of an existing building relative to a new building despite the capacity of the existing building not changing.

3. Earthquake Resistance Standards

For this assessment, the building's earthquake resistance is compared with the current New Zealand Building Code requirements for a new building constructed on the site. This is expressed as a percentage of new building standard (%NBS). The new building standard load requirements have been determined in accordance with the current earthquake loading standard (NZS 1170.5:2004 Structural design actions - Earthquake actions - New Zealand).

The likely capacity of this building has been derived in accordance with the New Zealand Society for Earthquake Engineering (NZSEE) guidelines 'Assessment and Improvement of the Structural Performance of Buildings in Earthquakes' (AISPBE), 2006. These guidelines provide an Initial Evaluation Procedure that assesses a buildings capacity based on a comparison of loading codes from when the building was designed and currently. It is a quick high-level procedure that can be used when undertaking a Qualitative analysis of a building. The guidelines also provide guidance on calculating a modified Ultimate Limit State capacity of the building which is much more accurate and can be used when undertaking a Quantitative analysis.

The New Zealand Society for Earthquake Engineering has proposed a way for classifying earthquake risk for existing buildings in terms of %NBS and this is shown in Figure 1 below.

Description	Grade	Risk	%NBS	Existing Building Structural Performance	Improvement of Structural Performance	
					Legal Requirement	NZSEE Recommendation
Low Risk Building	A or B	Low	Above 67	Acceptable (improvement may be desirable)	The Building Act sets no required level of structural improvement (unless change in use) This is for each TA to decide. Improvement is not limited to 34%NBS.	100%NBS desirable. Improvement should achieve at least 67%NBS
Moderate Risk Building	B or C	Moderate	34 to 66	Acceptable legally. Improvement recommended		Not recommended. Acceptable only in exceptional circumstances
High Risk Building	D or E	High	33 or lower	Unacceptable (Improvement	Unacceptable	Unacceptable

Figure 1. NZSEE Risk Classifications Extracted from table 2.2 of the NZSEE 2006 AISPBE

Figure 2 compares the percentage NBS to the relative risk of the building failing in a seismic event with a 10% risk of exceedance in 50 years (i.e. 0.2% in the next year). It is noted that the current seismic risk in Christchurch results in a 6% risk of exceedance in the next year.

Percentage of New Building Standard (%NBS)	Relative Risk (Approximate)
>100	<1 time
80-100	1-2 times
67-80	2-5 times
33-67	5-10 times
20-33	10-25 times
<20	>25 times

Figure 2. %NBS Compared to Relative Risk of Failure

4. Building Description

4.1 General

Hornby Courts Block B is located at 2 Goulding Avenue, Hornby, Christchurch. The building is used for residential purposes.

The building consists of three characteristic portions; two single story "wings" and a two story central portion, as is shown in the figure:

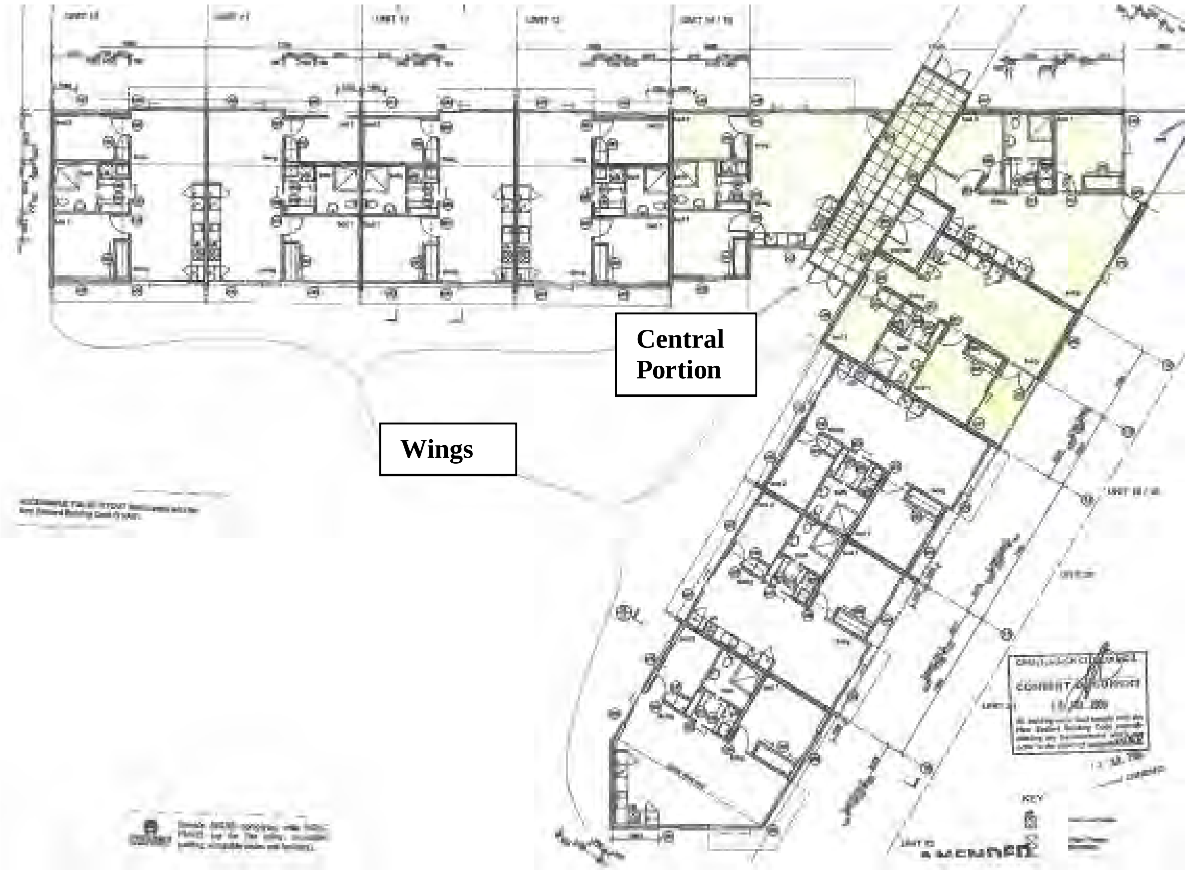

Figure 3. Basement of the Building

In the central portion of the building there is a long, heavy RC staircase with an intermediate landing. The staircase is "built in" at the top and at the bottom.

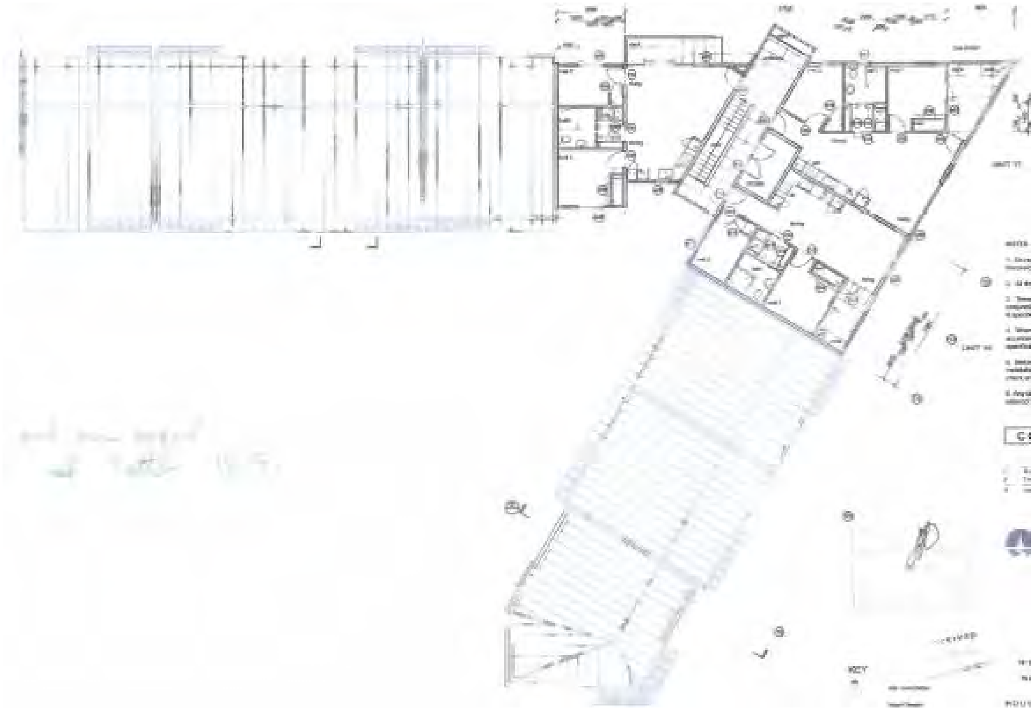

Figure 4. Building's First Floor

The reinforced concrete wall system is shown below:

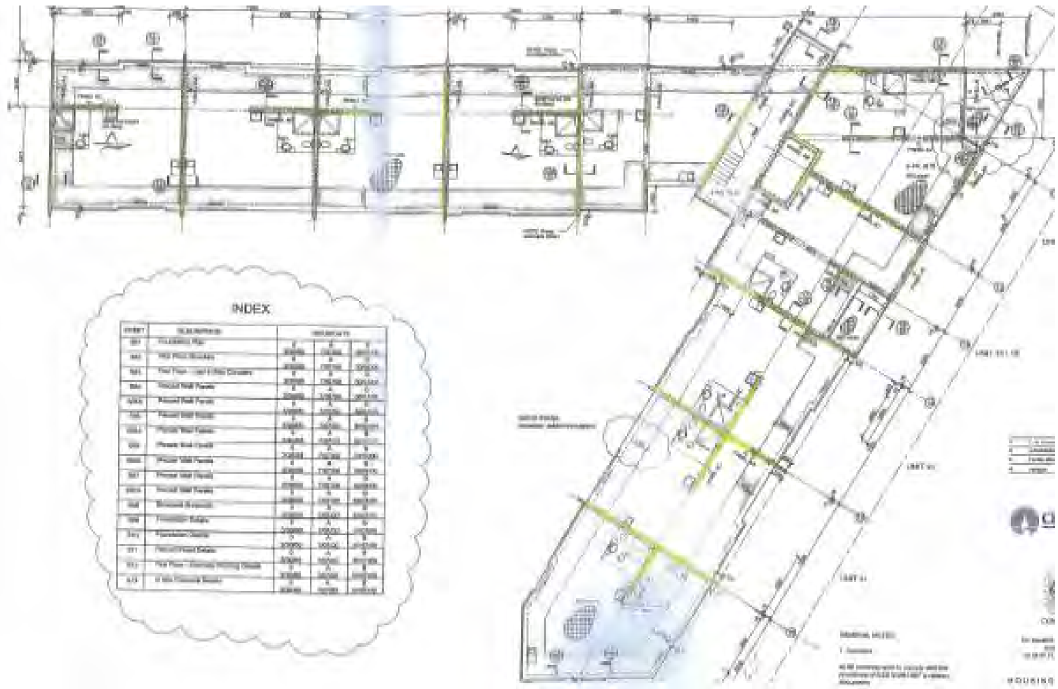

Figure 5. RC Walls System

The first floor slab is a combination of the in-situ 200 mm slab and a 150 mm composite structure (75 mm uni- spans with 75 mm overlaying in-situ casting concrete).

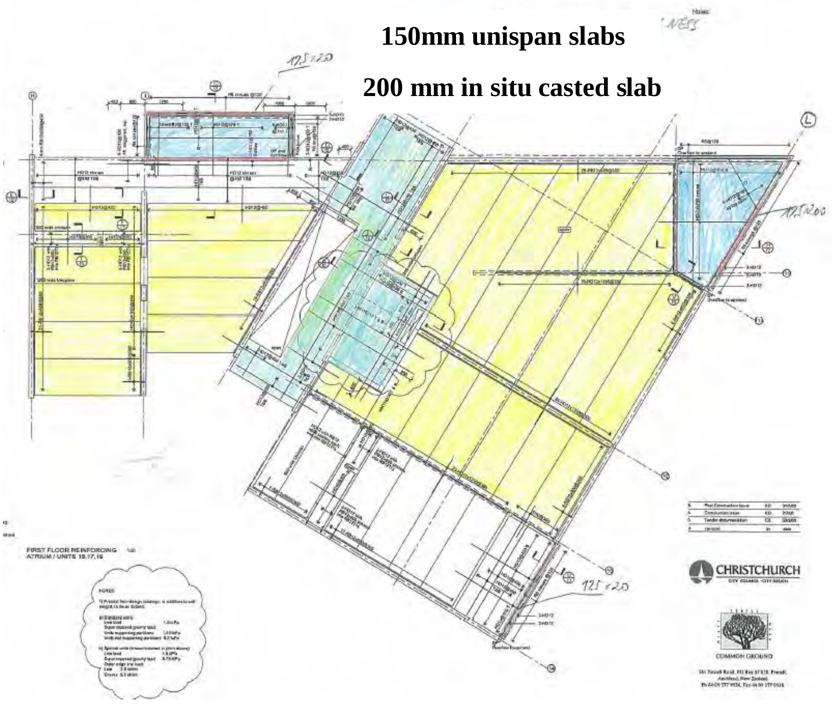

Figure 6. First Floor Slabs

Some parts of the roof are made by timber trusses and others by 250x100 timber rafters with 150x50 purlins (Figure 7.).

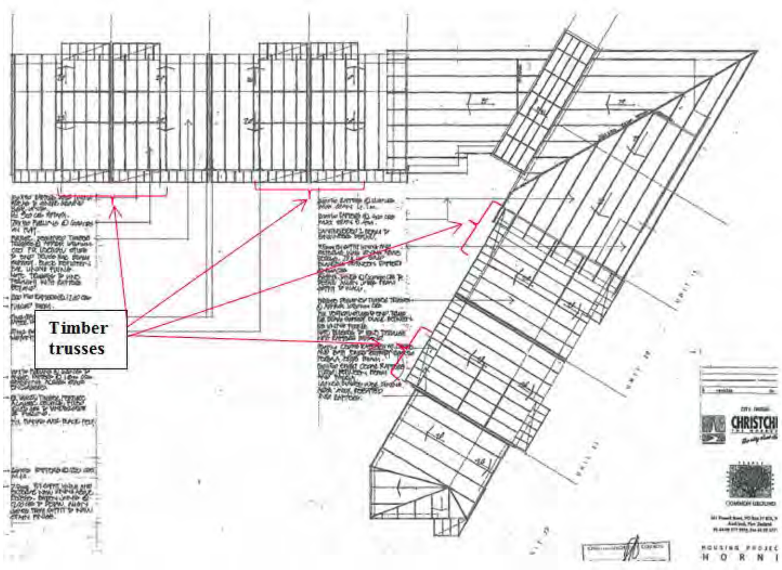

Figure 7. Portions of the Building with Timber Trusses at the Roof Level

The infill walls are light and timber framed; externally these walls are partially brick clad.

The attributes mentioned above are shown in greater detailed in Appendix B (existing drawings).

4.2 Gravity Load Resisting System

The load is transferred to the RC walls from the timber roof structure which has is made up of a variety of timber elements depending on the building portion considered. Gravity loads are then passed through the walls into the 500 x 300 mm concrete foundation beams.

4.2.1 Wings portions of the building- timber trusses at the roof

In this portion of the building the gravity load is transferred from the metal cladding by the 150x50 timber purlins to the timber trusses. These trusses are supported by a RC wall in the middle of their span and by the 250x100 timber beams at their edges. The load from the 250x100 timber beams further goes to the RC walls, then to the foundation concrete beams.

4.2.2 Wings portions of the building- part without timber trusses

The main elements in this portion are the 250x100 timber rafters which span between the RC walls and timber trusses (Figure 8.).

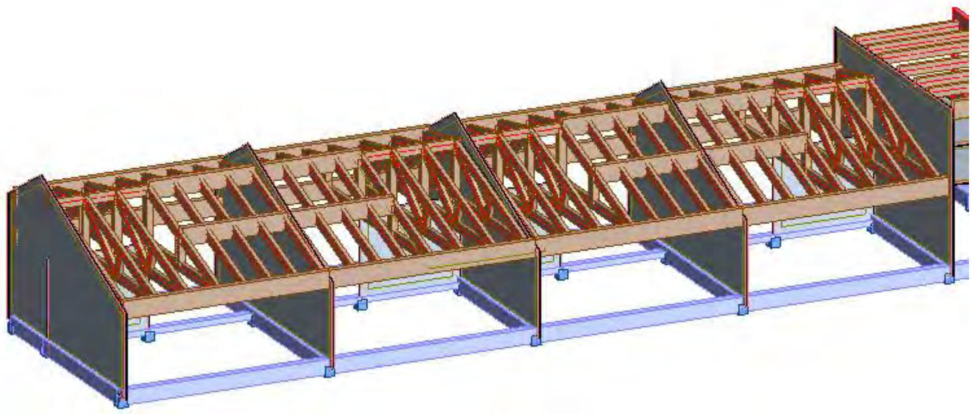

Figure 8. Roof Structural Elements in the "Wings" Portions of the Building

4.2.3 Two story portion

In the two storied section of the building the timber roof structure consists of primary timber rafters which span over RC walls supporting the timber purlins.

The internal gravity loads are transferred through the floor slabs to the supporting concrete walls and down to the foundations.

4.3 Lateral Load Resisting System

The full lateral load is carried by the RC walls which are connected by the roof structure that provides nominal diaphragm action in the part of the wings. In the portion of the two story building, the diaphragm action is provided by the first floor slab as well.

5. Assessment

5.1 Site Inspection

An inspection of the building was undertaken on the 5th of March 2012. Both the interior and exterior of the building were inspected. The building was observed to have a green placard in place. The main structural components of the building were all able to be viewed however details of the roof structure could not be observed. It should be noted that no inspection of the foundations of the structures was able to be undertaken.

The inspection consisted of observing the building to determine the structural systems and likely behaviours of the building during earthquake. The site was assessed for damage, including observing the ground condition, checking for damage areas where damage would be expected for the structure type observed and noting general damage observed throughout the building in both structural and non-structural elements.

5.2 Available Drawings

The full building architectural design done by "Housing Project of HORNBY" was available to GHD. Both Block A and Block B details are in the same design. The following drawings are relevant to Block B:

Table 1 Existing Drawings

Item #	Title	Sheet No.	Date
1	Foundation Plan	S 01	July 2000
2	First Floor Structure	S 02	July 2000
3	Precast Wall Panels	S 06	July 2000
4	Precast Wall Panels	S 06 A	July 2000
5	Precast Wall Panels	S 07	July 2000
6	Precast Wall Panels	S 07 A	July 2000
7	Foundation Details	S 10	July 2000
8	Precast Panel Details	S 11	July 2000
9	First Floor Concrete Flooring Details	S 12	July 2000
10	In situ Concrete Details	S 13	July 2000
11	Roof Framing Plan	WD 04	July 2000
12	Roof Plan	WD 05	July 2000
13-16	Elevations	WD 06- WD 09	July 2000
17-20	Cross Sections	WD 10- WD 13	July 2000
21-24	Details	WD 14- WD 17	July 2000

All drawings are attached as Appendix B.

5.3 Analysis and Modelling Methodology

Mathematical Modelling

An analytical three-dimensional (shell) model of the Hornby Court- Block B building was created using the finite element software pocket, ROBOT, version 2012.

The main structural elements of the building are RC walls. The ROBOT subprogram form - “SHELL” design was used.

To avoid modeling the panels with openings, some panels were split and connected with beams and columns; one example is shown below.

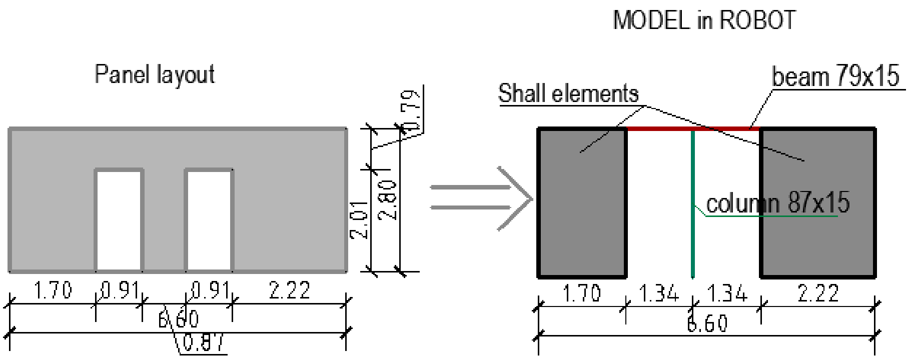

Figure 9. Modeling of the Panel- Model without Openings

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RC slabs, both uni span and cast in situ, are modeled as shell elements. .

Some concrete parapet walls and unreinforced masonry walls are modeled with an equivalent diagonal compression strut. Properties of all struts were calculated based on the recommendations of the New Zealand Society for Earthquake Engineering (NZSEE), Assessment and Improvement of the Structural Performance of Buildings in Earthquakes (2006).

Unreinforced masonry walls not bounded by the reinforced concrete frames were not modeled as these are non-structural elements that are expected to fail. The weight of the masonry wall is considered by modeling a line load equivalent to the density of the wall.

The timber roof structure is modeled as a semi-flexible diaphragm with equivalent characteristics (weight and modulus of elasticity) to the real roof structure.

Overview of the materials is listed in the table (**Error! Reference source not found.**):

Table 2 Material Properties

Elements	Robot name material	Material properties	
All RC panels, beams, columns	CONCR	Unit weight	γ = 23.61 kN/m^3
		Young Modulus	E = 31,500.00 MPa
		Poisson Ratio	μ = 0.167
Parapet brick walls	BRICK	Unit weight	γ = 76.97 kN/m^3
		Young Modulus	E = 2,000.00 MPa
		Poisson Ratio	μ = 0.30
Parapet concrete walls	CONCRETE M	Unit weight	γ = 23.61 kN/m^3
		Young Modulus	E = 21,000.00 MPa
		Poisson Ratio	μ = 0.167
Roof diaphragm	CONCR 3	Unit weight	γ = 5.72 kN/m^3
		Young Modulus	E = 315,000.00 MPa
		Poisson Ratio	μ = 0.167

The 3D model of the building is shown below:

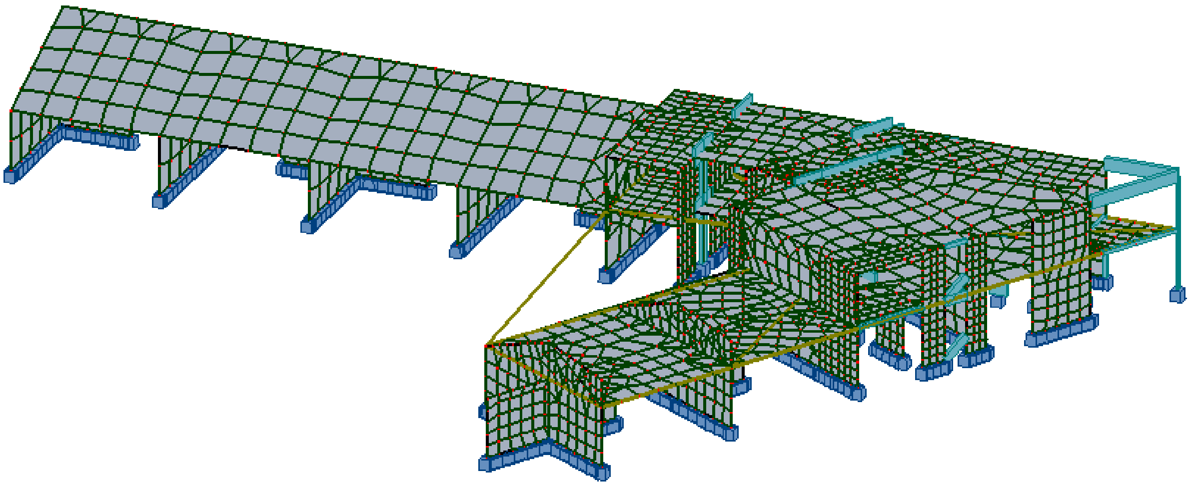


Figure 10. 3D Model of the Building

The staircases are not included in the 3D model as a structural element; they have been modelled separately in a 2D frame ROBOT design.

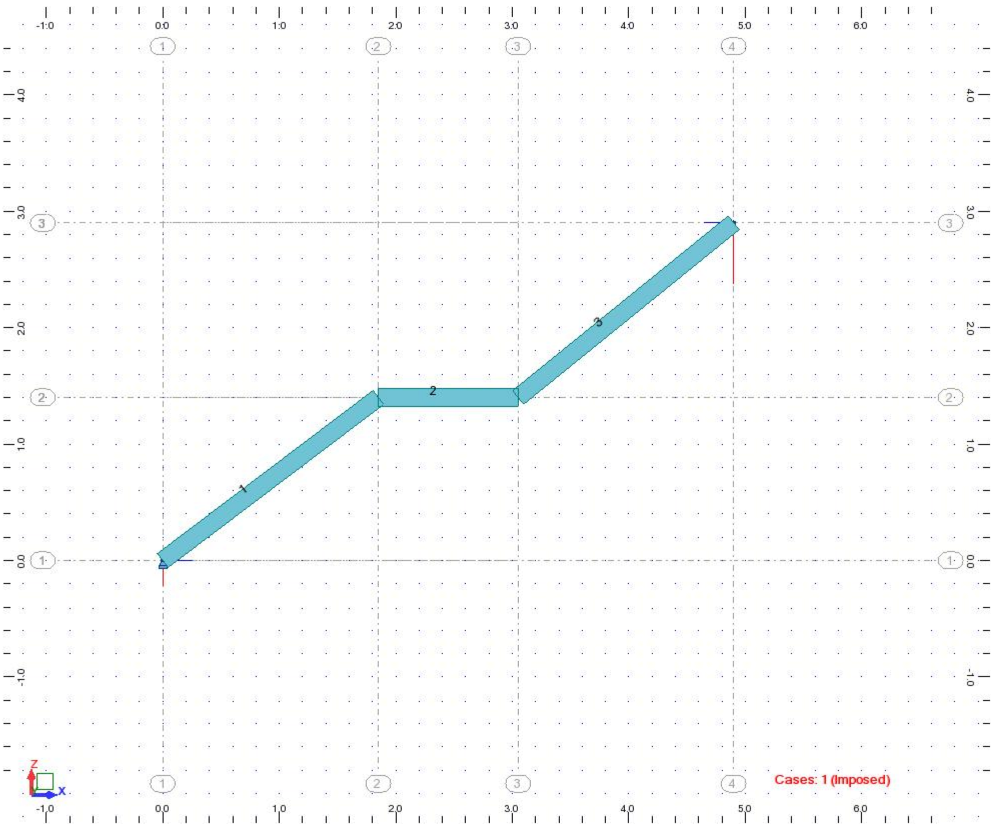


Figure 11. 2D Model of the Staircases

The obtained reactions from the self-weight and imposed load were then applied in a 3D building model.

Loading Conditions

- **Design Load Types:**
  - Dead Loads

    1. DL1: Self-weight of structural elements of the building,
    2. Difference of the concrete panels: The weight of the wall's parts which are not modeled,
    3. Brick walls: Weight of brick walls (plus reaction from the staircases),

  - Live Loads

    1. Roof structure: Imposed load at roof level = 0.25 kPa
    2. Imposed action

       1.5 kPa – for the residence units

       2.0 kPa - Staircase & Landing

  - Seismic load -Seismic Analysis Procedure: Modal Response Spectral Analysis

Critical load combinations – those that impose the greatest stress on the structure – are selected for design and listed below:

1. **1.0G+0.3Q**
2. **1.2G+1.5Q**
3. **1.0G+0.4Q±Ex**

    3a. 1.0G+0.4Q+Ex

    3b. 1.0G+0.4Q-Ex

4. **1.0G+0.4Q±Ey**

    4a. 1.0G+0.4Q+Ey

    4b. 1.0G+0.4Q-Ey

5. **1.0G+0.4Q±1.0Ex±0.3Ey**

    5a. 1.0G+0.4Q+1.0Ex+0.3Ey

    5b. 1.0G+0.4Q+1.0Ex-0.3Ey

    5c. 1.0G+0.4Q-1.0Ex+0.3Ey

    5d. 1.0G+0.4Q-1.0Ex-0.3Ey

6. **1.0G+0.4Q±1.0Ey±0.3Ex**

    6a. 1.0G+0.4Q+1.0Ey+0.3Ex

    6b. 1.0G+0.4Q+1.0Ey-0.3Ex

    6c. 1.0G+0.4Q-1.0Ey+0.3Ex

    6d. 1.0G+0.4Q-1.0Ey-0.3Ex

Determination of %NBS

Member forces resulting from the modal response spectral analysis were used to determine the seismic demand on each structural member. These were compared with the member capacities. The single factor to assess the acceptability of each member is the ratio of the seismic demand of the structural member over the member capacity (DCR). The DCRs are then expressed as a % NBS to determine the risk level of the building.

Based on the %NBS of each structural member and the overall building's behavior, the deficiencies in the structure were identified.

Seismic Design

The building structure was checked to the seismic design standards in accordance with the AS/NZ 1170.5, NZBC Clause B1 Structure and New Zealand Society of Earthquake Engineering Guidelines for Assessment and Improvement of the Structural Performance of Buildings in Earthquakes.

6. Damage Assessment

6.1 Surrounding Buildings

The closest building to the Court- Block B is the Hornby Court Block A. The damages observed on this building are minor and include the follows:

• Minor cracks in the staircase located between the communal block and residential block

• Minor cracks in the window corners at lower floors in the communal block of the building

• Cracks in the suspended slab connected to the steel columns in the communal block of the building

6.2 Residual Displacements and General Observations

No significant residual displacements of the structure were noticed during site inspection of the building.

Minor cracks were observed in the plasterboard walls in several areas of the building.

Minor spalling and cracking to the construction joint between landing slab and staircase. These damages can be found in Photographs 2 and 6 in Appendix A.

6.3 Ground Damage

No ground damage was observed during our inspection of the site.

7. Structural Analysis

7.1 Seismic Parameters

Earthquake loads shall be calculated using New Zealand Code.

◗ Site Classification	D
◗ Seismic Zone factor (Z)	
(Table 3.3, NZS 1170.5:2004 and NZBC Clause B1 Structure)	0.30 (Christchurch)
◗ Annual Probability of Exceedance	
(Table 3.3, NZS 1170.0:2002)	1/500 (ULS) Importance Level 2
◗ Annual Probability of Exceedance	
(Table 3.3, NZS 1170.0:2002)	1/25 (SLS)
◗ Return Period Factor (Ru)	
(Table 3.5, NZS 1170.5:2004)	1.0 (ULS)
◗ Return Period Factor (Rs)	
(Table 3.5, NZS 1170.5:2004 and NZBC Clause B1 Structure)	0.33 (SLS)
◗ Ductility Factor (μ)	2.0
◗ Ductility Scaling Factor (k_μ)	1.57
◗ Performance Factor (Sp), based on NZS 3.1.0.1	0.7 (ULS)
◗ Gravitational Constant (g)	9.81 m/s^2

An increased Z factor of 0.3 for Christchurch has been used in line with recommendations from the Department of Building and Housing recommendations resulting in a reduced % NBS score.

7.2 Modal Response Spectral Analysis

Modal Response Spectral Analyses (EMA) in the transverse and longitudinal directions of the building were carried out. The fundamental building period calculated from ROBOT was very low; T= 0.05 seconds. The base shears calculated from EMA are V_L=996.55 kN (longitudinal) and V_T=1076.62 kN (transverse).

An equivalent static analysis was also carried out as a consistency check of the EMA output. A 1434.96 kN (V_e) base shear was calculated from the equivalent static method. The EMA base shears are scaled to 100% of the equivalent static method base shear by applying scaling factors of 1.44 in the longitudinal direction and 1.33 in the transverse direction. The building was analyzed as having a ductility of μ= 2.0 and the design actions were applied separately in each perpendicular direction. This calculation is shown below.

The elastic site hazard spectrum for horizontal loading:

$$C(T_1)=C_h \cdot Z \cdot R \cdot N(T,D)$$

C_h=2.06 – Value from Modal Response Spectrum Curve for the period calculated from ROBOT (T=0.05s)

Z=0.3 – Hazard factor determined from the table 3.3 (NZS 1170.5:2004)

R=1.0 – Return period factor determined from the table 3.5 (NZS 1170.5:2004)

N (T,D) = 1.0 – Near fault factor- clause 3.1.6. (NZS 1170.5:2004)

$C(T_1)= 2.06 \cdot 0.3 \cdot 1.0 \cdot 1.0 = 0.618$

The horizontal design action coefficient:

$$C_d(T_1)=\frac{C(T_1)\cdot S_p}{k_\mu}=\frac{0.618\cdot 0.79}{1.57}=0.311$$

Horizontal seismic shear for static equivalent forces method:

$V_e=C_d(T_1)\cdot W_t=0.311\cdot 4614.02=1434.96$ kN

Where:

W_t- Summary of all vertical forces (Fz) for the combination 1.0G+0.3Q taken from ROBOT.

As per NZS 1170.5:2004, Clause 5.2.2.2- Ultimate limit state design- scaling of actions and displacements, calculated base shear (sum of horizontal forces for Ex and Ey) in Robot is less than corresponding to the equivalent static analysis, scaling factor are taken:

$$k_x=\frac{V_e}{V}=\frac{1434.96}{996.55}=1.44$$

$$k_y=\frac{V_e}{V}=\frac{1434.96}{1076.62}=1.33$$

8. Geotechnical Consideration

8.1 Site Description

The subject site is located in western Christchurch within the suburb of Hornby. The site is predominantly flat and surrounded by residential and commercial properties and boarded to the north by Goulding Avenue. The site is approximately 2km from the Heathcote River and at approximately 28m above mean sea level.

8.2 Public Information on Ground Conditions

8.2.1 Published Geology

The geological map of the area[1] indicates that the site is underlain by Holocene alluvial soils of the Yaldhurst Member, sub-group of the Springston Formation, comprising alluvial sand and silt overbank deposits.

8.2.2 Environmental Canterbury Logs

Information from Environment Canterbury (ECan) indicates that seven boreholes are located within a 100m radius of the site. The lithology for two of these boreholes, the site geology described in these logs show the area is predominantly underlain by gravelly sands with silt and sand bands.

It should be noted that the purpose of the boreholes the well logs are associated with, were sunk for groundwater extraction and not for geotechnical purposes. Therefore, the amount of material recovered and available for interpretation and recording will have been variable at best and may not be representative. The logs have been written by the well driller and not a geotechnical professional or to a standard. In addition strength data is not recorded.

8.2.3 EQC Geotechnical Investigation

The Earthquake Commission has undertaken geotechnical testing in some areas of Christchurch. For the Hornby area, no investigations were carried out, as of 23rd of January 2012.

8.2.4 Land Zoning

Canterbury Earthquake Recovery Authority (CERA) has published areas showing the Green Zone Technical Category in relation to the risk of future liquefaction and how these areas are expected to perform in future earthquakes. The Hornby Library site is in the “not applicable” technical category, as it is in a rural area or beyond the extent of land damage mapping. Following these guidelines, normal consenting procedures apply.

[1] Brown, L. J. and Weeber J.H. 1992: Geology of the Christchurch Urban Area. Institute of Geological and Nuclear Sciences 1:25,000 Geological Map 1. Lower Hutt. Institute of Geological and Nuclear Sciences Limited.

8.2.5 Post February Aerial Photography

Aerial photography taken following the 22 February 2011 earthquake shows no signs of liquefaction outside the building footprint or adjacent to the site.

Figure 12. Post February 2011 Earthquake Aerial Photography

8.2.6 Summary of Ground Conditions

From the ECan borehole information, the ground conditions on Goulding Avenue comprise multiple strata of gravelly sands with silt and sand bands.

8.3 Seismicity

8.3.1 Nearby Faults

There are many faults in the Christchurch region, however only those considered most likely to have an adverse effect on the site are detailed in **Error! Reference source not found.**.

Table 3 Summary of Known Active Faults[2,3]

Known Active Fault	Distance from Site (km)	Max Likely Magnitude	Avg Recurrence Interval
Alpine Fault	120	8.3	~300 years
Greendale (2010) Fault	13	7.1	~15,000 years
Hope Fault	100	7.2~7.5	120~200 years
Kelly Fault	100	7.2	~150 years
Porters Pass Fault	54	7.0	~1100 years

Recent earthquakes since 22 February 2011 have identified the presence of a new active fault system / zone underneath Christchurch City and the Port Hills. Research and published information on this system is in development and not generally available. Average recurrence intervals are yet to be estimated.

8.3.2 Ground Shaking Hazard

This seismic activity has produced earthquakes of Magnitude-6.3 with peak ground accelerations (PGA) up to twice the acceleration due to gravity (2g) in some parts of the city. This has resulted in widespread liquefaction throughout Christchurch.

New Zealand Standard NZS 1170.5:2004 quantifies the Seismic Hazard factor for Christchurch as 0.30, being in a moderate to high earthquake zone. This value has been provisionally upgraded recently (from 0.22) to reflect the seismicity hazard observed in the earthquakes since 4 September 2010.

In addition, the ground conditions are anticipated to be Holocene alluvial soils comprising alluvial gravel, sand, and silt, with bedrock expected to be in excess of 500m deep. Combining this with a 475-year PGA (peak ground acceleration) of ~0.4 (Stirling et al, 2002), the ground shaking is expected to be moderate to high.

8.3.3 Slope Failure and/or Rockfall Potential

The site is located within Hornby, a flat suburb in western Christchurch. Global slope instability risk is considered negligible. However, any localised retaining structures and/or embankments should be further investigated to determine the site-specific slope instability potential.

8.3.4 Liquefaction Potential

The site is considered at minor risk from liquefaction during further earthquakes as evidenced by:

- No previous liquefaction at the site post February ($_{MW}$ 6.3, 2.0g) and the June ($_{MW}$ 5.6-6.3, 1.5g) events.
- Ground conditions encountered highlighting sand layers considered to be moderately liquefiable.

[2] Stirling, M.W. McVerry, G.H., and Berryman, K.R. (2002). A New Seismic Hazard Model for New Zealand, Bulletin of the Seismological Society of America, Vol. 92 No. 5, pp. 1878-1903, June 2002.

[3] GNS Active Faults Database

8.3.5 Recommendations

If a more detailed assessment is required, intrusive investigation comprising one piezocone CPT test to 20m bgl should be undertaken. This will allow a numerical liquefaction analysis to be carried out.

8.3.6 Conclusions & Summary

This assessment is based on a review of the geology and existing ground investigation information, and observations from the Christchurch earthquakes since 4 September 2010.

The site appears to be situated on stratified alluvial deposits, comprising gravelly sands with silt and sand bands. Associated with this the site also has a minor to moderate liquefaction potential, in particular where sands and/or silts are present. Liquefaction in this area could cause settlement of ground and damage to property

Should a more comprehensive liquefaction and/or ground condition assessment be required, it is recommended that an intrusive investigation comprising of one piezocone CPT be conducted.

A soil class of **D** (in accordance with NZS 1170.5:2004) should be adopted for the site.

9. Results of Analysis

9.1 Characteristic Results

The achieved percentages of the NBS for the characteristic structural elements are listed in the Table 4:

Table 4 %NBS for the Building Elements

Element	% NBS
Columns	>100
Beams	>100
Slabs	>100
Walls	>100

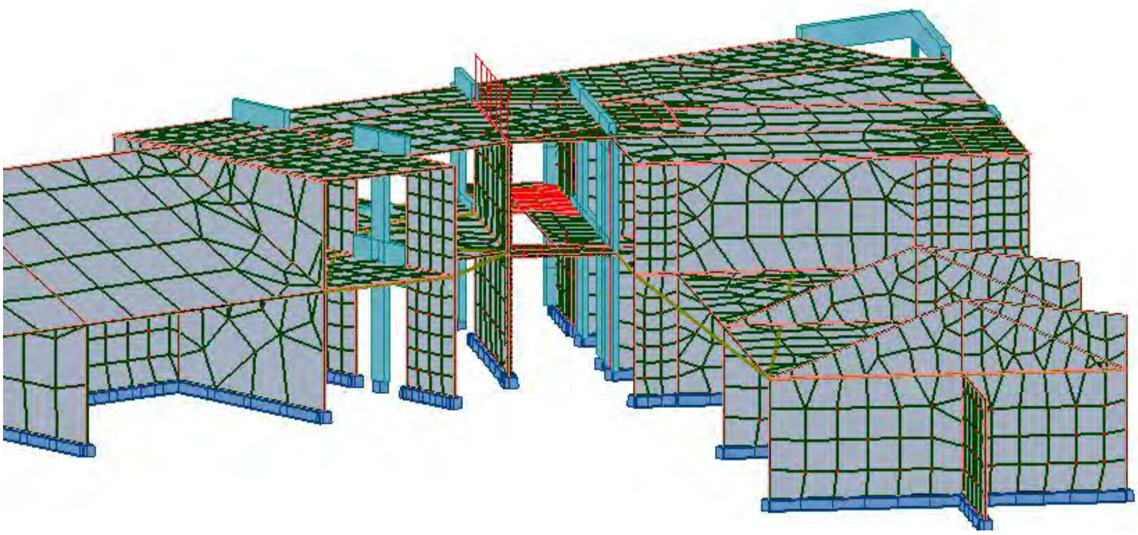


Figure 13. 3D View of the Building

9.2 Discussion of Results

Following the quantitative assessment, the building has been assessed as achieving greater than 100% NBS. As the building strength is greater than 67% NBS and is therefore not considered as Earthquake Prone or Earthquake Risk in accordance with NZSEE guidelines.

The plan irregularity noted during the qualitative assessment, in the form of the two long wings, was deemed insignificant. This was due to the detailing of the building providing adequate resistance.

10. Recommendations and Conclusions

Following the quantitative assessment, the building has been assessed as achieving greater than 100% NBS. As the building strength is greater than 67% NBS and is therefore not considered as Earthquake Prone or Earthquake Risk in accordance with NZSEE guidelines.

As the building has achieved greater than 67% NBS no further assessment to this building is recommended. In addition general access is allowed.

11. Limitations

11.1 General

This report has been prepared subject to the following limitations:

- Available drawings itemised in 5.2 was used in the assessment.
- The roof structure and foundations of the building were unable to be inspected.
- Foundations were not checked.
- No level or verticality surveys have been undertaken.
- No material testing has been undertaken.

It is noted that this report has been prepared at the request of Christchurch City Council and is intended to be used for their purposes only. GHD accepts no responsibility for any other party or person who relies on the information contained in this report.

11.2 Geotechnical Limitations

The data and advice provided herein relate only to the project and structures described herein and must be reviewed by a competent geotechnical professional before being used for any other purpose. GHD Limited (GHD) accepts no responsibility for other use of the data by third parties.

Where drill hole or test pit logs, cone tests, laboratory tests, geophysical tests and similar work have been performed and recorded by others under a separate commission, the data is included and used in the form provided by others. The responsibility for the accuracy of such data remains with the issuing authority, not with GHD.

The advice tendered in this report is based on information obtained from the desk study investigation location test points and sample points. It is not warranted in respect to the conditions that may be encountered across the site other than at these locations. It is emphasised that the actual characteristics of the subsurface materials may vary significantly between adjacent test points, sample intervals and at locations other than where observations, explorations and investigations have been made. Subsurface conditions, including groundwater levels and contaminant concentrations can change in a limited time. This should be borne in mind when assessing the data.

It should be noted that because of the inherent uncertainties in subsurface evaluations, changed or unanticipated subsurface conditions may occur that could affect total project cost and/or execution. GHD does not accept responsibility for the consequences of significant variances in the conditions and the requirements for execution of the work.

The subsurface and surface earthworks, excavations and foundations should be examined by a suitably qualified and experienced Engineer who shall judge whether the revealed conditions accord with both the assumptions in this report and/or the design of the works. If they do not accord, the Engineer shall modify advice in this report and/or design of the works to accord with the circumstances that are revealed.

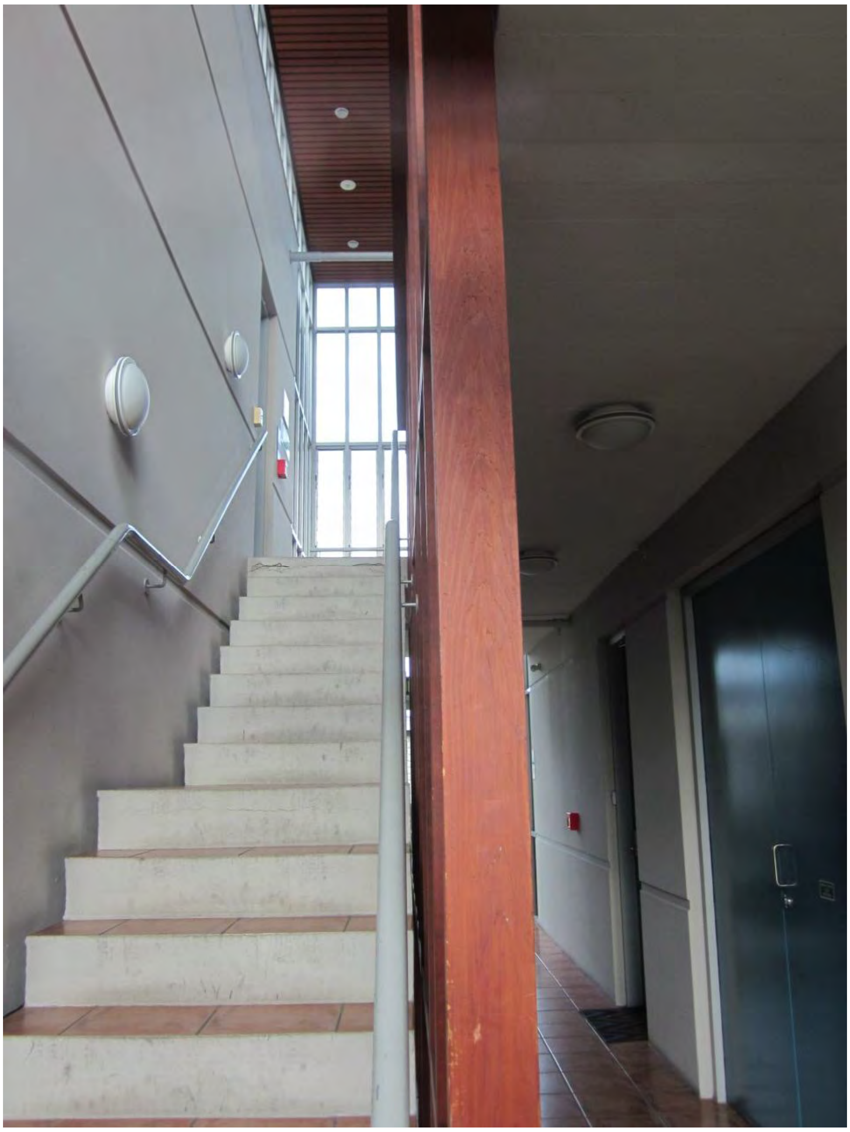
An understanding of the geotechnical site conditions depends on the integration of many pieces of information, some regional, some site specific, some structure specific and some experienced based. Hence this report should not be altered, amended or abbreviated, issued in part and issued incomplete in any way without prior checking and approval by GHD. GHD accepts no responsibility for any circumstances which arise from the issue of the report which have been modified in any way as outlined above.

Appendix A

Photographs

Photograph 1 Overall view of the building

Photograph 2 View of the portions where are staircases



Photograph 3 Staircases

Photograph 4 **Minor Spalling and Cracking at the Construction Joint between Landing Slab and Staircase**

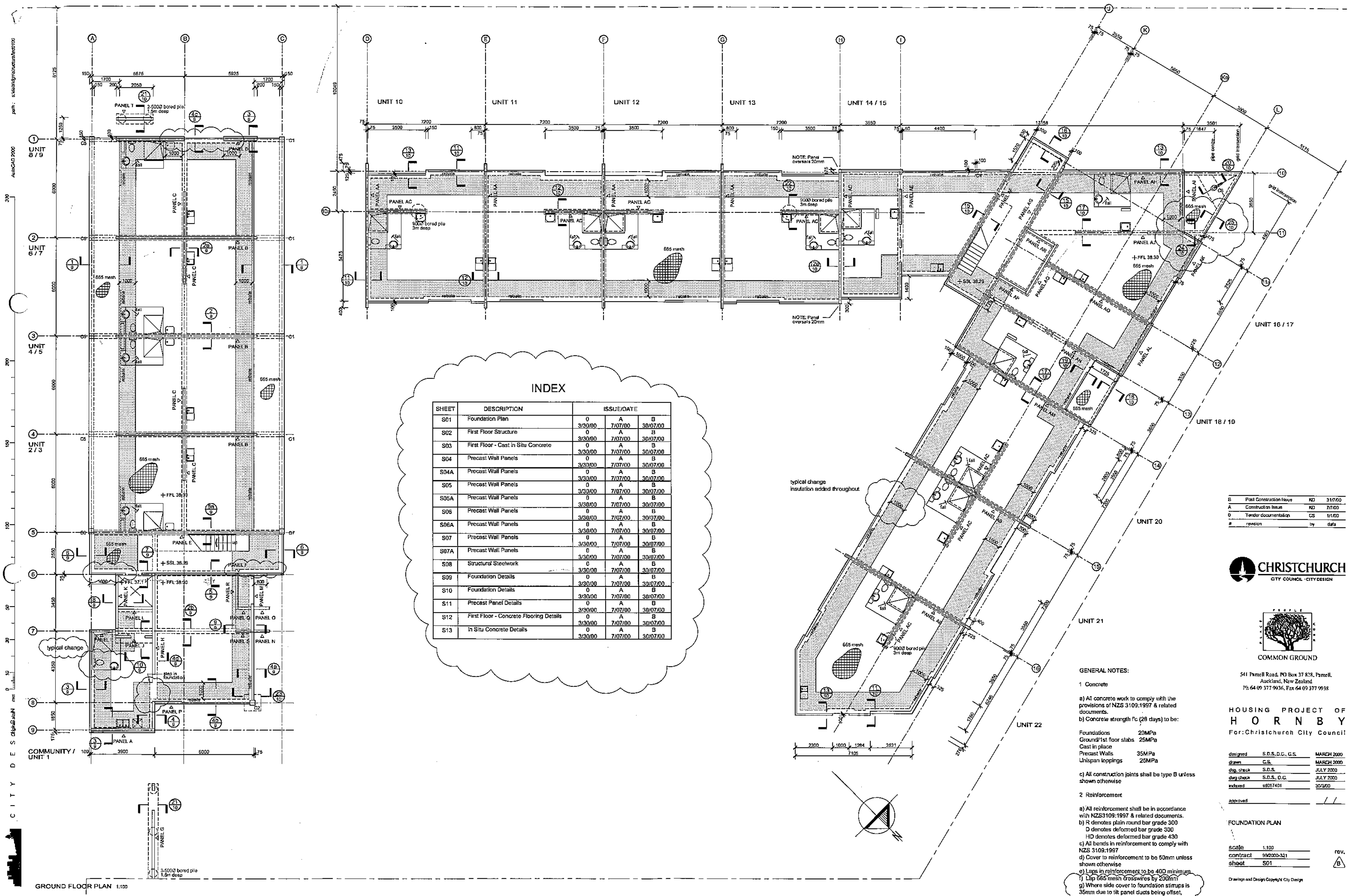
Photograph 5 **Hairline Cracking at the Bottom of the Staircases**

Photograph 6 Minor Spalling and Cracking at the Construction Joint between Landing Slab and Staircase

Appendix B

Existing Drawings

Notes:



INDEX

SHEET	DESCRIPTION	ISSUE/DATE		
S01	Foundation Plan	0 3/30/00	A 7/07/00	B 30/07/00
S02	First Floor Structure	0 3/30/00	A 7/07/00	B 30/07/00
S03	First Floor - Cast in Situ Concrete	0 3/30/00	A 7/07/00	B 30/07/00
S04	Precast Wall Panels	0 3/30/00	A 7/07/00	B 30/07/00
S04A	Precast Wall Panels	0 3/30/00	A 7/07/00	B 30/07/00
S05	Precast Wall Panels	0 3/30/00	A 7/07/00	B 30/07/00
S05A	Precast Wall Panels	0 3/30/00	A 7/07/00	B 30/07/00
S06	Precast Wall Panels	0 3/30/00	A 7/07/00	B 30/07/00
S06A	Precast Wall Panels	0 3/30/00	A 7/07/00	B 30/07/00
S07	Precast Wall Panels	0 3/30/00	A 7/07/00	B 30/07/00
S07A	Precast Wall Panels	0 3/30/00	A 7/07/00	B 30/07/00
S08	Structural Steelwork	0 3/30/00	A 7/07/00	B 30/07/00
S09	Foundation Details	0 3/30/00	A 7/07/00	B 30/07/00
S10	Foundation Details	0 3/30/00	A 7/07/00	B 30/07/00
S11	Precast Panel Details	0 3/30/00	A 7/07/00	B 30/07/00
S12	First Floor - Concrete Flooring Details	0 3/30/00	A 7/07/00	B 30/07/00
S13	In Situ Concrete Details	0 3/30/00	A 7/07/00	B 30/07/00

GENERAL NOTES:

1 Concrete

a) All concrete work to comply with the provisions of NZS 3109:1997 & related documents.
b) Concrete strength f'c (28 days) to be:

Foundations	20MPa
Ground/1st floor slabs	25MPa
Cast in place	
Precast Walls	35MPa
Unispan toppings	25MPa

c) All construction joints shall be type B unless shown otherwise

2 Reinforcement

a) All reinforcement shall be in accordance with NZS3109:1997 & related documents.
b) R denotes plain round bar grade 300
D denotes deformed bar grade 300
HD denotes deformed bar grade 430
c) All bends in reinforcement to comply with NZS 3109:1997
d) Cover to reinforcement to be 50mm unless shown otherwise
e) Laps in reinforcement to be 40D minimum
f) Lap 665 mesh crosswires by 200mm
g) Where side cover to foundation stirrups is 35mm due to tilt panel ducts being offset, stirrups are to be hot dip galvanised

#	revision	by	date
B	Post Construction Issue	KD	31/7/00
A	Construction Issue	KD	7/7/00
0	Tender documentation	CS	1/1/00

CHRISTCHURCH
CITY COUNCIL · CITY DESIGN

COMMON GROUND
541 Parnell Road, PO Box 37 828, Parnell, Auckland, New Zealand
Ph 64 09 377 9936, Fax 64 09 377 9938

HOUSING PROJECT OF
H O R N B Y
For: Christchurch City Council

designed	S.D.S., D.C., G.S.	MARCH 2000
drawn	C.S.	MARCH 2000
dsg. check	S.D.S.	JULY 2000
dwg check	S.D.S., D.C.	JULY 2000
indexed	sd017401	30/3/00
approved		/ /

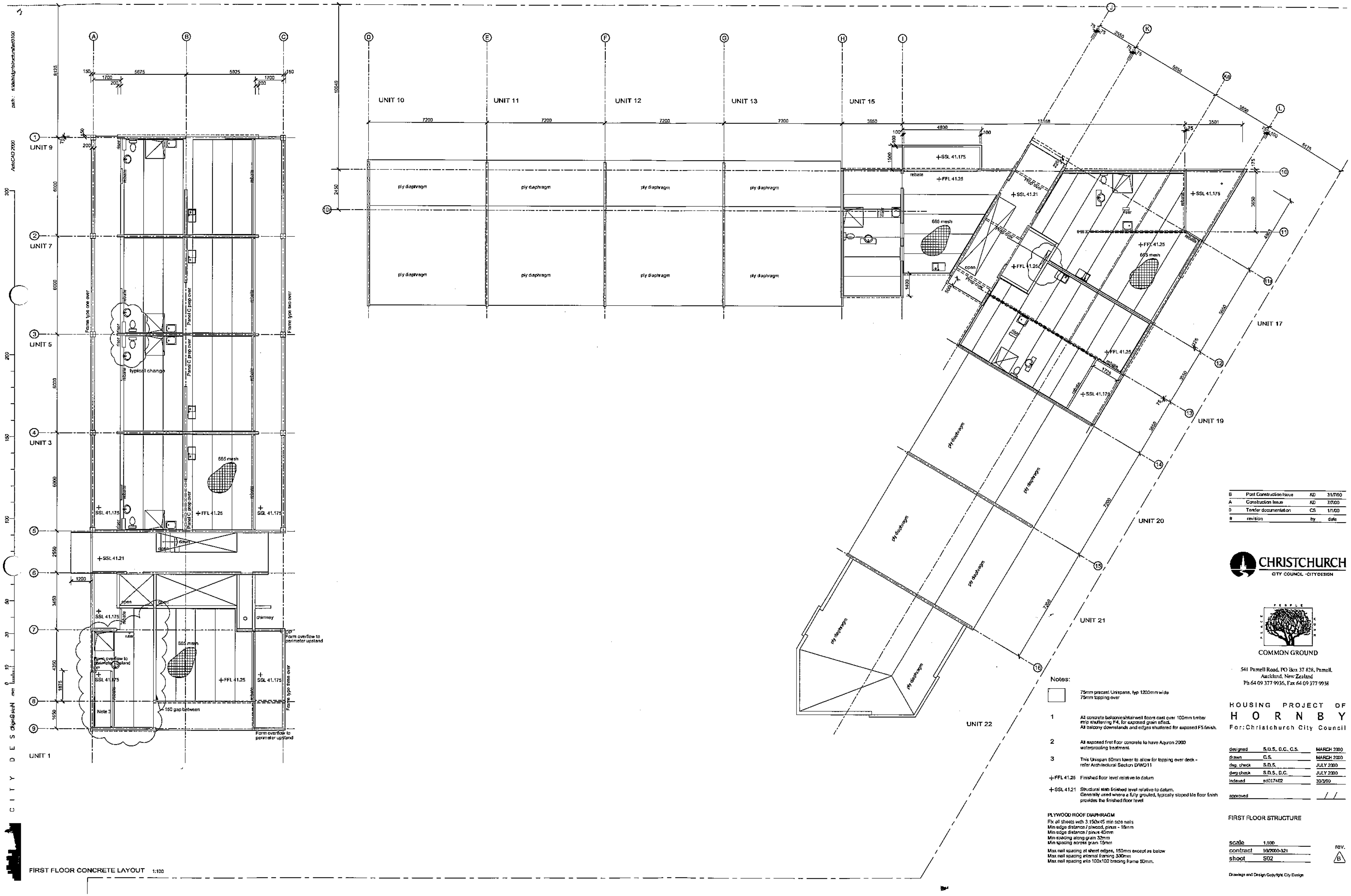
FOUNDATION PLAN

scale	1:100
contract	99/2000-321
sheet	S01

rev. B

Notes:

Refer sheet S01



Notes:

☐	75mm precast Unispans, typ 1200mm wide 75mm topping over
1	All concrete balconies/stairwell floors cast over 100mm timber strip shuttering F4, for exposed grain effect. All balcony downstands and edges shuttered for exposed F5 finish.
2	All exposed first floor concrete to have Aquron 2000 waterproofing treatment.
3	This Unispan 50mm lower to allow for topping over deck - refer Architectural Section D/WD11
+FFL 41.25	Finished floor level relative to datum
+SSL 41.21	Structural slab finished level relative to datum. Generally used where a fully grouted, typically sloped tile floor finish provides the finished floor level

PLYWOOD ROOF DIAPHRAGM

Fix all sheets with 3.150x45 min size nails
Min edge distance / plywood, pinus - 16mm
Min edge distance / pinus 40mm
Min spacing along grain 32mm
Min spacing across grain 16mm

Max nail spacing at sheet edges, 150mm except as below
Max nail spacing internal framing 300mm
Max nail spacing into 100x100 bracing frame 50mm.

B	Post Construction Issue	KD	31/7/00
A	Construction Issue	KD	7/7/00
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CHRISTCHURCH
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PEOPLE PLACE WORK
COMMON GROUND

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HOUSING PROJECT OF
H O R N B Y
For: Christchurch City Council

designed	S.D.S., D.C., C.S.	MARCH 2000
drawn	C.S.	MARCH 2000
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FIRST FLOOR STRUCTURE

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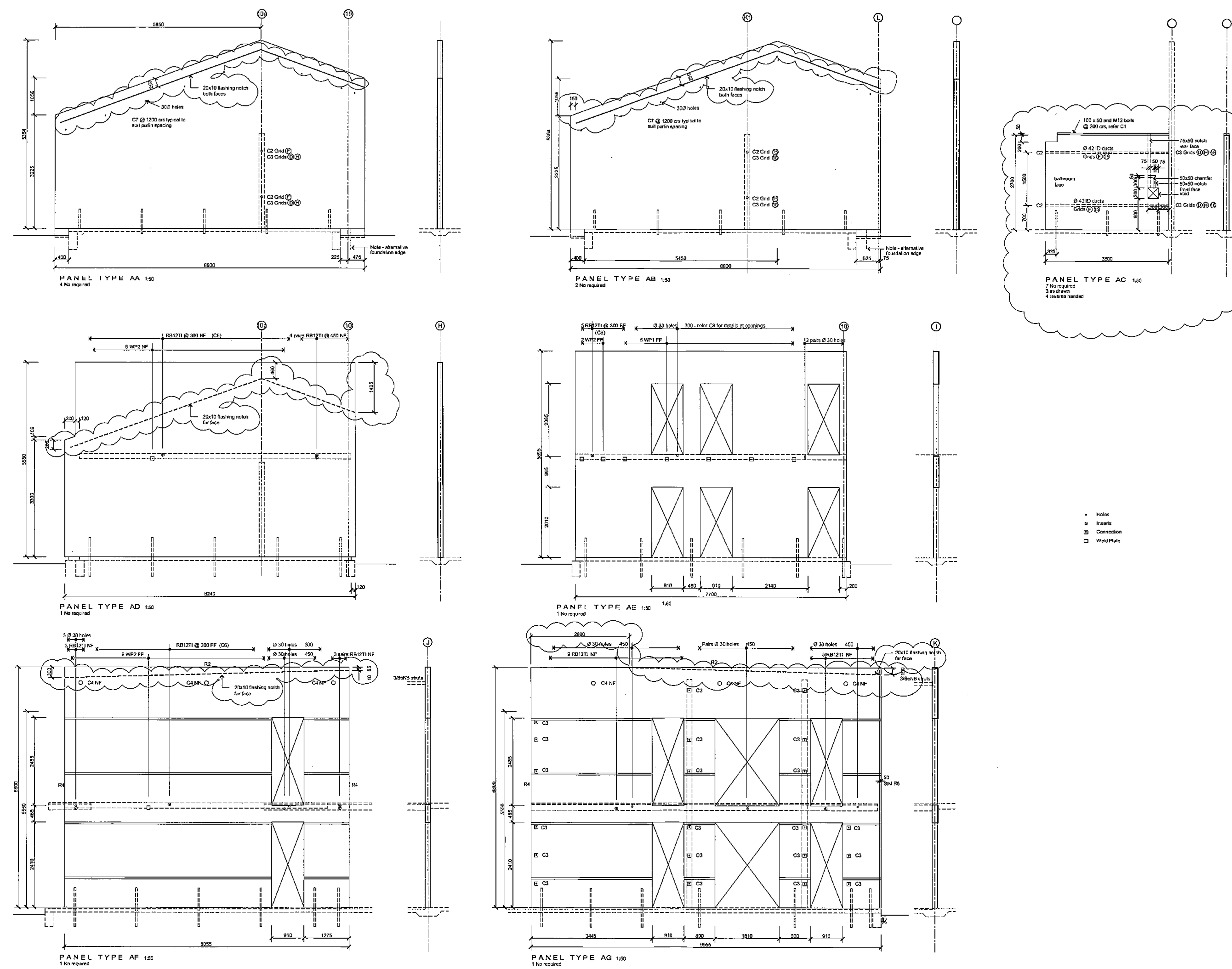

Notes:

PRECAST WALL NOTES:
-Refer to note on drawing S04

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A	Construction Issue	KD	7/7/00
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approved		/ /

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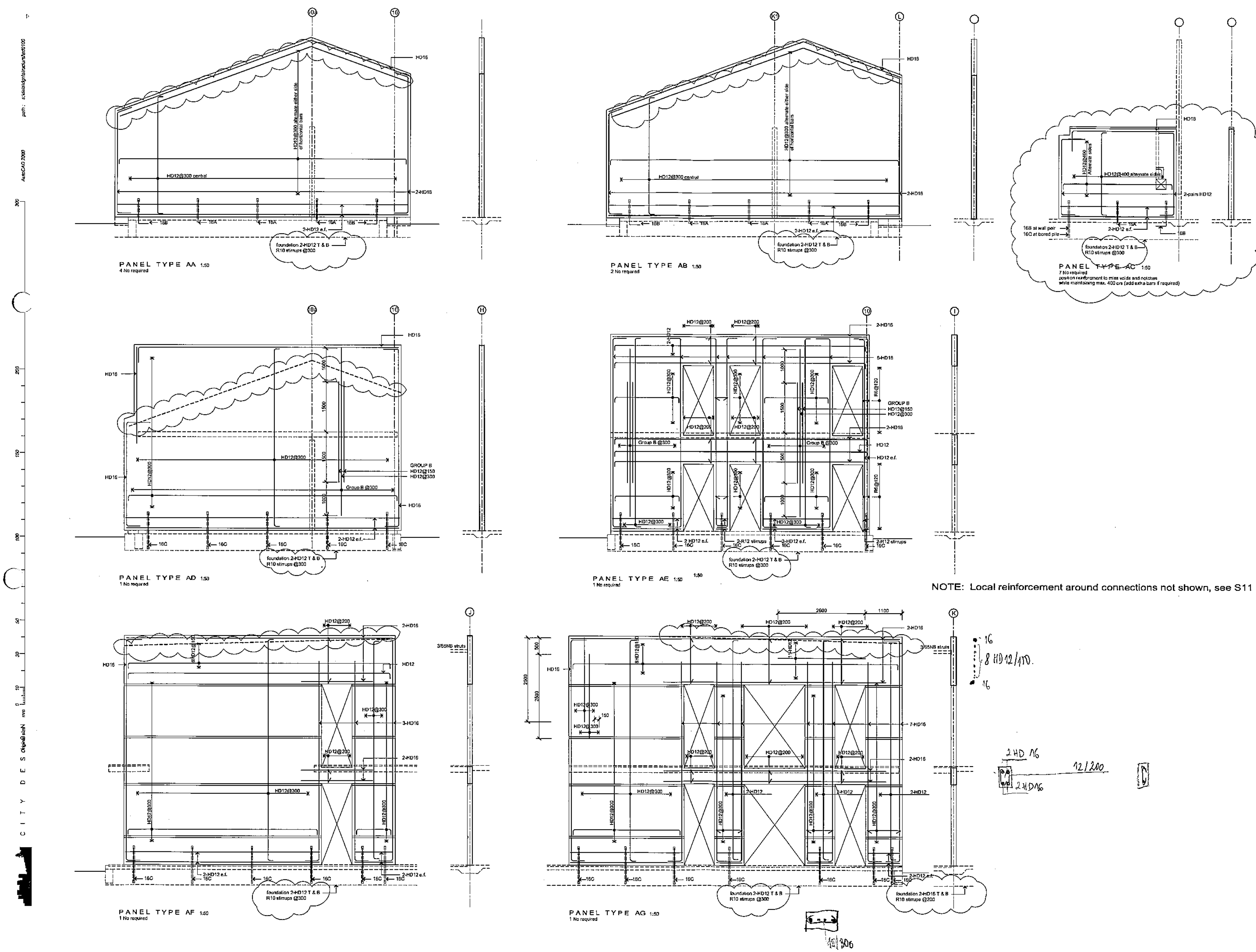
rev.	B

Notes:

PRECAST WALL NOTES:
-Refer to note on drawing S04



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HOUSING PROJECT OF
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designed	S.D.S.,D.C., C.S.	MARCH 2000
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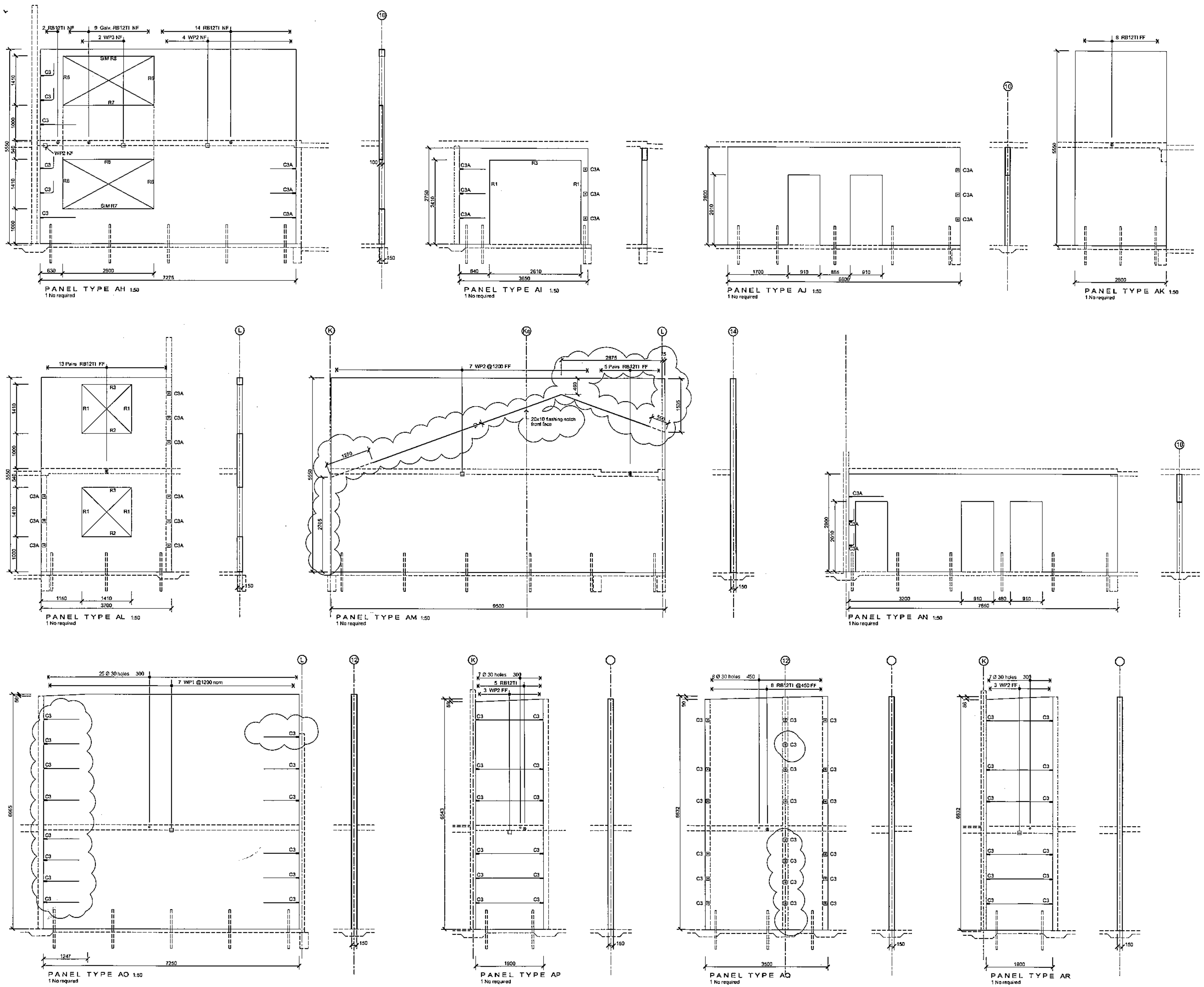
rev. B



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PRECAST WALL NOTES:
-Refer to note on drawing S04

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0	Tender documentation	CS	20/3/00

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For: Christchurch City Council

designed	S.D.S.,D.C., C.S.	MARCH 2000
drawn	C.S.	MARCH 2000
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dwg check	S.D.S., D.C.	JULY 2000
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rev. B

Notes:

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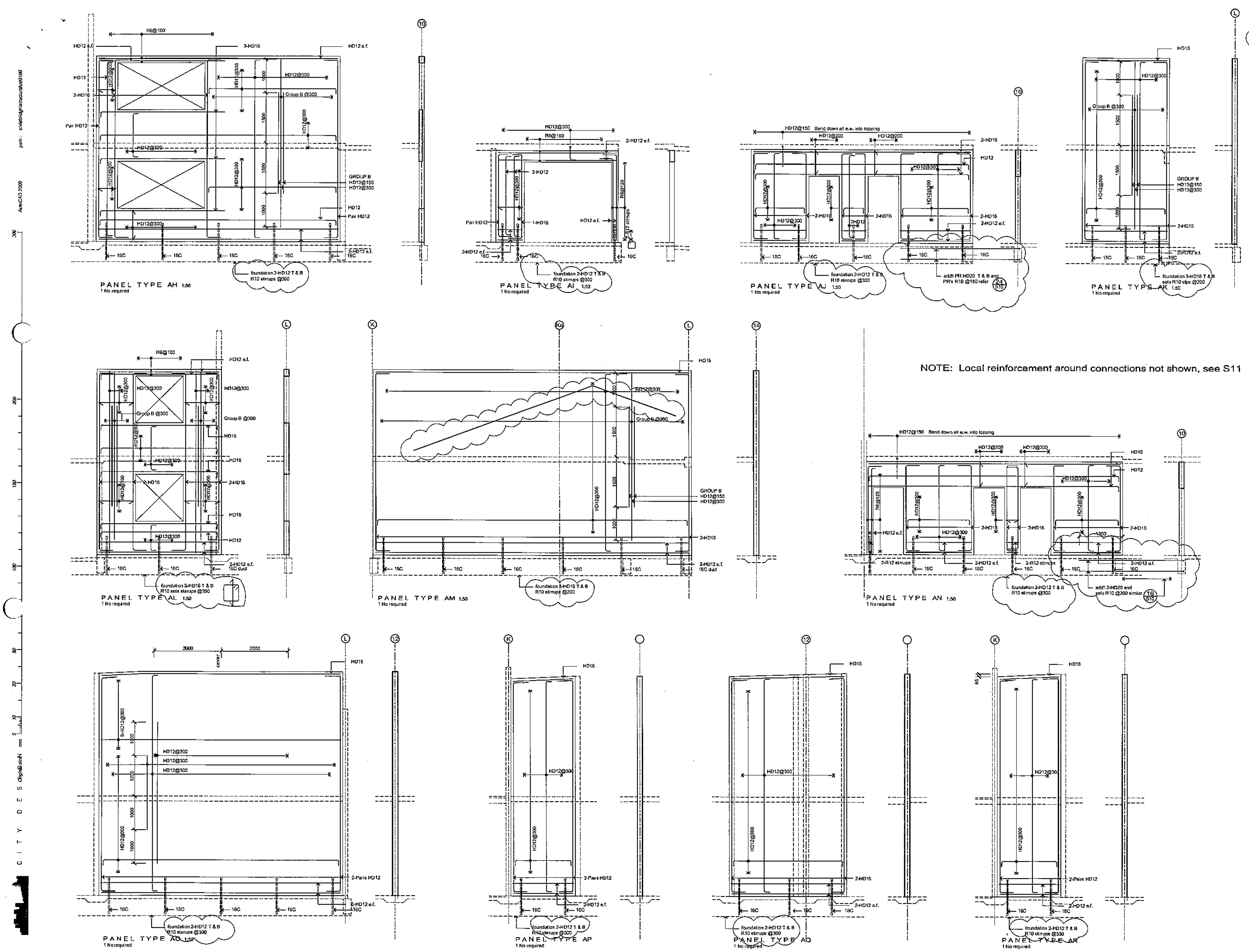
-Refer to note on drawing S04



NOTE: Local reinforcement around connections not shown, see S11

#	revision	by	date
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A	Construction Issue	KD	7/7/00
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rev. B

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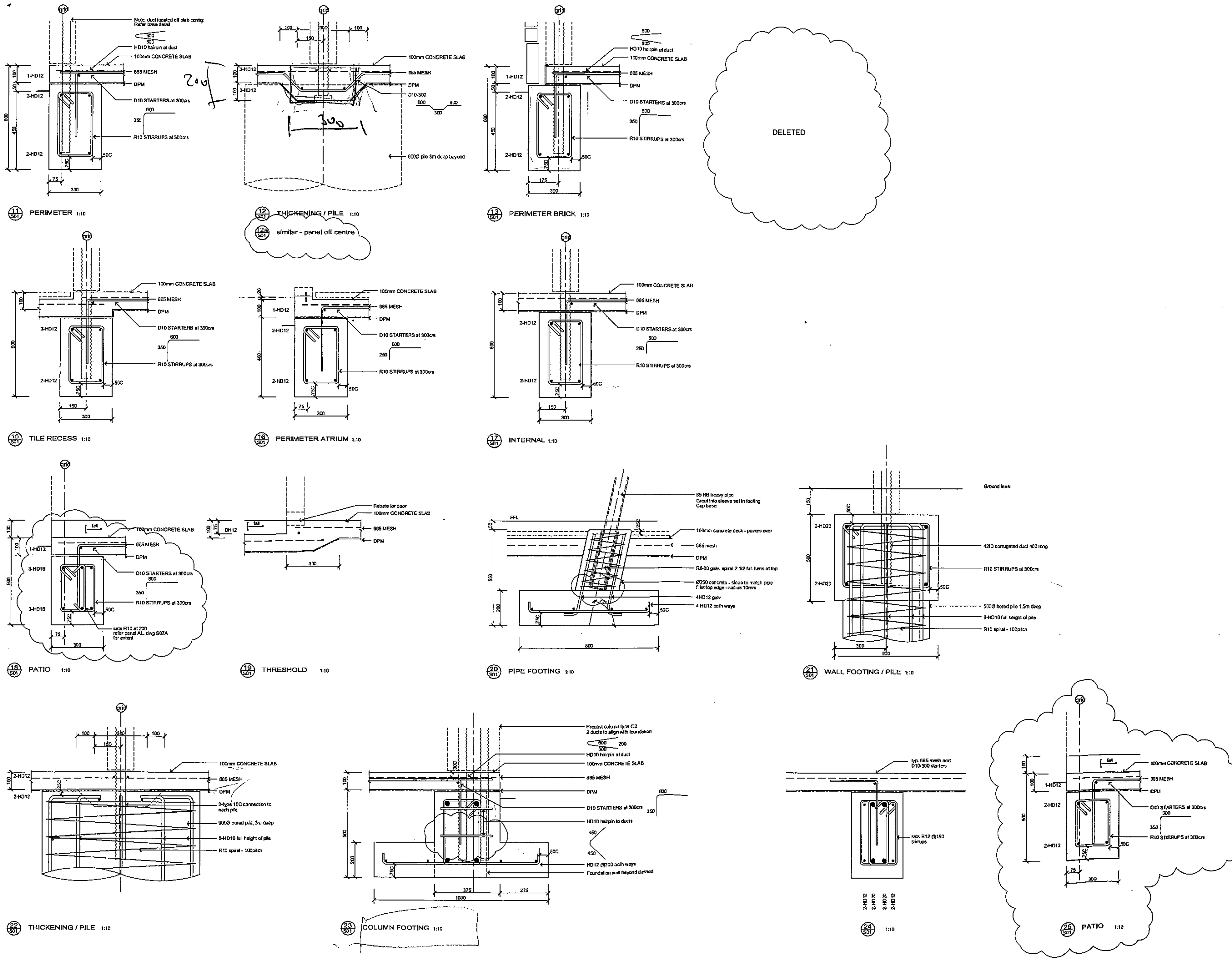

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rev. B

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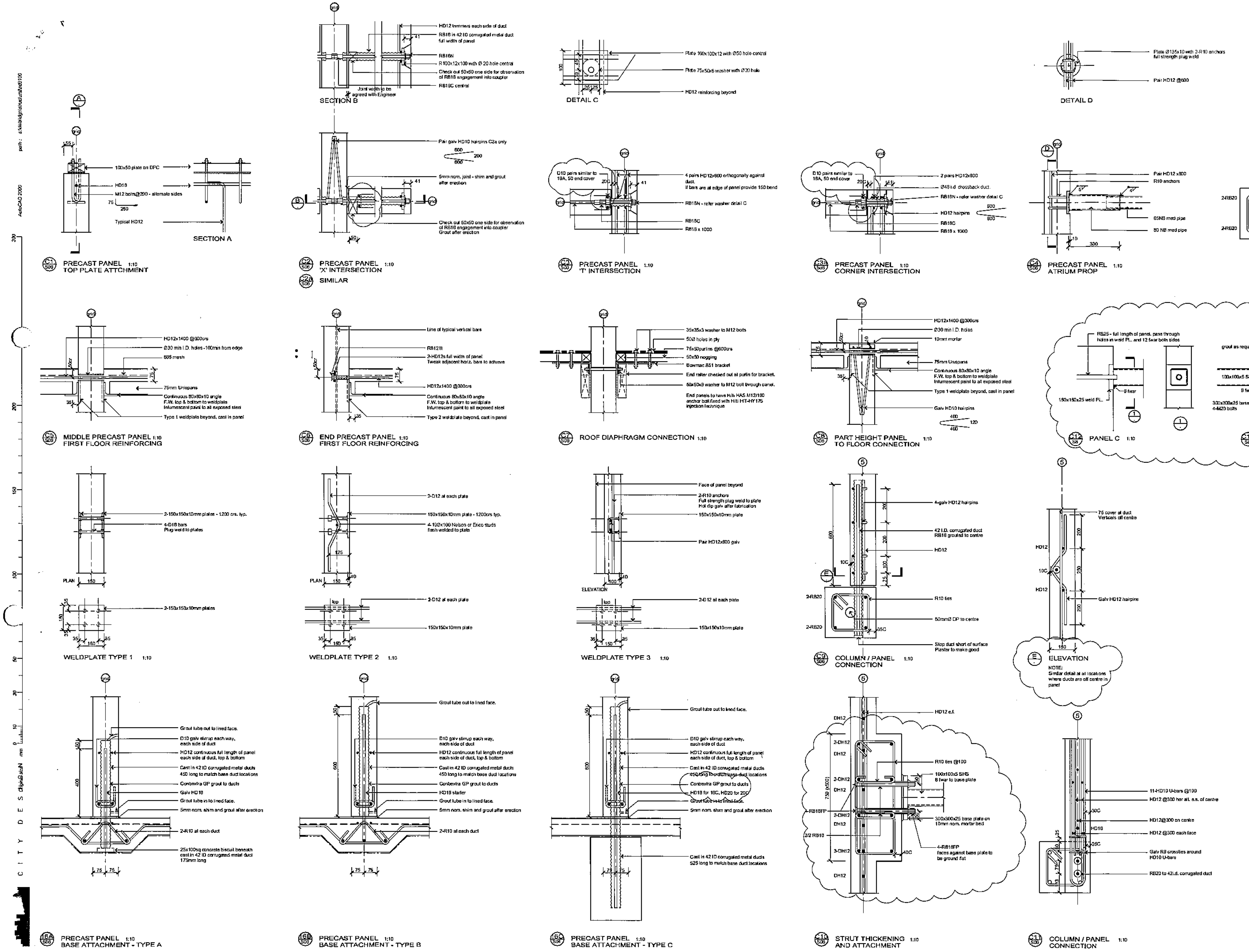

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indexed	sd017411	30/3/00
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sheet	S11

rev. B

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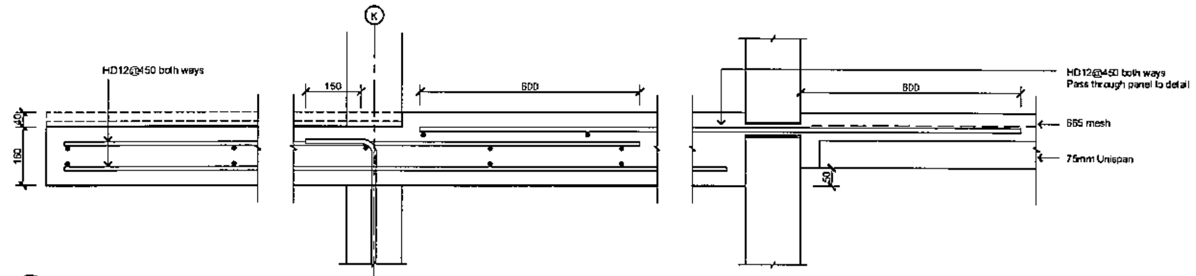

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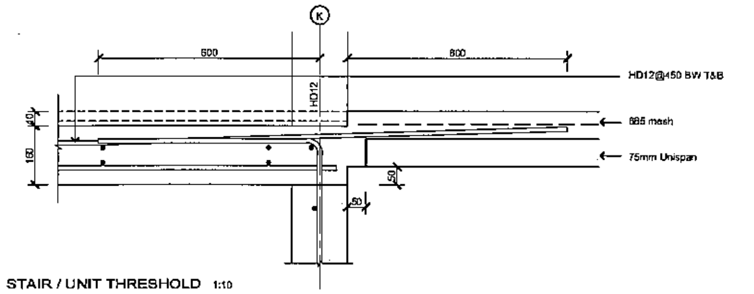
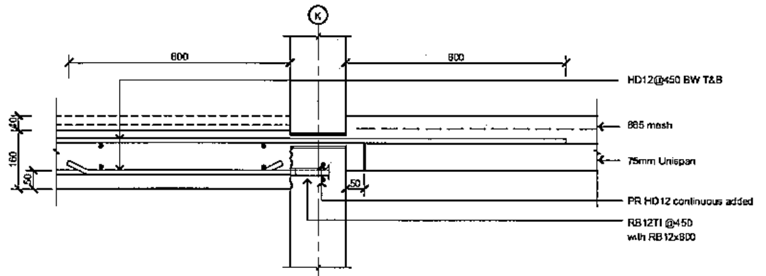


B/S03 STAIR / UNIT THRESHOLD 1:10



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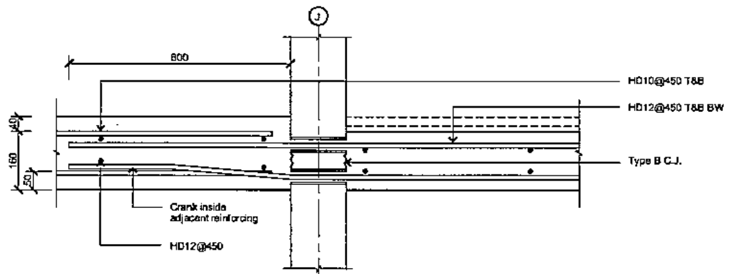

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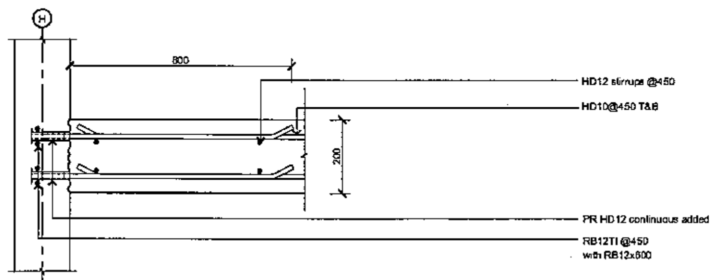

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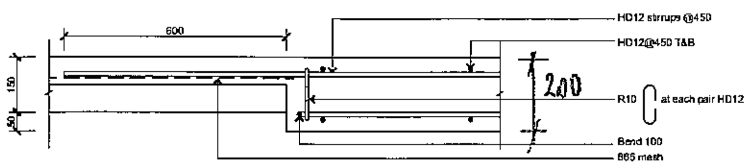

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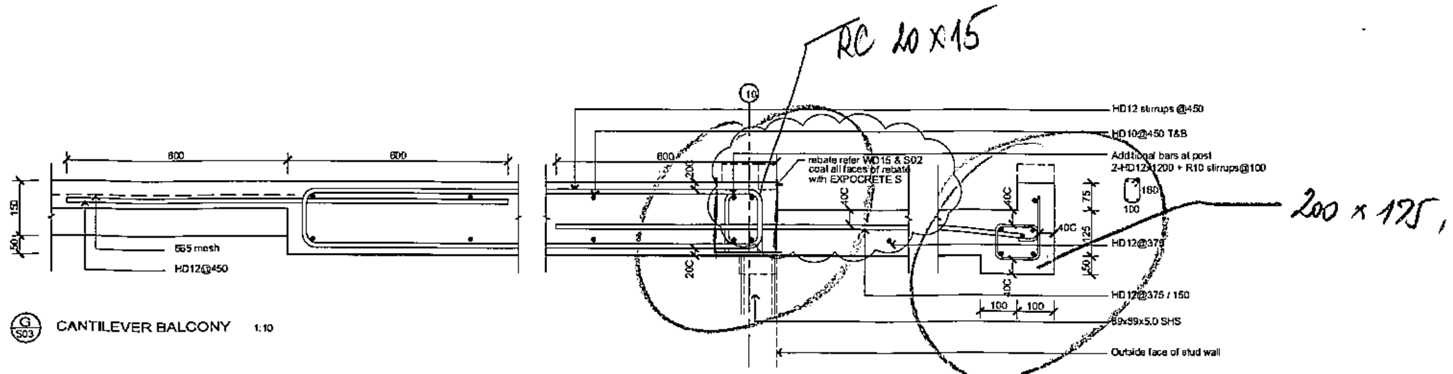

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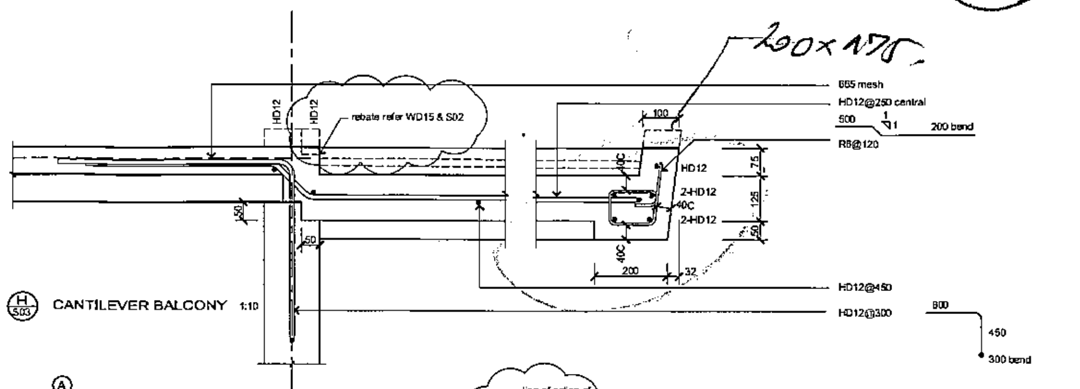

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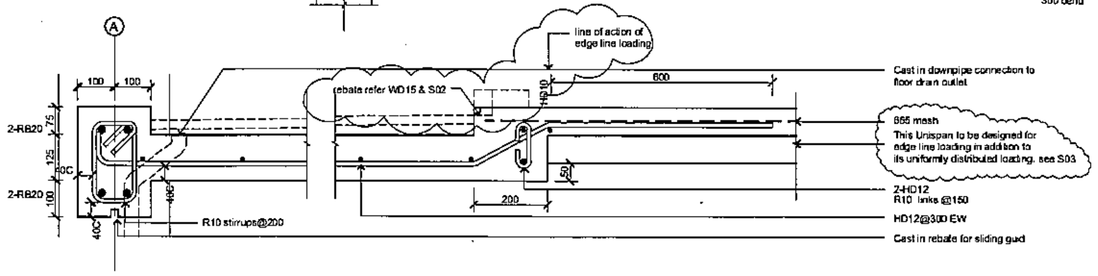

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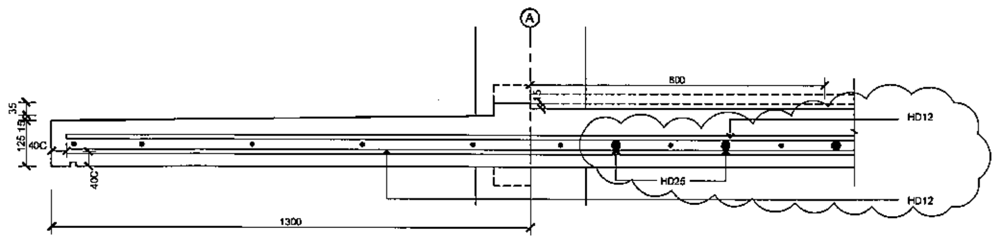

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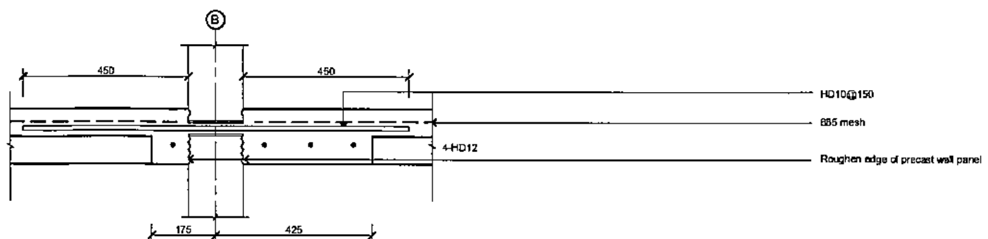

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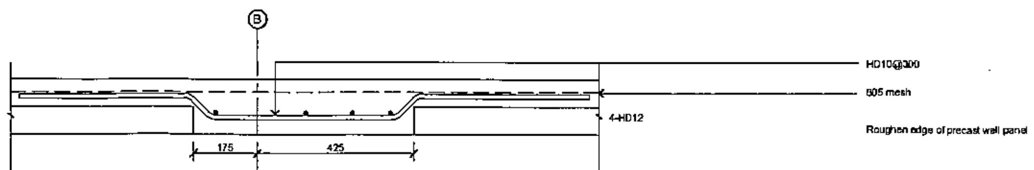

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A	Construction Issue	KD	7/7/00
0	Tender documentation	CS	1/1/00
#	revision	by	date

CHRISTCHURCH
CITY COUNCIL · CITY DESIGN

COMMON GROUND

541 Parnell Road, PO Box 37 828, Parnell,
Auckland, New Zealand
Ph 64 09 377 9936, Fax 64 09 377 9938

HOUSING PROJECT OF
HORNBY
For:Christchurch City Council

designed	S.D.S, D.C, C.S.	MARCH 2000
drawn	C.S.	MARCH 2000
dsg. check	S.D.S.	JULY 2000
dwg check	S.D.S, D.C	JULY 2000
indexed	sd017412	30/3/00
approved		/ /

FIRST FLOOR
CONCRETE FLOORING DETAILS

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contract	99/2000-321
sheet	S12

rev. B

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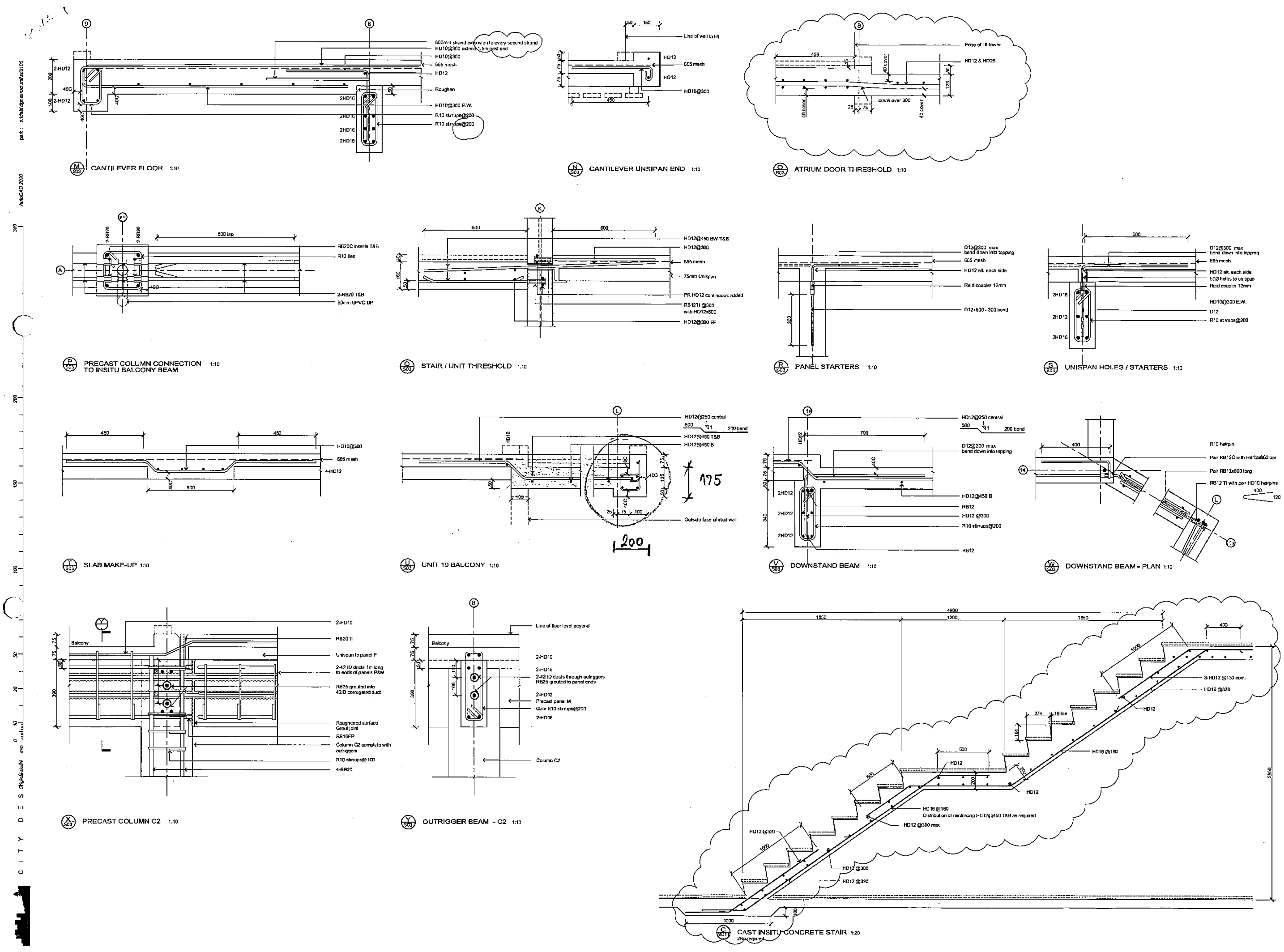
AutoCAD 2000
CITY DESIGN

Notes:



B	Post Construction Issue	KD	31/7/00
A	Construction Issue	KD	7/7/00
0	Tender documentation	CS	1/1/00
#	revision	by	date

CHRISTCHURCH
CITY COUNCIL - CITY DESIGN

COMMON GROUND

541 Parnell Road, PO Box 37 828, Parnell, Auckland, New Zealand
Ph 64 09 377 9936, Fax 64 09 377 9938

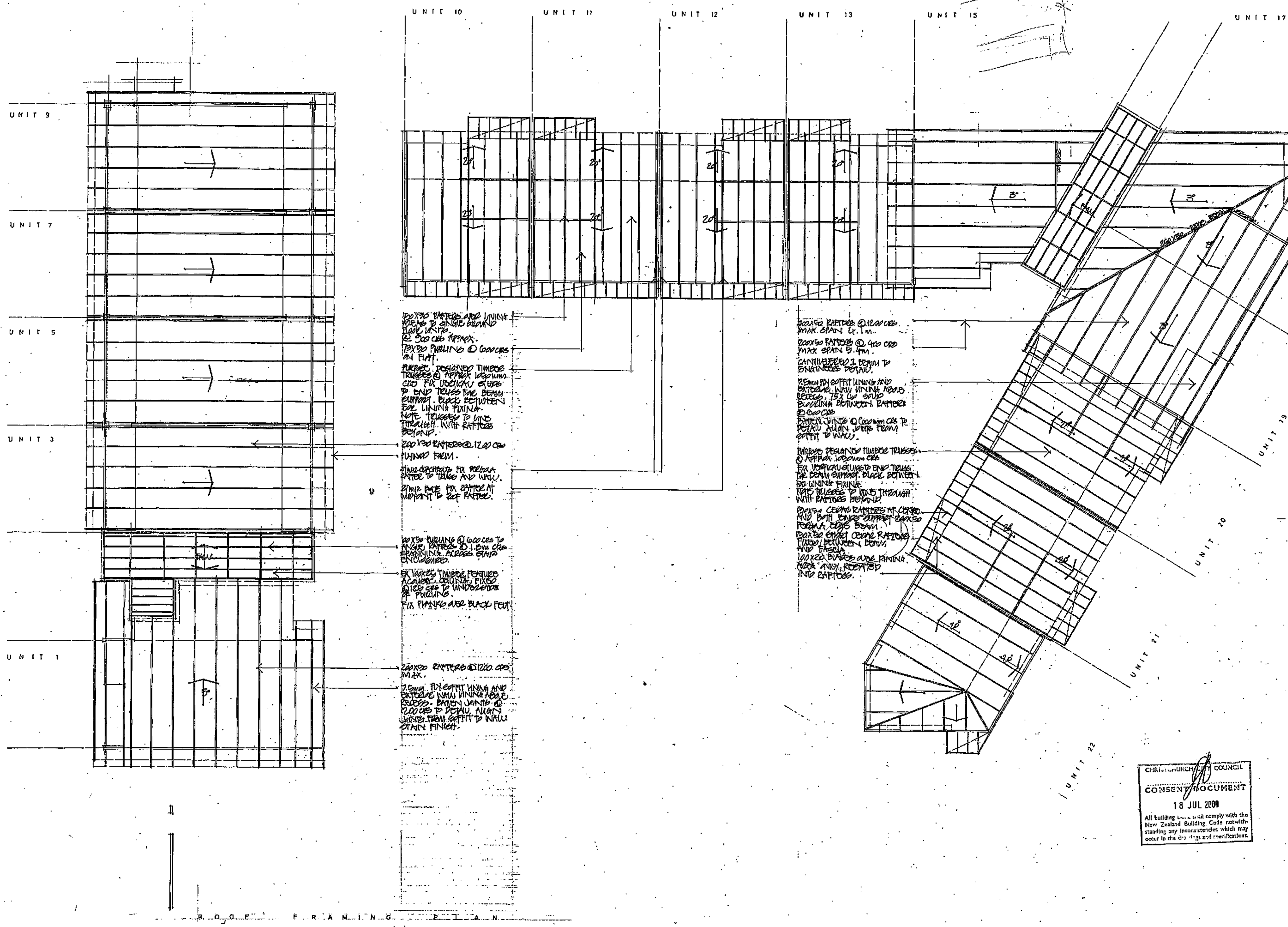
HOUSING PROJECT OF
H O R N B Y
For: Christchurch City Council

designed	S.D.S, D.C, C.S.	MARCH 2000
drawn	C.S.	MARCH 2000
dsg. check	S.D.S.	JULY 2000
dwg check	S.D.S, D.C.	JULY 2000
indexed	sd017413	30/3/00
approved		/ /

INSITU CONCRETE DETAILS

scale	1:10
contract	99/2000-321
sheet	S13

rev. B



NOTES

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#	revision	by	date

CITY DESIGN

CHRISTCHURCH
THE GARDEN CITY
The city that shines

COMMON GROUND

541 Parnell Road, PO Box 37 828, Parnell,
Auckland, New Zealand
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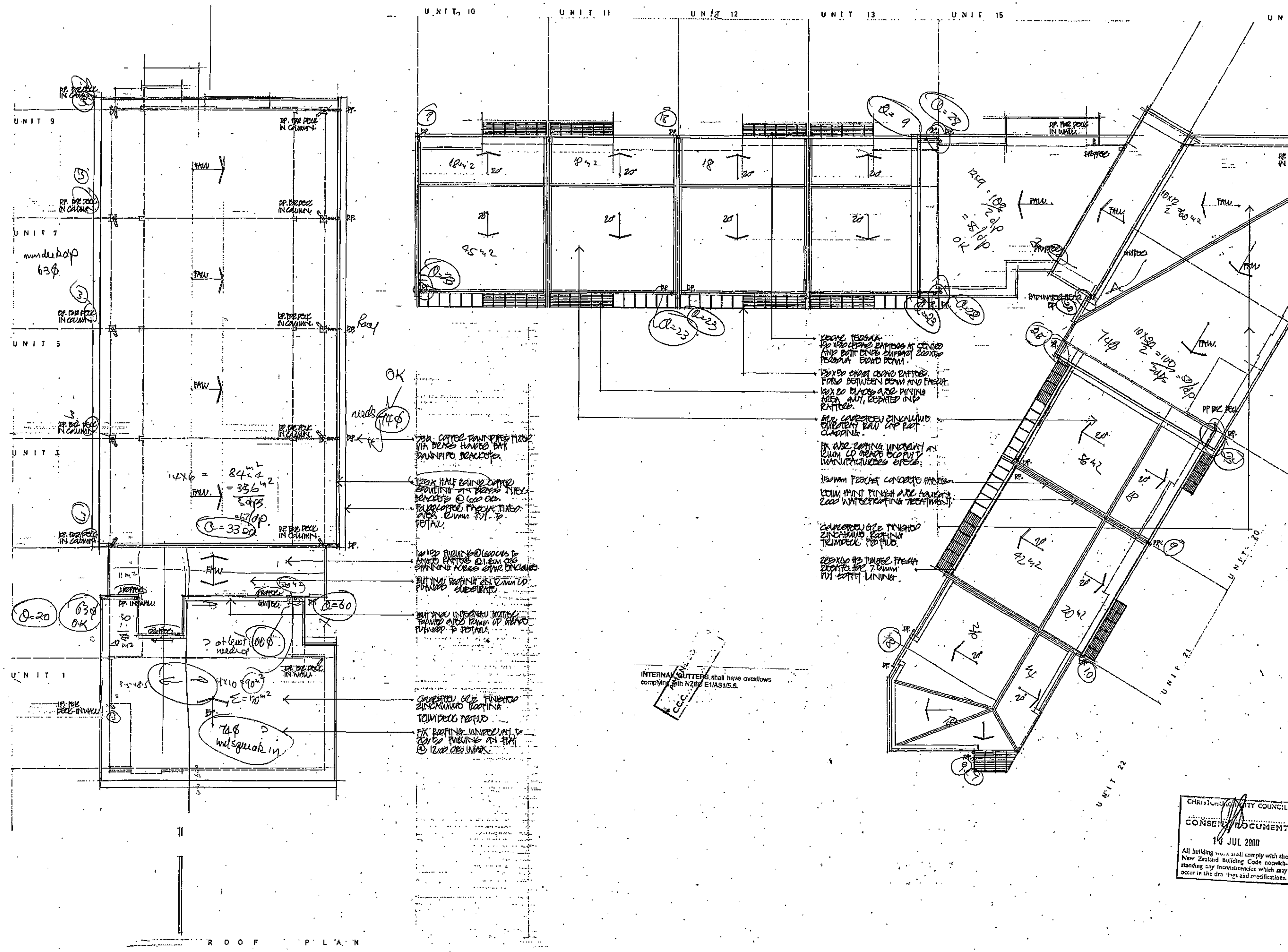
CHRISTCHURCH CITY COUNCIL
CONSENT DOCUMENT
18 JUL 2000
All building work shall comply with the New Zealand Building Code notwithstanding any inconsistencies which may occur in the drawings and specifications.

HOUSING PROJECT OF
HORNBY
For: Christchurch City Council

ROOF · FRAMING PLAN.

scale	1 : 100		rev.
contract			
sheet	WD 04		△
designed	H.K.B. C.S.	03 2000	
drawn	H.K.B.	03 2000	
dsg. check			
dwg check			
indexed			
approved		/ /	



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CITY DESIGN

CHRISTCHURCH THE GARDEN CITY *The city that shines*

COMMON GROUND

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HOUSING PROJECT OF
H O R N B Y
For Christchurch City Council

R O O F P L A N

CHRISTCHURCH CITY COUNCIL
CONSENT DOCUMENT
13 JUL 2000
All building work shall comply with the New Zealand Building Code notwithstanding any inconsistencies which may occur in the drawings and specifications.

scale	1 : 100		rev.
contract			
sheet	WD 05		△
designed	H.K.B. C.S.	03 2000	
drawn	H.K.B.	03 2000	
dsg. check			
dwg check			
indexed			
approved		/ /	

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CONSENT DOCUMENT
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CITY DESIGN
CHRISTCHURCH THE GARDEN CITY

COMMON GROUND

541 Parnell Road, PO Box 37 828, Parnell, Auckland, New Zealand
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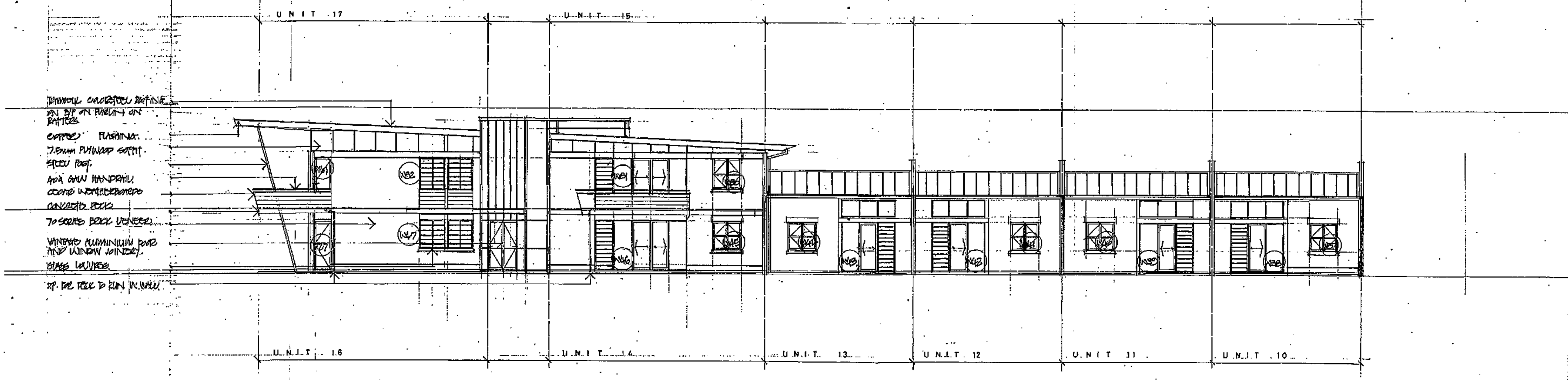
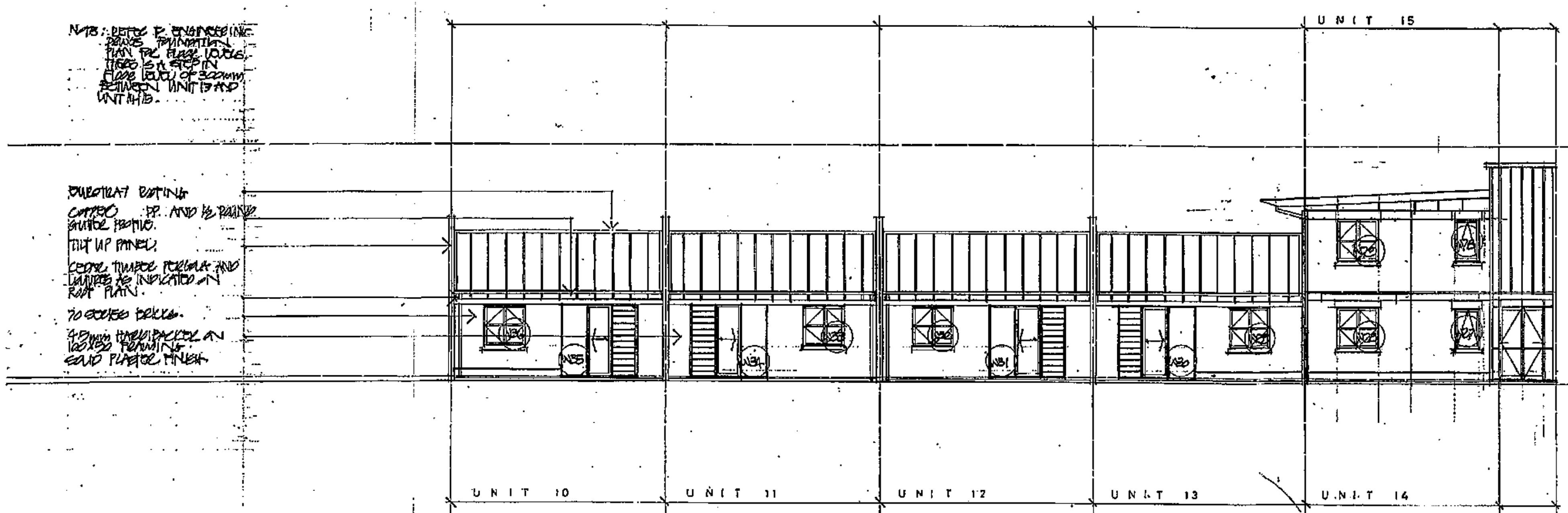
HOUSING PROJECT OF HORNBY

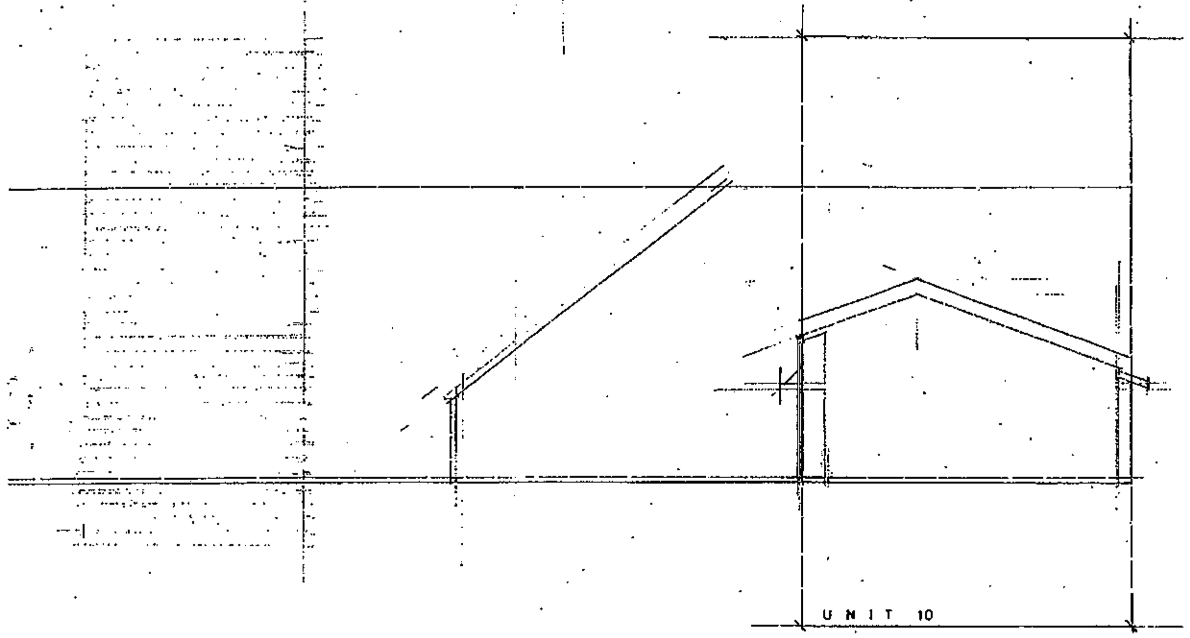
For: Christchurch City Council

ELEVATIONS.

scale	1 : 100.	rev.
contract		
sheet	WD 06	△
designed	H.K.B. C.S.	03 2000
drawn	H.K.B.	03 2000
dsg. check		
dwg check		
indexed		
approved		/ /







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CITY DESIGN
CHRISTCHURCH
THE GARDEN CITY
The city that shines

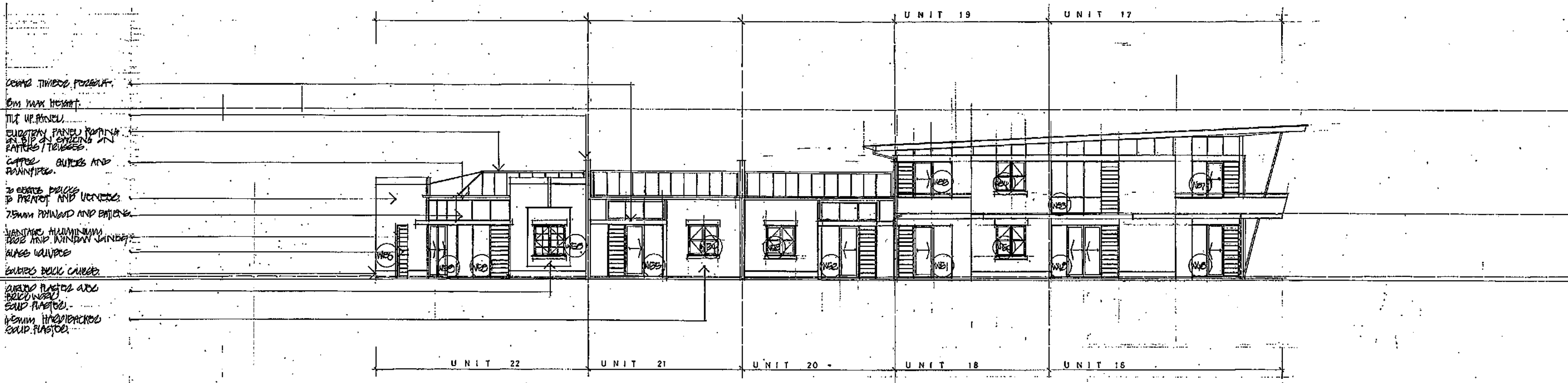
COMMON GROUND

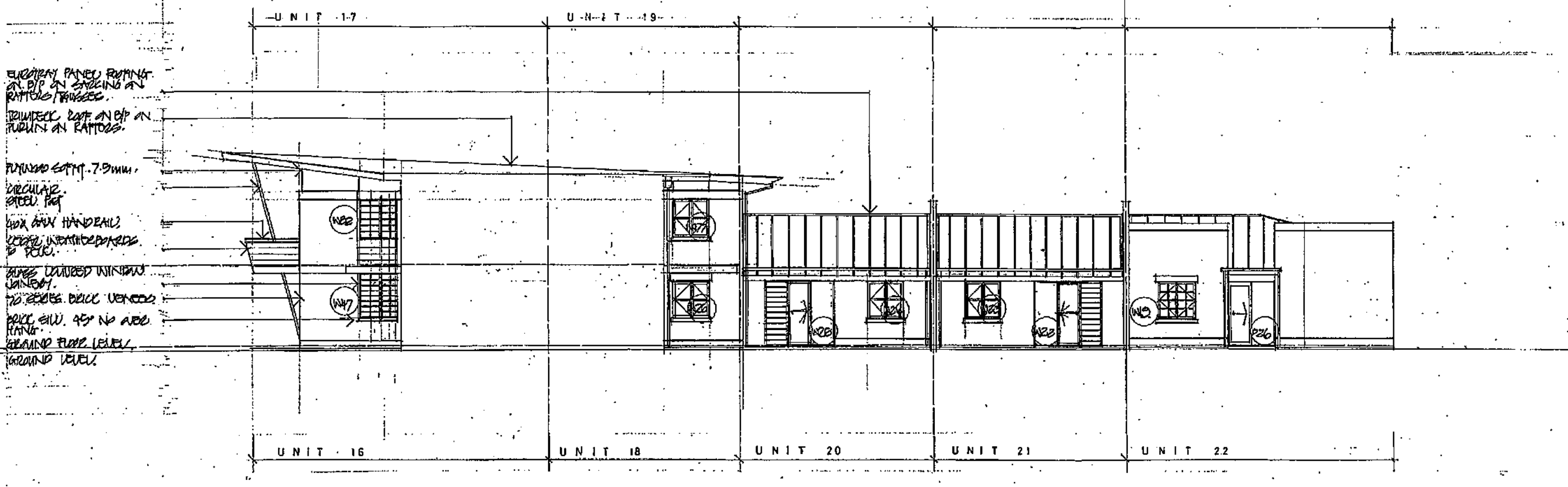
541 Parnell Road, PO Box 37 828, Parnell,
Auckland, New Zealand
Ph 64 09 377 9936, Fax 64 09 377 9938

HOUSING PROJECT OF
H O R N B Y
For: Christchurch City Council

E L E V A T I O N S

scale	1 : 100.		rev.
contract			
sheet	WD 07		△
designed	H.K.B. C.S.		03 2000
drawn	H.K.B.		03 2000
dsg. check			
dwg check			
indexed			
approved			/ /





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revision	by	date

CITY DESIGN

CHRISTCHURCH THE GARDEN CITY

The city that shines

COMMON GROUND

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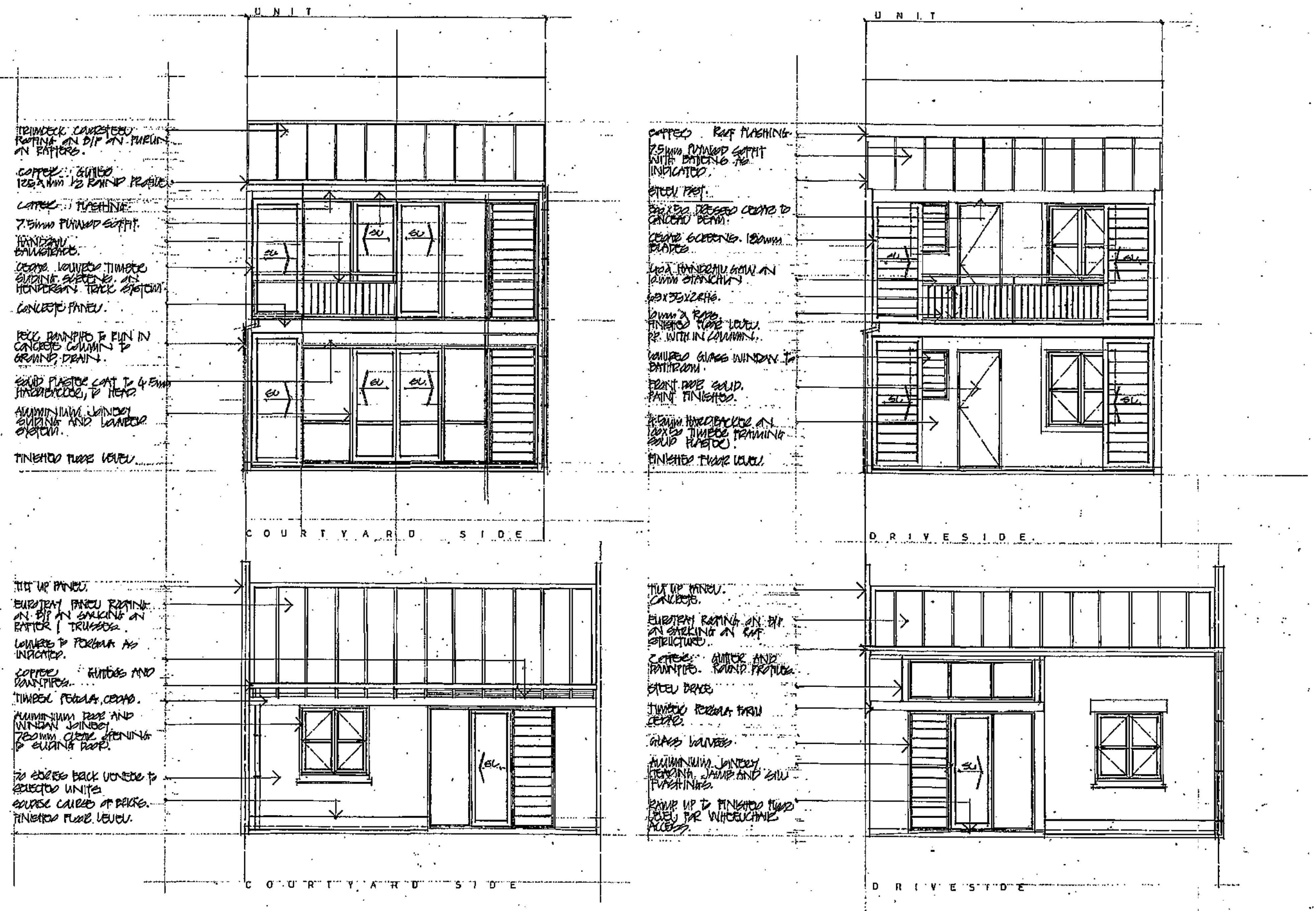
HOUSING PROJECT OF

HORNBY

For: Christchurch City Council

ELEVATIONS.

scale	1 : 100.	rev.
contract		
sheet	WD 08	△
designed	H.K.B. C.S.	03 2000
drawn	H.K.B. C.S.	03 2000
dsg. check		
dwg check		
indexed		
approved		/ /



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CITY DESIGN

CHRISTCHURCH
THE GARDEN CITY
The city that shines

COMMON GROUND

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CHRISTCHURCH CITY COUNCIL
CONSENT DOCUMENT
18 JUL 2000
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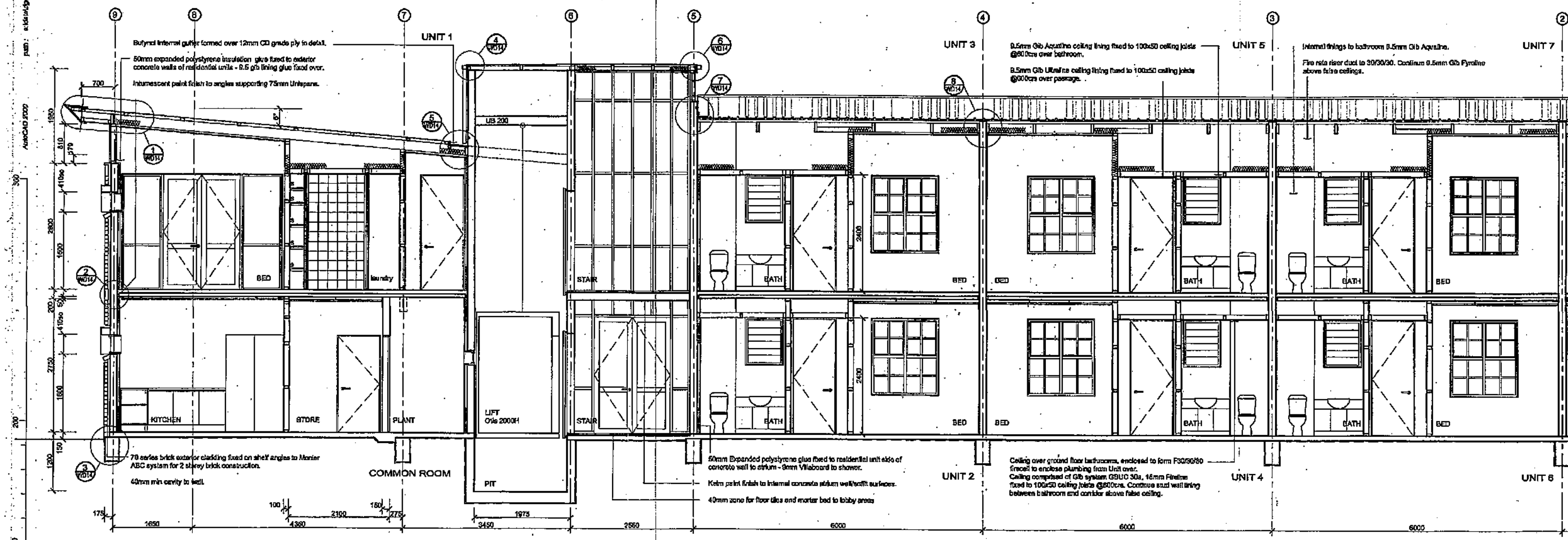
HOUSING PROJECT OF HORNBY
For: Christchurch City Council

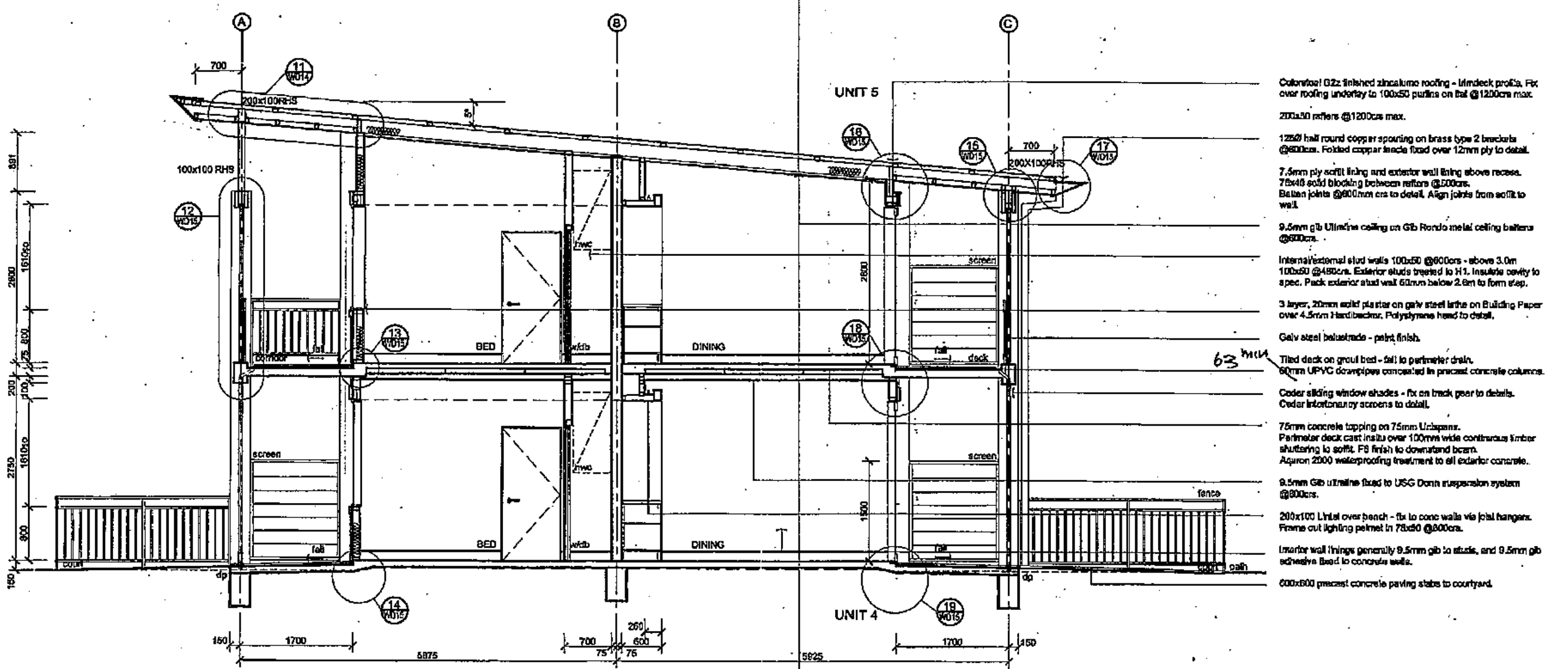
ELEVATIONS

scale	1 : 100.		rev.
contract			
sheet	WD 09		△
designed	H.K.B. C.S.	03 2000	
drawn	H.K.B.	03 2000	
dsg. check			
dwg check			
indexed			
approved		/ /	

Notes:



SECTION A-A 1:50



SECTION B-B 1:50

TENDER

#	revision	by	date
0	Tender documentation	CS	30/3/00

CHRISTCHURCH
CITY COUNCIL · CITY DESIGN

COMMON GROUND

541 Parnell Road, PO Box 37 828, Parnell,
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CHRISTCHURCH CITY COUNCIL
CONSENT DOCUMENT
18 JUL 2000
All building work shall comply with the New Zealand Building Code notwithstanding any inconsistencies which may occur in the drawings and specifications.

HOUSING PROJECT OF
H O R N B Y
For:Christchurch City Council

designed	J.L., H.K.B., C.S.	MARCH 2000
drawn	C.S.	MARCH 2000
dsg. check		
dwg check		
indexed	sd017510	30/3/00
approved		/ /

CROSS SECTIONS

scale	1:50	rev.
contract	92/2000-321	
sheet	WD10	0

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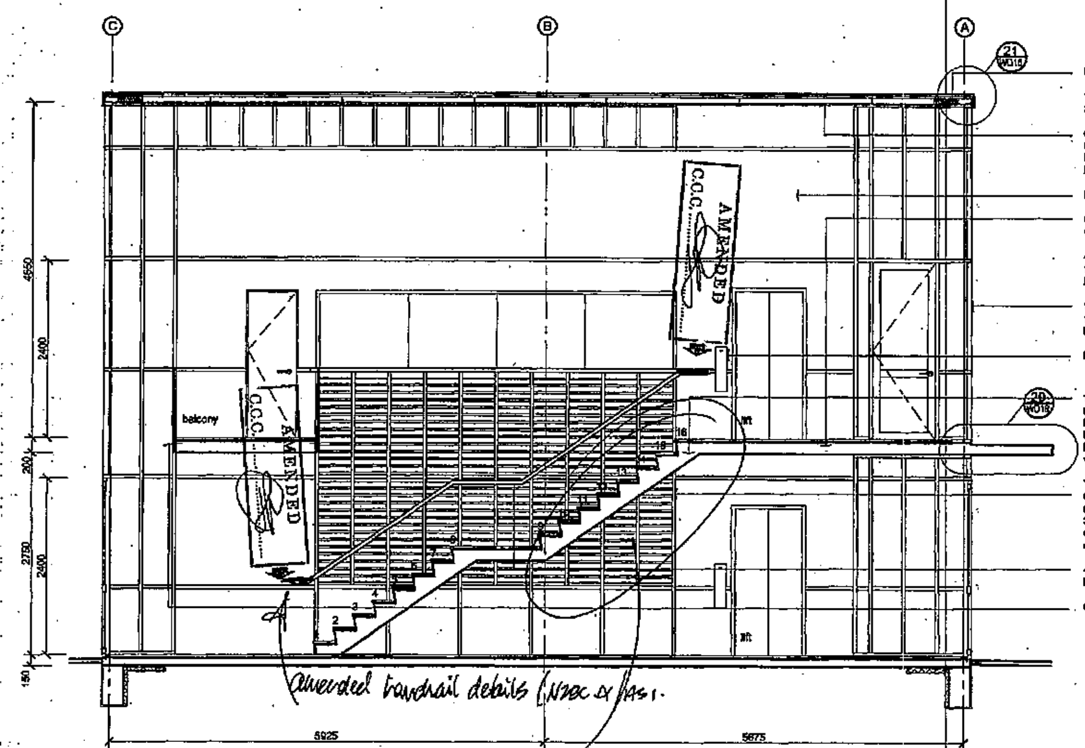
CITY DESIGN



Butynol roofing on 12mm CD ply substrate.

100x50 purlins @600crs to angle rafters @1.8m crs spanning across stair enclosure.

ex 75x25 timber feature acoustic ceiling, fixed @100crs to underside of purlins.
Fix planks over black felt.
Insulation to ceiling cavity to spec.

Keim paint finish to interior concrete walls.

Concrete first floor cast insitu over 100mm wide continuous timber shuttering to soffit. F6 finish to perimeter edges.

40mm zone for floor tiles and mortar bed to ground floor and first floors.
Return tiles over exposed concrete slab edges.

100mm shopfront suite atrium to specific design by aluminium window fabricator.
Mullions to support angle frame and roof over.

Lift control panel surface mounted - cast in conduit for wiring.

150mm minimum thickness concrete staircase, 284 going, 164 rise, 25 nosing. Line through with opening beyond.
F6 finish to edges and underside. 50mm gap at edge to wall and balustrade.
Floor tiles fixed on mortar bed to staircase treads. Finish flush with concrete edges.

Timber frame forms full height balustrade from Ground Floor.
6No ex100x50 posts @equal centres full height fixed via 12mm ms rod grouted to floor slab and timber.
3No ex 100x50 nogging, studs dowel jointed between.
ex 100x25 Louvre blades rebated to posts either side.
ex 250x75 rail to top, dowel jointed to posts.

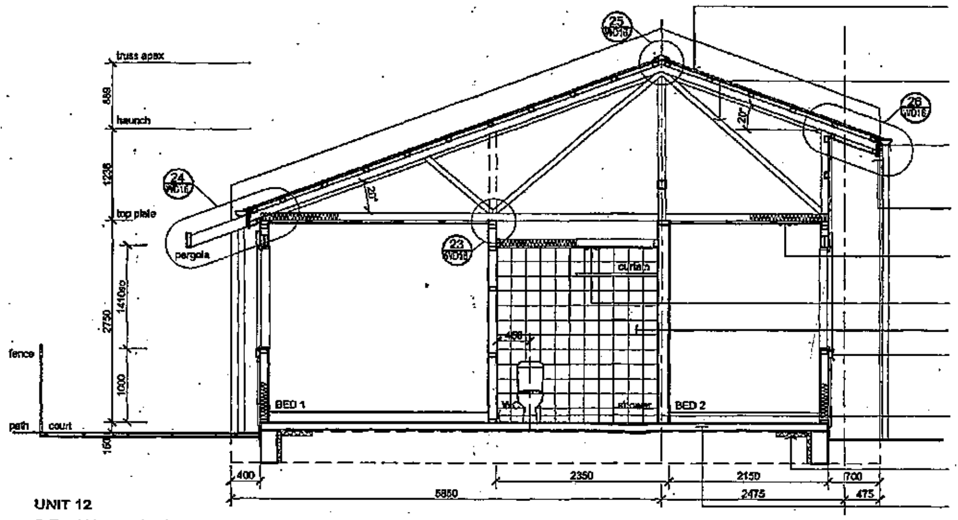
40mm NB galv ms handrail both sides of stair fixed via 12No brackets to balustrade / wall.

Galv ms balustrade to Gallery edges.

ATRIUM
SECTION C-C 1:50

Refer to structural dwgs for amended details (S13)

JK Q5LW/ms



G2z Colorsteel Zincalume Eurotray Roll Cap roof cladding. Fix over roofing underlay on 12mm CD grade Ecoply to manufacturers specifications. Colorsteel flashings to detail.

75x50 purlins @600mm centres on flat.

Purpose designed timber trusses @ approx 1050mm centres. Timber post / brace from partition wall to engineers details. Block between end truss for wall lining fixing. Note trusses to line through with rafters beyond.

125Ø half round copper spouting fixed on brass type2 brackets @600crs.
75Ø copper downpipes fixed via brass Holder Bat downpipe brackets.

225x40 H3 timber fascia - rebate for 7.5mm Ply soffit lining.

Insulation to specification.

9.5mm Gib ultraline fixed to Rondo steel ceiling battens @600crs.

9.5mm Gib aqualine ceiling to 100x50 ceiling joists in Bathroom areas. Block for sheet fixing.

Tiles fixed to precast concrete wall. Fall tiled floor to shower.

100x50 @600crs H1 exterior stud wall. Insulate cavity to spec. 3 layer plaster on galv steel lathe, on Building Paper over 4.5mm Hardibacker. Polystyrene head / sill former to detail.

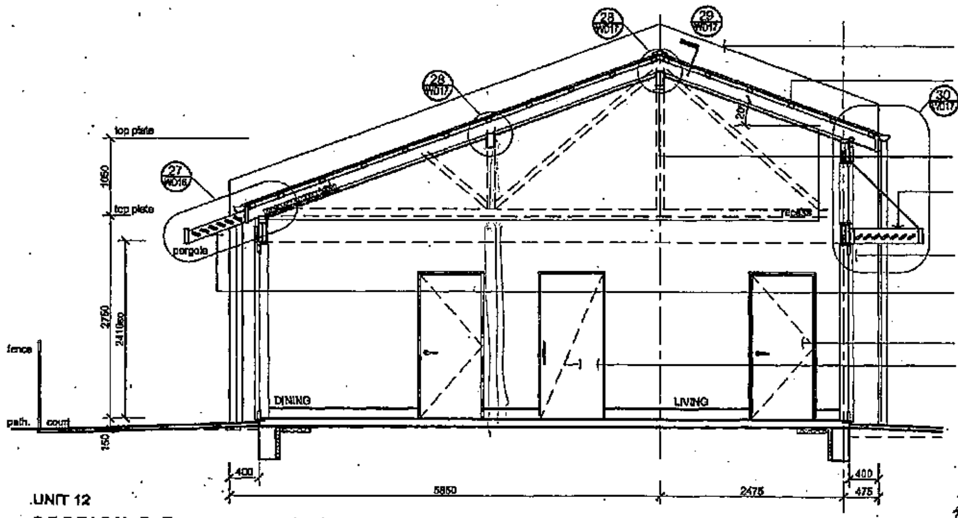
Untreated 100x50 @600crs stud walls to interior.
Interior wall linings generally 9.5mm gib to studs, and 9.5mm gib adhesive fixed directly to precast interior concrete walls.
9.5mm Gib Aqualine wall lining to bathroom / laundry.

50mm polystyrene insulation to perimeter of foundation wall.
10mm solid plaster over foundation wall.

100mm concrete slab on DPM.
Cast over concrete foundation walls to engineers details.

UNIT 12
SECTION E-E 1:50

9,15·9,05·5 / 9,9 =



150mm precast concrete panels to structural engineers details. Keim paint finish over Aquron 2000 waterproofing treatment.

75x50 purlins @600mm centres on flat.

150x50 rafters @900mm centres approx.

9.5mm gib ultraline fixed to Rondo steel battens @600crs.

Beams supported via joist hangers to 2No 100x50 posts fixed into first truss (dashed).

Cedar sunshade panels to detail.
100x20 blades sloped at 30°, rebated into shade rafters.
Support outside edge via 316 grade ss droppers each end to detail.

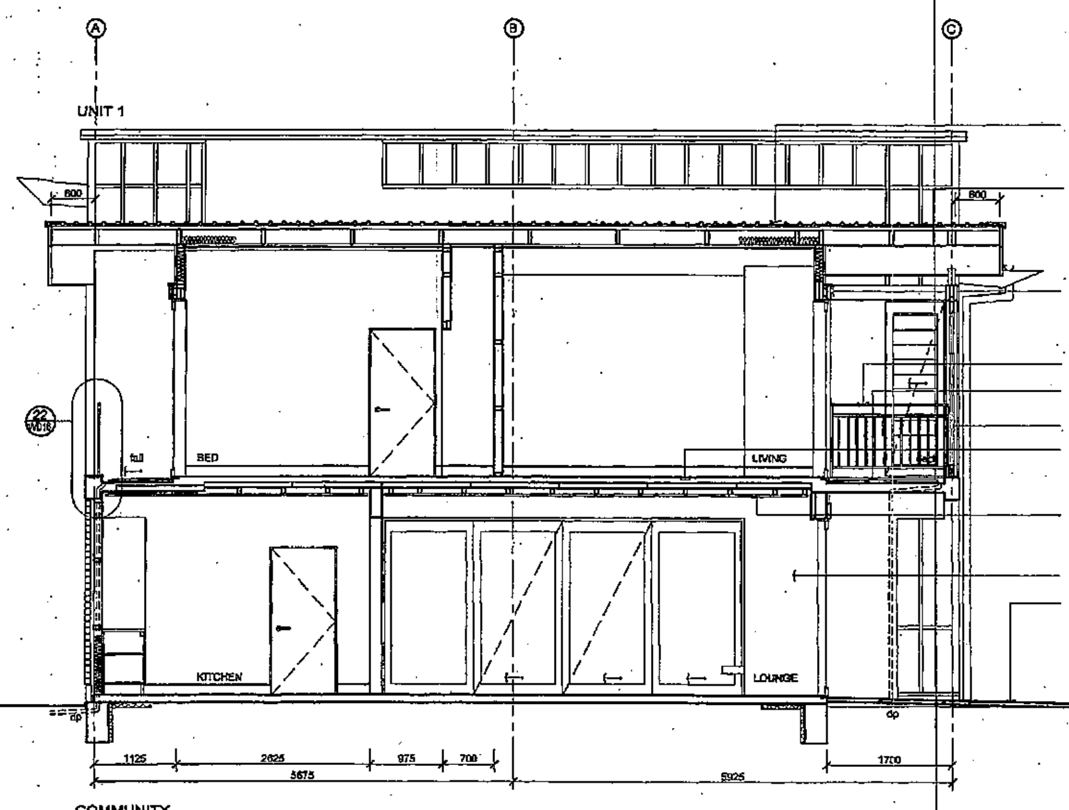
PPC 40mm grade aluminium windows / doors.

150x50 cedar rafters at centre and both ends support 200x50 pergola edge beam.
150x50 short cedar rafters fixed between beam and fascia.
100x20 blades over Dining area only, rebated into rafters.

Paint grade hollow core interior doors to schedule.

Cavity slider door to bathroom.

UNIT 12
SECTION F-F 1:50



Colorsteel G2x finished zincalume roofing - trimdeck profile. Fix over roofing underlay to 100x50 purlins on flat @1200crs max.

200x50 rafters @1200crs max.

7.5mm ply soffit lining and exterior wall lining above recess. Battens as elevated. Align joints from soffit to wall. Stain finish.

9.5mm gib Ultraline ceiling on Gib Rondo metal ceiling battens @600crs.

Internal & external stud walls generally 100x50 @600crs.
Walls above 3.0m 100x50 @480crs. H3
Exterior studs treated to H1. Insulate cavity to spec.
Pack exterior stud wall 50mm below 2.6m to form step.

3 layer plaster on galv steel lathe on Building Paper over 4.5mm Hardibacker. Polystyrene head to detail.

Galv steel balustrade - paint finish to spec.

Tiled deck on grout bed - fall to perimeter drain.
60mm UPVC downpipes concealed in precast concrete columns.

Cedar sliding window shades - fix on track gear to details.

75mm concrete topping on 75mm Unispans.
Perimeter deck cast insitu over 100mm wide continuous timber shuttering to soffit. F6 finish to downstand beam.
Aquron 2000 waterproofing treatment to all exterior concrete.

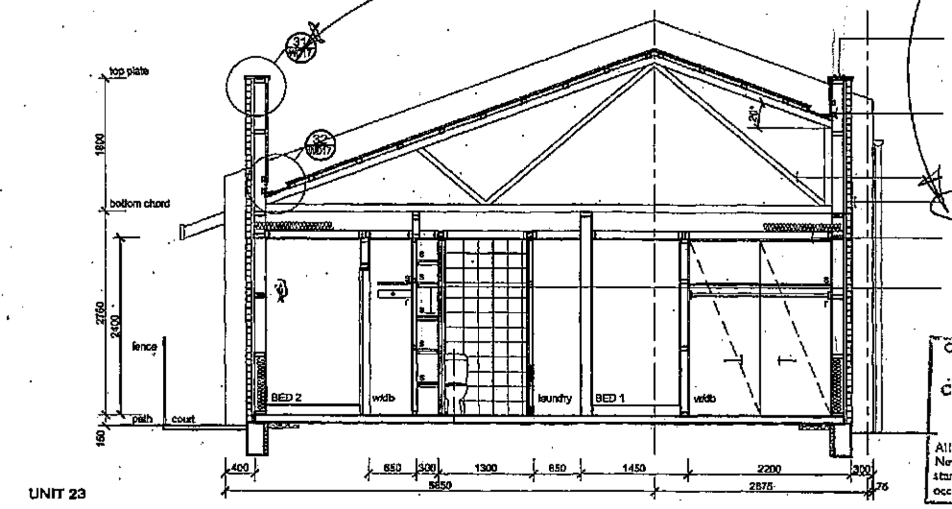
ex 100x25 timber feature ceiling beneath concrete slab to Community Kitchen, Lounge and Atrium.
Fix planks over black felt to 50x40 battens @600crs.
40mm insulation blanket to cavity.

Keim paint finish to interior concrete walls.

600x600 precast concrete paving slabs to courtyard.

COMMUNITY
SECTION D-D 1:50

Refer to amended details.



150x50 studs @400crs to parapet wall.

4.5mm Hardflex cladding to back face, ends of parapet wall.
Expressed joint finish.
Colorsteel cap to parapet wall apex.

Butynol internal guttering adhesive fixed to 12mm CD Ecoply.
Lap up roof 200mm min.
Wrap up wall 300mm min. and lap cladding over butynol 50mm min.

Trusses to similar profile - fix via joist hangers.

70 series brick exterior cladding fixed on shelf angles to Monier ABC system for 2 storey brick construction.

Form bulkhead over bedroom entry.
Sliding / bifolding doors on track gear set flush with ceiling lining to bedroom and laundry cupboards.

Slatted pine shelves to linen cupboard

Ensure contractor has a copy of Monier ABC 2 storey brick on site & Branz bulletin 381.

UNIT 23
SECTION G-G 1:50

CHRISTCHURCH CITY COUNCIL
CONSENT DOCUMENT
16 JUL 2000
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T E N D E R

#	revision	by	date
0	Tender documentation	CS	30/3/00

CHRISTCHURCH
CITY COUNCIL · CITY DESIGN

COMMON GROUND

541 Parnell Road, PO Box 37 828, Parnell, Auckland, New Zealand
Ph 64 09 377 9936, Fax 64 09 377 9938

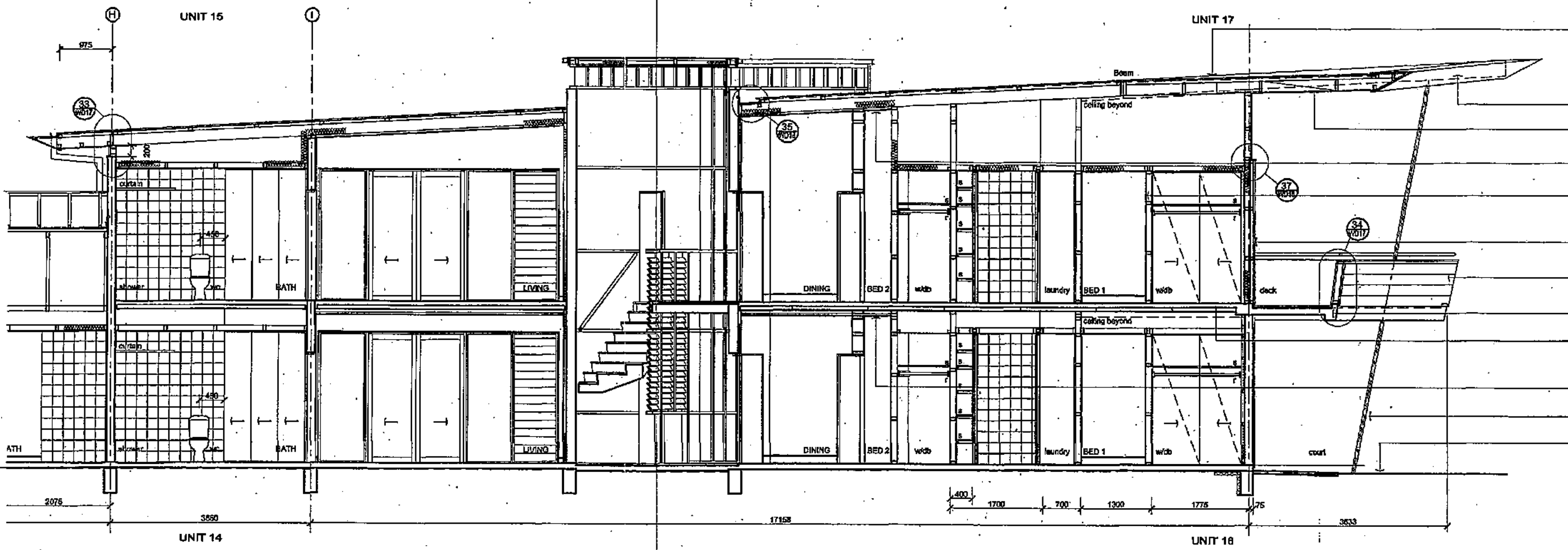
HOUSING PROJECT OF
H O R N B Y
For: Christchurch City Council

designed	J.L., H.K.S., O.S.	MARCH 2000
drawn	C.S.	MARCH 2000
dsg. check		
dwg check		
indexed	sd017511	30/3/00
approved		/ /

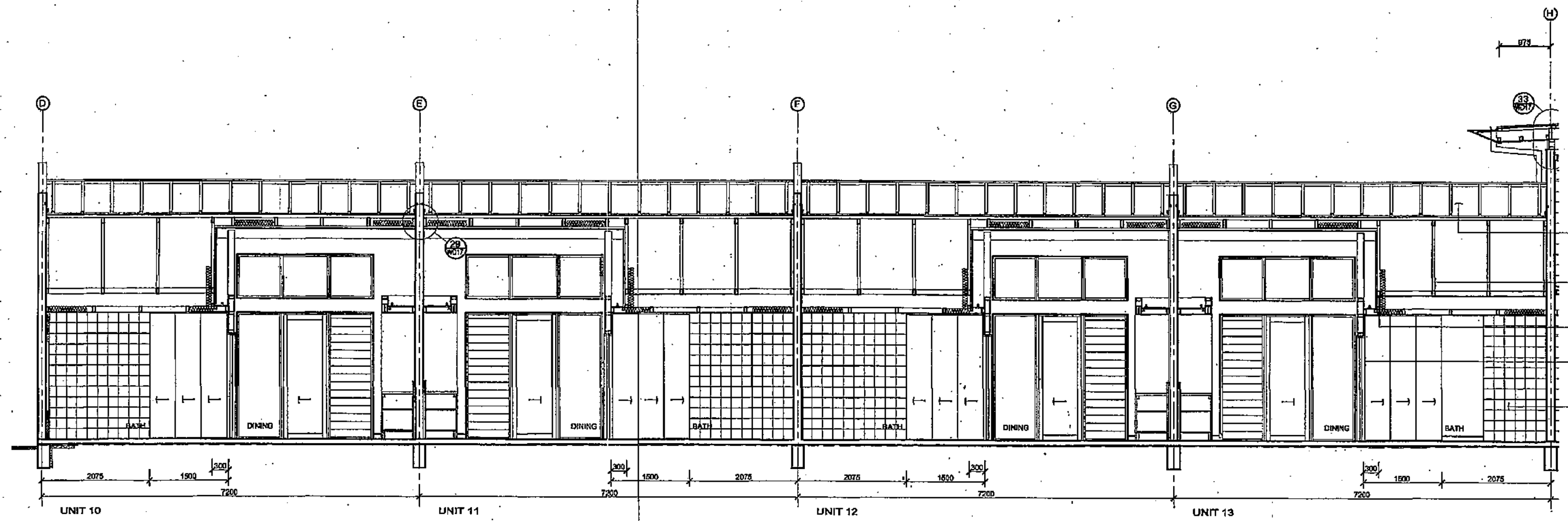
CROSS SECTIONS

scale	1:50
contract	98/2000-321
sheet	WD11.

rev. 0



SECTION H-H 1:50
PART ONE



SECTION H-H 1:50
PART TWO

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10 JUL 2000
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TENDER

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541 Parnell Road, PO Box 37 828, Parnell,
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Ph 64 09 377 9936, Fax 64 09 377 9938

HOUSING PROJECT OF HORNBY

For: Christchurch City Council

designed	J.L., H.K.B., C.S.	MARCH 2000
drawn	C.S.	MARCH 2000
dsg. check		
dwg check		
indexed	ed011512	30/3/00
approved		/ /

CROSS SECTIONS

scale	1:50	rev.
contract	99/2000-321	
sheet	WD12	0

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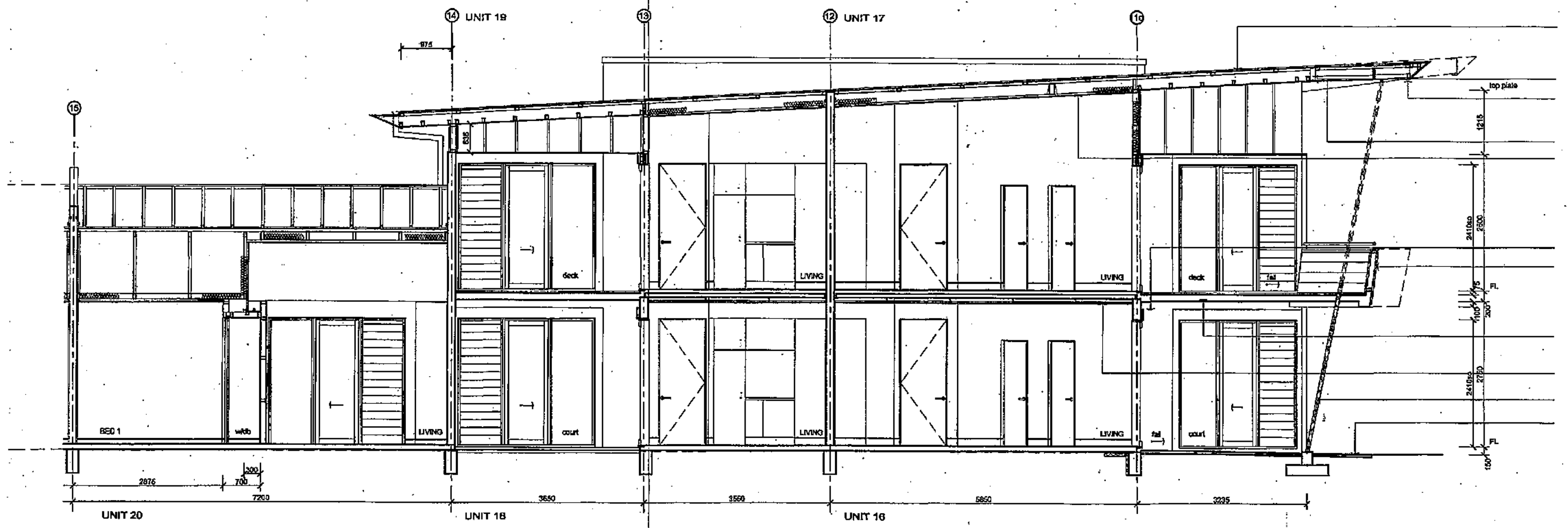
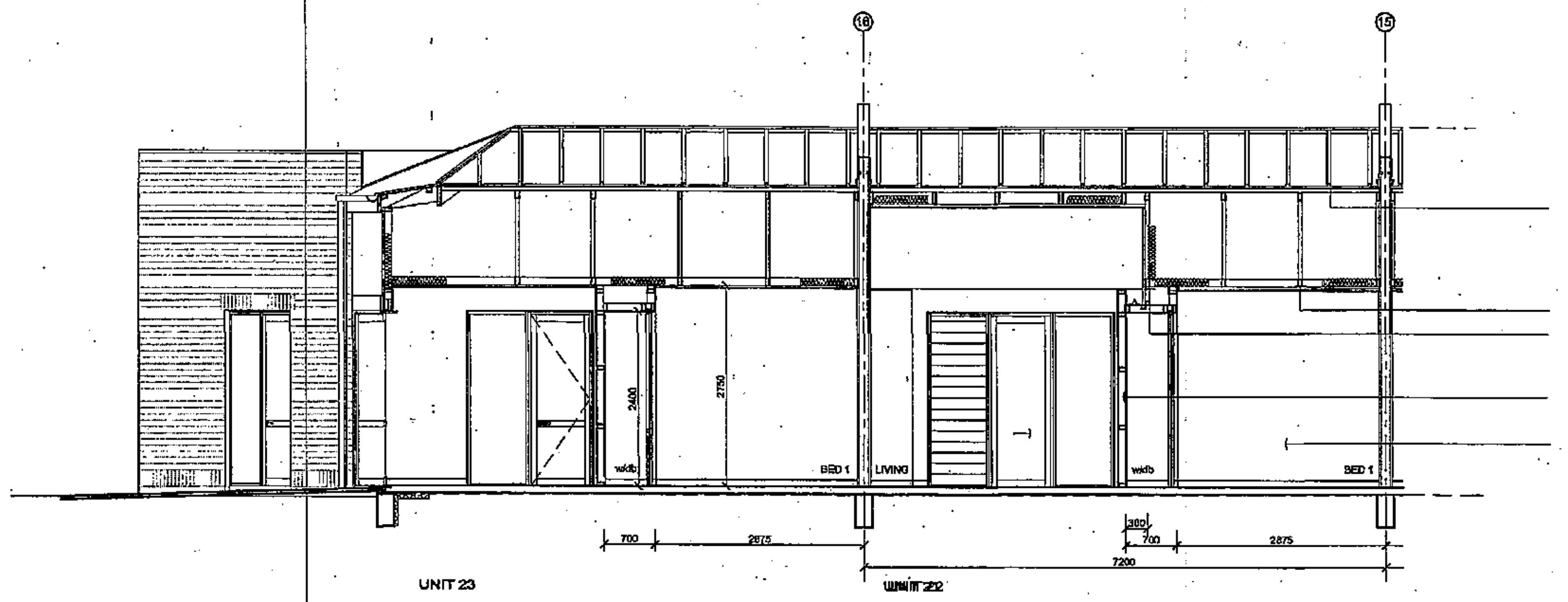


SECTION I-I 1:50
PART ONE

TENDER

0	Tender documentation	CS	30/3/00
#	revision	by	date

CHRISTCHURCH
CITY COUNCIL · CITY DESIGN



SECTION I-I 1:50
PART TWO

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CONSENT DOCUMENT
18 JUL 2000
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HORNBY
For:Christchurch City Council

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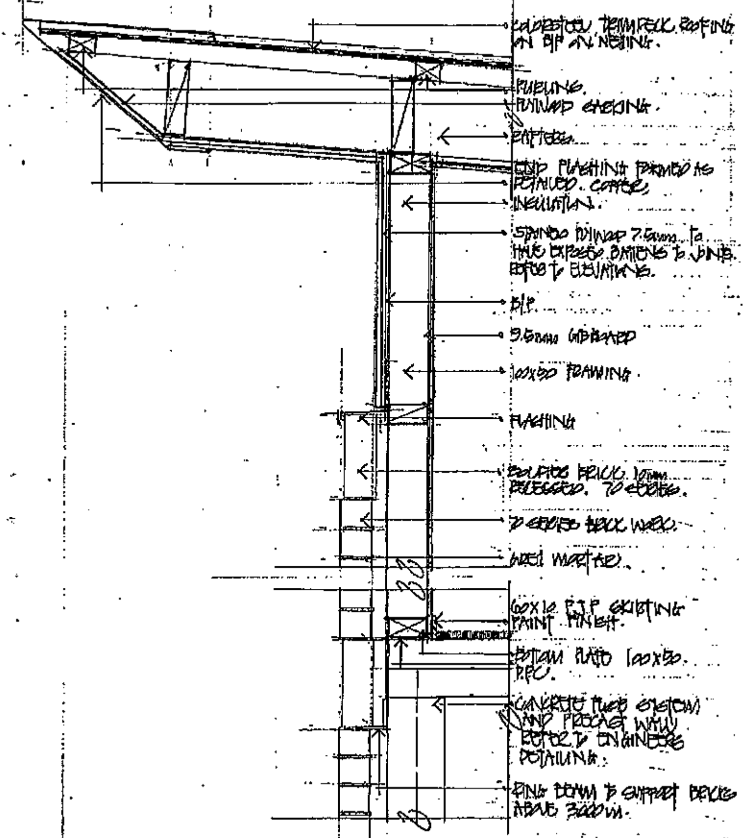
drawn	C.S.	MARCH 2000
dsg. check		
dwg check		
indexed	sd017513	30/3/00
approved		/ /

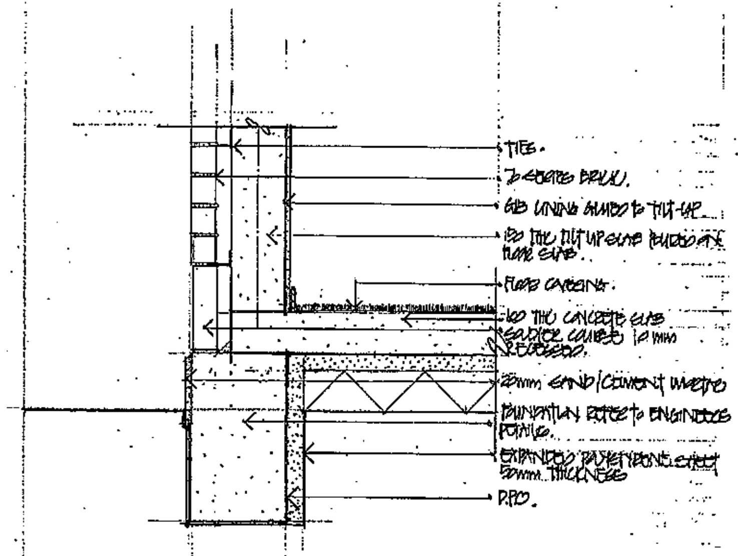
CROSS SECTIONS

scale	1:50
contract	09/2000-321
sheet	WD13

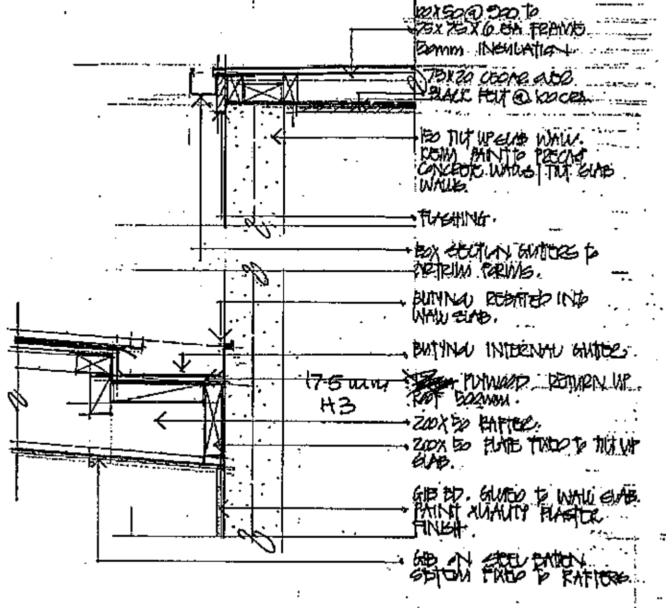
rev. 0



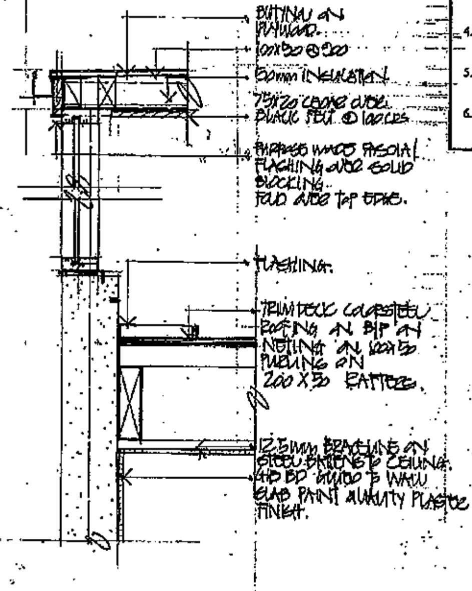
1,2 WD 10	EAVE SOFFIT VENEER DETAIL



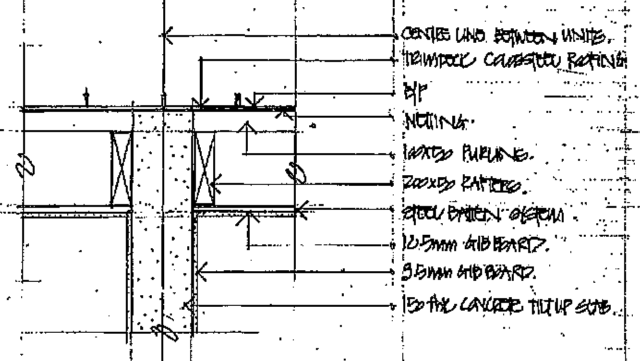
03 WD 10	BRICK VENEER FOOTING



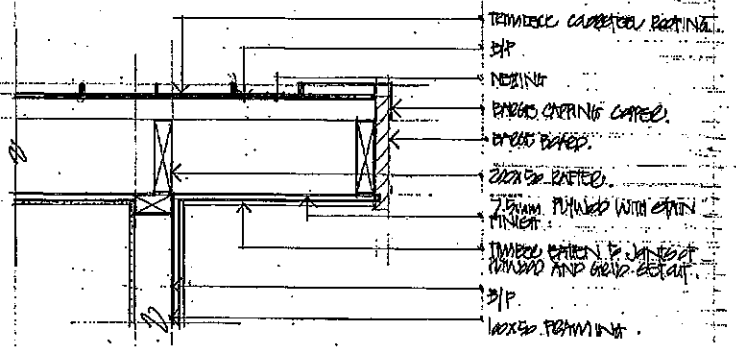
4,5 WD 10	ROOF EAVE INTERNAL GUTTER



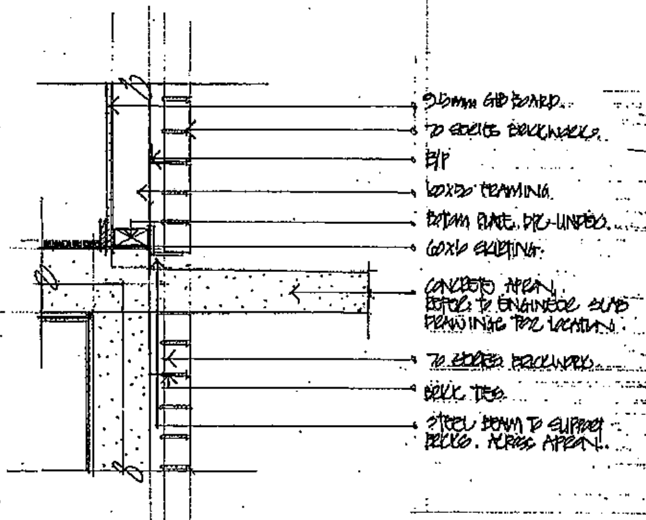
6,7 WD 10	ROOF EAVE



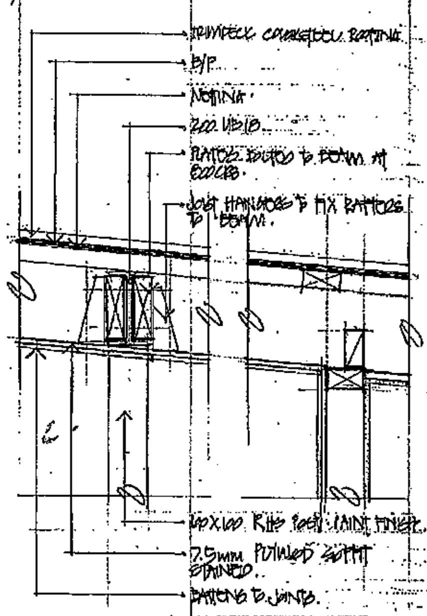
08 WD 10	ROOF TILT SLAB WALL JUNCTION



09 WD 10	BARGE DETAIL



10 WD 10	BRICKWORK / APRON



11 WD 10	CORRIDOR ROOF

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CHRISTCHURCH
THE GARDEN CITY

COMMON GROUND

541 Parnell Road, PO Box 37 828, Parnell, Auckland, New Zealand
Ph 64 09 377 9936, Fax 64 09 377 9938

HOUSING PROJECT OF
HORNBY
For Christchurch City Council

CHRISTCHURCH CITY COUNCIL
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10 JUL 2000
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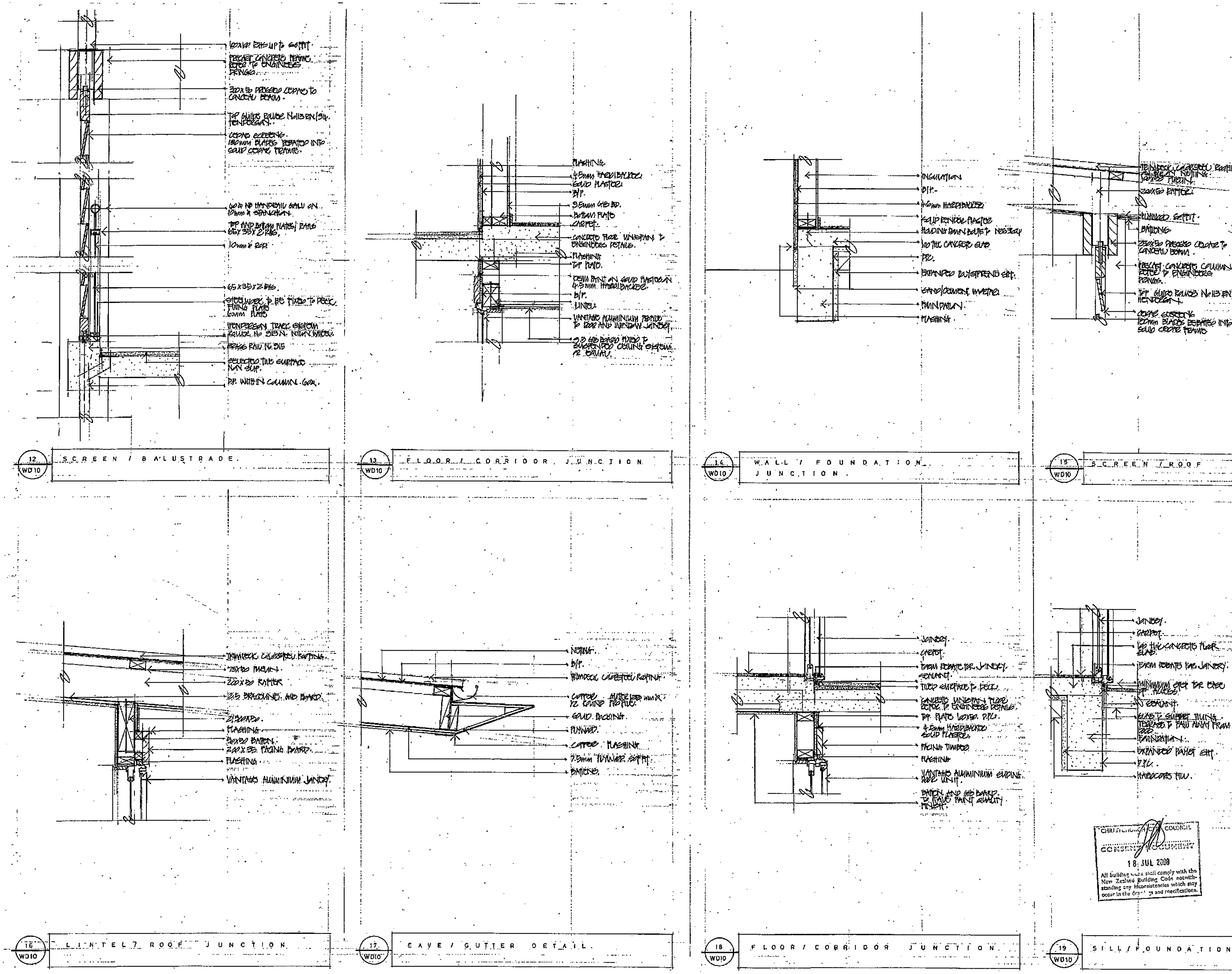
DETAILS

scale	1 : 10	rev.
contract		
sheet	WD 14	△
designed	H.K.B. C.S.	03 2000
drawn	H.K.B.	03 2000
dwg check		
dwg check		
indexed		
approved		/ /



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DETAILS

scale	1 : 10.	rev.
contract		
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designed	H.K.B. C.S	03 2000
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dwg check		
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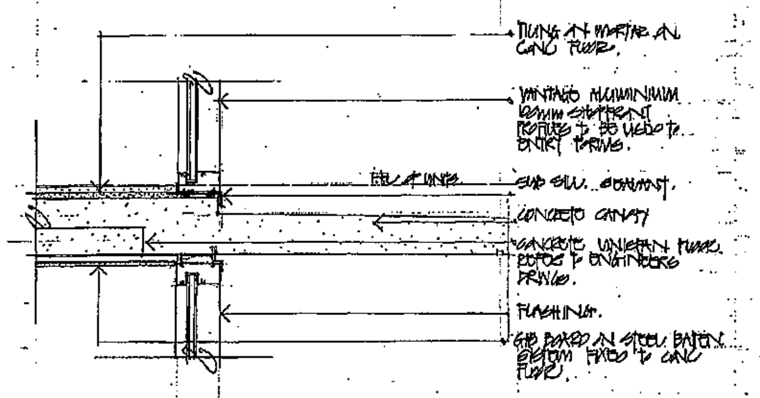
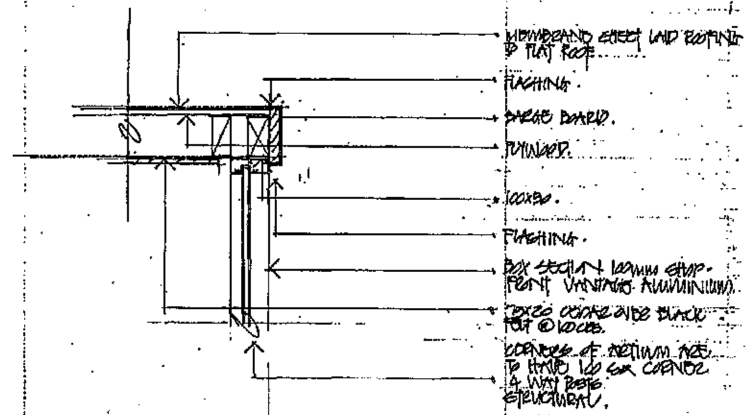
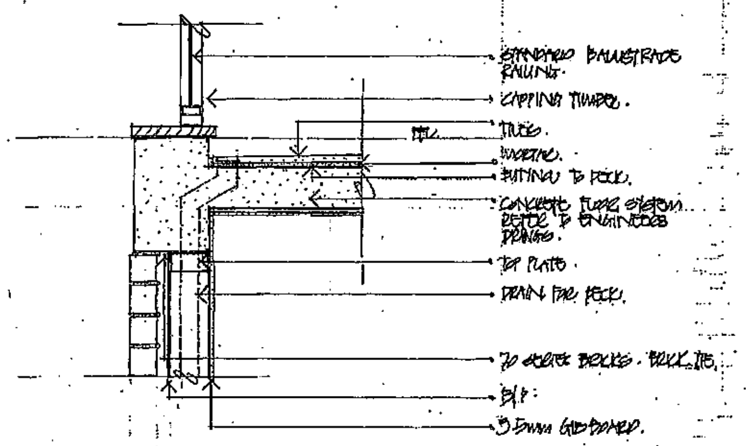


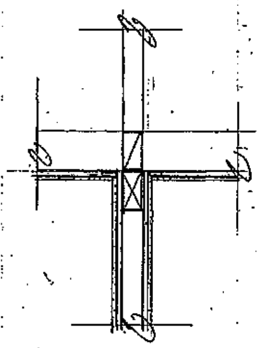
20 WD 11 ENTRY CANOPY. JOINERY JUNCTION



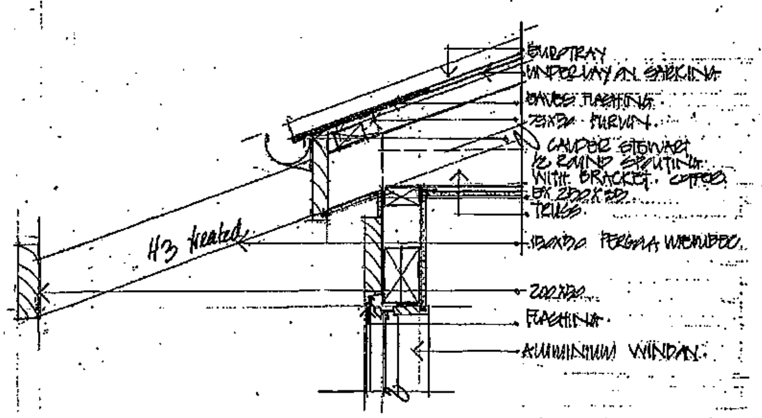
21 WD 11 EAVE DETAIL



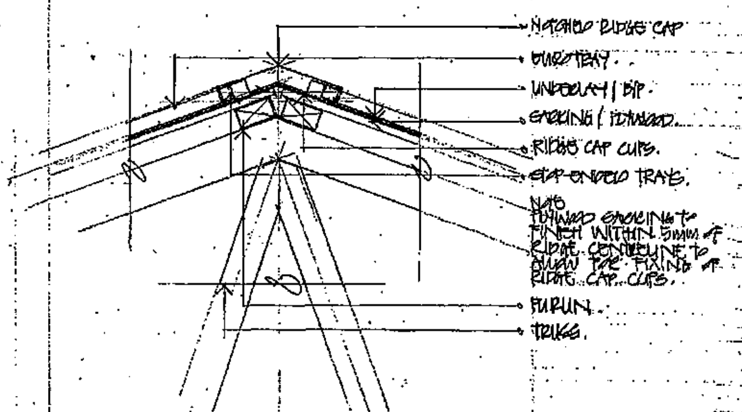
22 WD 11 DECK VENEER JUNCTION



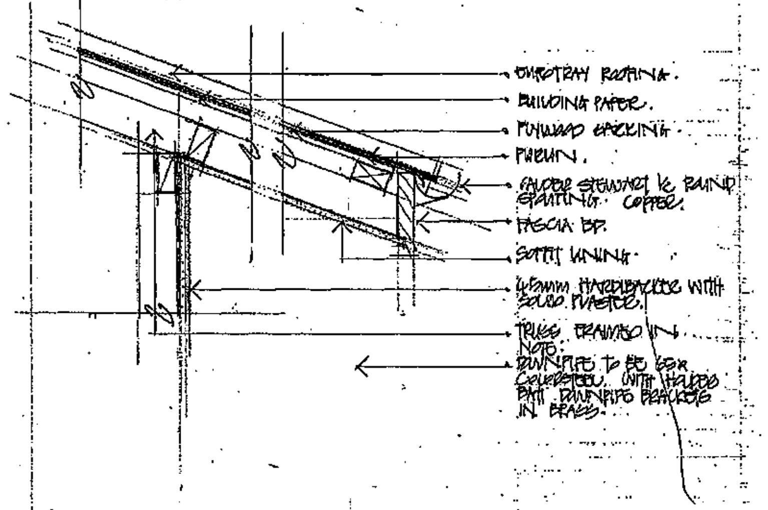
23 WD 11 WALL CEILING JUNCTION.



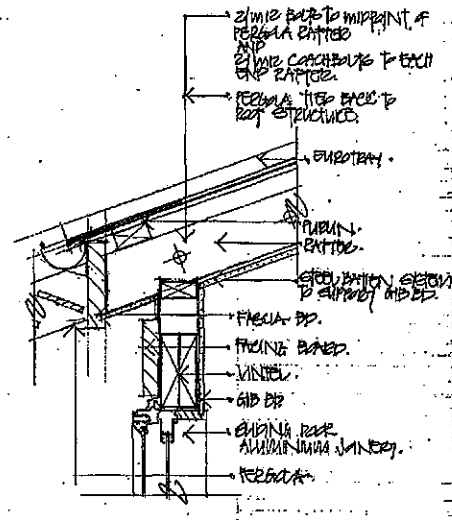
24 WD 11 PERGOLA EAVE.



25 WD 11 RIDGE DETAIL



26 WD 11 EAVE DETAIL.



27 WD 11 EAVE DETAIL

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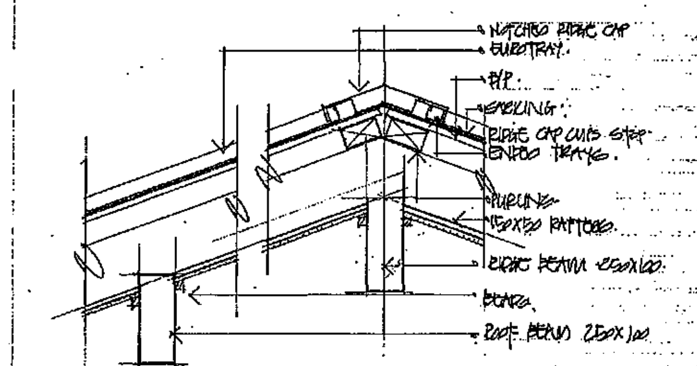
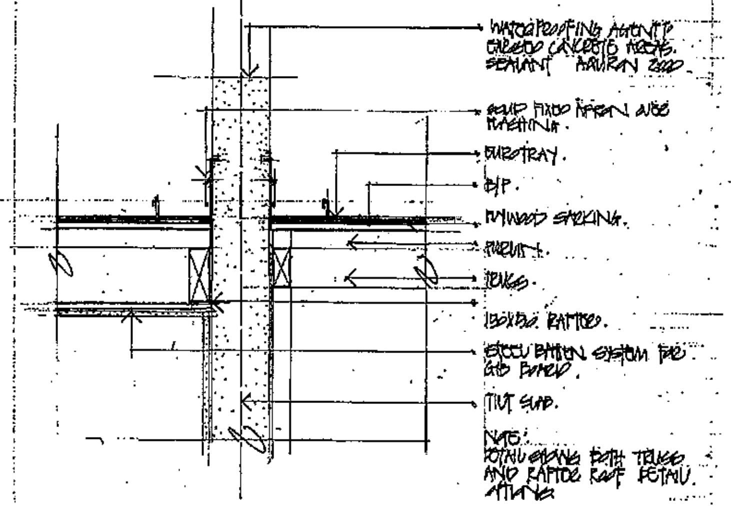
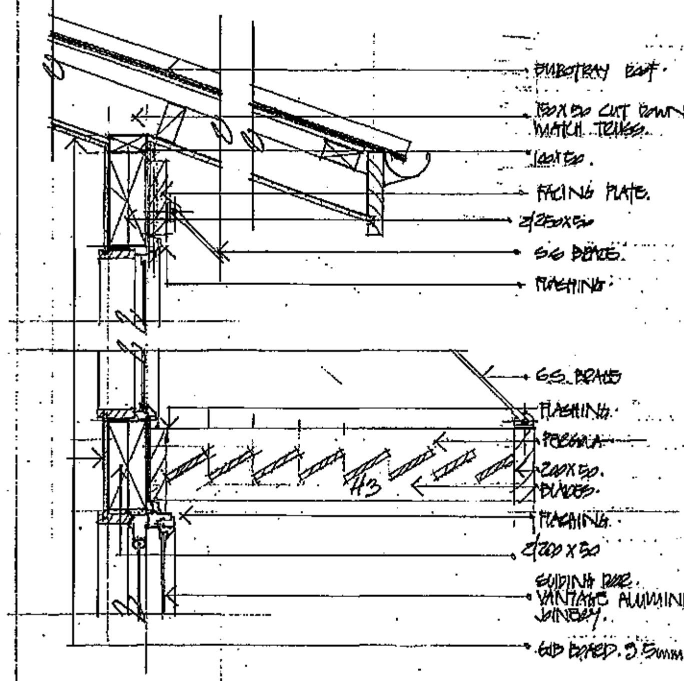


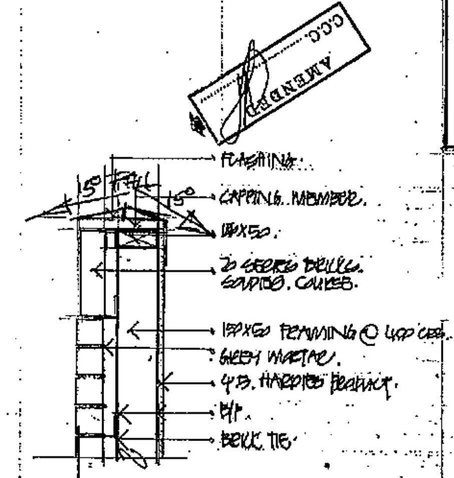
28 WD11 — ROOF BEAM DETAILS



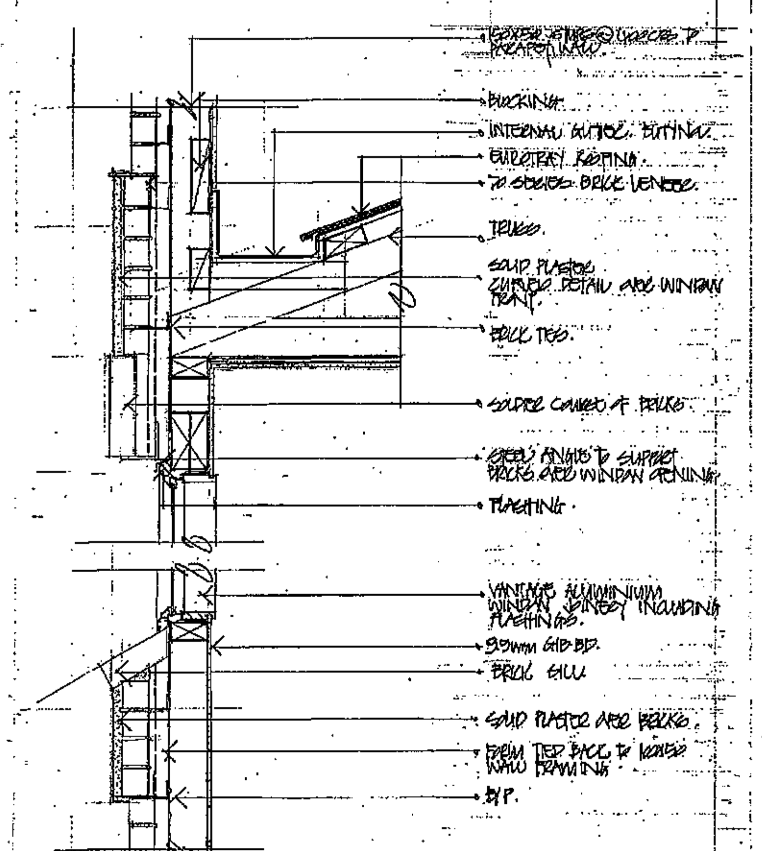
29 WD11 — TILT SLAB HEAD



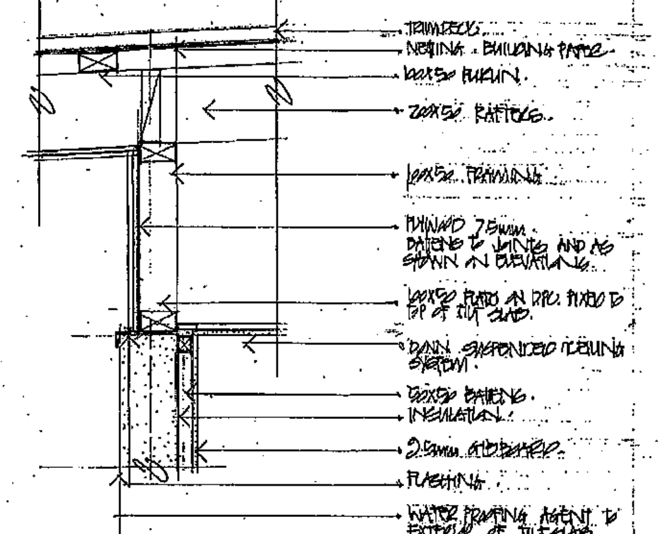
30 WD11 — EAVE PERGOLA



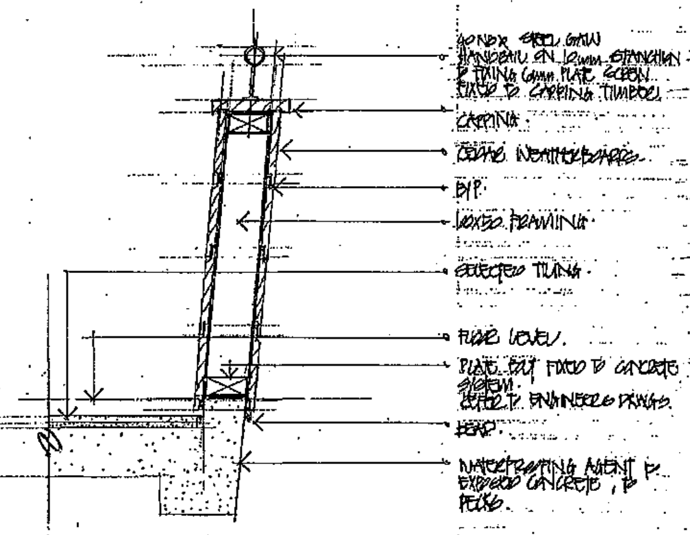
31 WD11 — PARAPET



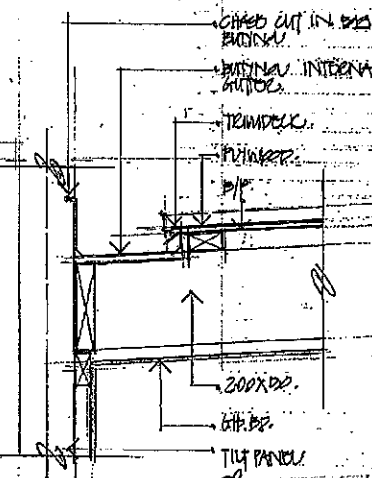
32 WD11 — WINDOW / VENEER DETAIL



33 WD12 — WALL EAVE DETAIL



34 WD12 — ROOF BEAM DETAIL



35 WD12 — BALUSTRADE

NOTES

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AMENDED C.C.C.

revision	by	date

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D E T A I L S

17

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contract		
sheet	WD - 17.	rev. △
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Appendix C

CERA Building Evaluation Form

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name:	Hornby Courts Block B	Reviewer:	Stephen Lee
	Unit / No: / Street	CPEng No:	1006840
Building Address:	10 to 22 / 2 / Goulding Avenue	Company:	GHD
Legal Description:	Lot 1, DP425517	Company project number:	513059620
		Company phone number:	(03) 3780900
	Degrees / Min / Sec		
GPS south:	172 / 31 / 18.02	Date of submission:	31/05/2013
GPS east:	-43 / 32 / 38.81	Inspection Date:	18/01/2012
		Revision:	Final V1.0
Building Unique Identifier (CCC):	PRO 1580-002	Is there a full report with this summary?	yes

Site

Site slope:	flat	Max retaining height (m):	0
Soil type:	sandy silt	Soil Profile (if available):	
Site Class (to NZS1170.5):	D		
Proximity to waterway (m, if <100m):		If Ground improvement on site, describe:	None
Proximity to clifftop (m, if < 100m):			
Proximity to cliff base (m,if <100m):		Approx site elevation (m):	30.00

Building

No. of storeys above ground:	2	single storey = 1	Ground floor elevation (Absolute) (m):	30.00
Ground floor split?	yes		Ground floor elevation above ground (m):	0.20
Storeys below ground	0			
Foundation type:	mat slab		if Foundation type is other, describe:	
Building height (m):	7.00		height from ground to level of uppermost seismic mass (for IEP only) (m):	4
Floor footprint area (approx):	900			
Age of Building (years):	11		Date of design:	1992-2004
Strengthening present?	no		If so, when (year)?	
			And what load level (%g)?	
Use (ground floor):	multi-unit residential		Brief strengthening description:	
Use (upper floors):	multi-unit residential			
Use notes (if required):	Residential			
Importance level (to NZS1170.5):	IL2			

<u>Gravity Structure</u>

Gravity System:	load bearing walls		
Roof:	timber framed	rafter type, purlin type and cladding	Lightweight metal cladding, timber rafters on timber purlins.
Floors:	concrete flat slab	slab thickness (mm)	200
Beams:	none	overall depth x width (mm x mm)	
Columns:	load bearing walls	typical dimensions (mm x mm)	150
Walls:	load bearing concrete	#N/A	

Lateral load resisting structure

Lateral system along:	concrete shear wall		**Note: Define along and across in detailed report!**	note total length of wall at ground (m):	140
Ductility assumed, μ:	2.00			wall thickness (m):	0.15
Period along:	0.40	0.00	from parameters in sheet	estimate or calculation?	estimated
Total deflection (ULS) (mm):				estimate or calculation?	
maximum interstorey deflection (ULS) (mm):				estimate or calculation?	
Lateral system across:	concrete shear wall			note total length of wall at ground (m):	158
Ductility assumed, μ:	2.00			wall thickness (m):	0.15
Period across:	0.40	0.00	from parameters in sheet	estimate or calculation?	estimated
Total deflection (ULS) (mm):				estimate or calculation?	
maximum interstorey deflection (ULS) (mm):				estimate or calculation?	

Separations:

north (mm):		leave blank if not relevant
east (mm):		
south (mm):		
west (mm):		

Non-structural elements

Stairs:	precast, full flight	describe supports	
Wall cladding:	brick or tile	describe (note cavity if exists)	Brick cladding on precast R.C. panels.
Roof Cladding:	Metal	describe	Lightweight metal
Glazing:	aluminium frames		
Ceilings:	plaster, fixed		
Services(list):			

Available documentation

Architectural	none	original designer name/date	
Structural	none	original designer name/date	
Mechanical	none	original designer name/date	
Electrical	none	original designer name/date	
Geotech report	none	original designer name/date	

Damage

Site:

(refer DEE Table 4-2)

Site performance:	Good	Describe damage:	
Settlement:	none observed	notes (if applicable):	
Differential settlement:	none observed	notes (if applicable):	
Liquefaction:	none apparent	notes (if applicable):	
Lateral Spread:	none apparent	notes (if applicable):	
Differential lateral spread:	none apparent	notes (if applicable):	
Ground cracks:	none apparent	notes (if applicable):	
Damage to area:	none apparent	notes (if applicable):	

Building:

Current Placard Status:	green		
Along Damage ratio:	0%	Describe how damage ratio arrived at:	
Describe (summary):	Insignificant		
Across Damage ratio:	0%		
Describe (summary):	Insignificant		
Diaphragms Damage?:	no	Describe:	
CSWs: Damage?:	no	Describe:	
Pounding: Damage?:	no	Describe:	
Non-structural: Damage?:	yes	Describe:	Minor cracking to plasterboard linings.

$$Damage\_Ratio = \frac{(\%NBS\,(before) - \%NBS\,(after))}{\%NBS\,(before)}$$

Recommendations

Level of repair/strengthening required:	minor non-structural		Describe:	
Building Consent required:	no		Describe:	
Interim occupancy recommendations:	full occupancy		Describe:	
Along Assessed %NBS before:	100%	##### %NBS from IEP below	If IEP not used, please detail assessment methodology:	Quantitative Assessment
Assessed %NBS after:	100%			
Across Assessed %NBS before:	100%	##### %NBS from IEP below		
Assessed %NBS after:	100%			

IEP **Use of this method is not mandatory - more detailed analysis may give a different answer, which would take precedence. Do not fill in fields if not using IEP.**

Period of design of building (from above): 1992-2004

h_n from above: 4m

Seismic Zone, if designed between 1965 and 1992:

not required for this age of building

Design Soil type from NZS4203:1992, cl 4.6.2.2: b) Intermediate

	along	across
Period (from above):	0.4	0.4
(%NBS)nom from Fig 3.3:		

Note:1 for specifically design public buildings, to the code of the day: pre-1965 = 1.25; 1965-1976, Zone A =1.33; 1965-1976, Zone B = 1.2; all else 1.0

Note 2: for RC buildings designed between 1976-1984, use 1.2

Note 3: for buildngs designed prior to 1935 use 0.8, except in Wellington (1.0)

	along	across
Final $(\%NBS)_{nom}$:	**0%**	**0%**

2.2 Near Fault Scaling Factor

Near Fault scaling factor, from NZS1170.5, cl 3.1.6:

	along	across
Near Fault scaling factor (1/N(T,D), **Factor A**:	#DIV/0!	#DIV/0!

2.3 Hazard Scaling Factor

Hazard factor Z for site from AS1170.5, Table 3.3:

Z_{1992}, from NZS4203:1992

Hazard scaling factor, **Factor B:** #DIV/0!

2.4 Return Period Scaling Factor

Building Importance level (from above):
Return Period Scaling factor from Table 3.1, **Factor C**:

2.5 Ductility Scaling Factor

	along	across
Assessed ductility (less than max in Table 3.2)		
Ductility scaling factor: =1 from 1976 onwards; or =kμ, if pre-1976, fromTable 3.3:		
Ductiity Scaling Factor, **Factor D**:	1.00	1.00

2.6 Structural Performance Scaling Factor:

Sp:		
Structural Performance Scaling Factor **Factor E**:	#DIV/0!	#DIV/0!

2.7 Baseline %NBS, $(NBS\%)_b = (\%NBS)_{nom}$ x A x B x C x D x E

$\%NBS_b$: **#DIV/0!** **#DIV/0!**

Global Critical Structural Weaknesses: (refer to NZSEE IEP Table 3.4)

3.1. Plan Irregularity, factor A: 1

3.2. Vertical irregularity, Factor B: 1

3.3. Short columns, Factor C: 1

3.4. Pounding potential

Pounding effect D1, from Table to right
Height Difference effect D2, from Table to right

Therefore, Factor D: 0

3.5. Site Characteristics 1

Table for selection of D1	Severe	Significant	Insignificant/none
Separation	0<sep<.005H	.005<sep<.01H	Sep>.01H
Alignment of floors within 20% of H	**0.7**	**0.8**	**1**
Alignment of floors not within 20% of H	**0.4**	**0.7**	**0.8**

Table for Selection of D2	Severe	Significant	Insignificant/none
Separation	0<sep<.005H	.005<sep<.01H	Sep>.01H
Height difference > 4 storeys	0.4	0.7	1
Height difference 2 to 4 storeys	0.7	0.9	1
Height difference < 2 storeys	1	1	1

3.6. Other factors, Factor F

	Along	Across
For ≤ 3 storeys, max value =2.5, otherwise max valule =1.5, no minimum		
Rationale for choice of F factor, if not 1		

Detail Critical Structural Weaknesses: (refer to DEE Procedure section 6)
List any: Refer also section 6.3.1 of DEE for discussion of F factor modification for other critical structural weaknesses

3.7. Overall Performance Achievement ratio (PAR) **0.00** **0.00**

4.3 PAR x (%NBS)b: PAR x Baselline %NBS: **#DIV/0!** **#DIV/0!**

4.4 Percentage New Building Standard (%NBS), (before) **#DIV/0!**

GHD

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
Draft	M. Hrnjak	S. Lee		N. Waddington		1/8/12
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V1.0	E. He	H. Mackinven		N. Waddington		31/5/13