

City Care Milton Street Depot – Tyre Bay Detailed Engineering Evaluation BU 1141-011 EQ2 Quantitative Report

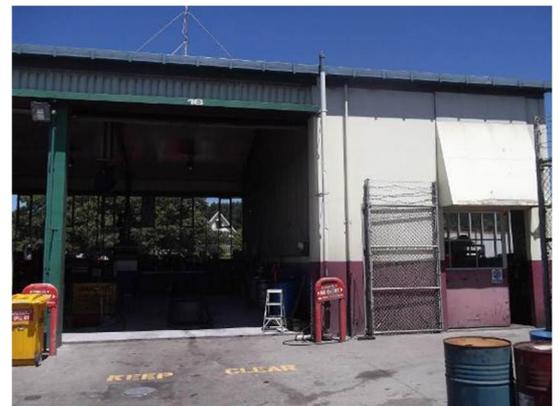
Prepared for Christchurch City Council (Client)

By Beca Carter Hollings & Ferner Ltd (Beca)

14 June 2013

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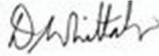
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Revision History

Revision N°	Prepared By	Description	Date
A	George El Haddad	Draft for CCC review	1 March 2013
B	Laura Chen	Final	14 June 2013

Document Acceptance

Action	Name	Signed	Date
Prepared by	George El Haddad		14 June 2013
Reviewed by	Nicholas Charman		14 June 2013
Approved by	David Whittaker		14 June 2013
on behalf of	Beca Carter Hollings & Ferner Ltd		

City Care Milton Street Depot- Tyre Bay BU 1141-011 EQ2

Detailed Engineering Evaluation Quantitative Report – SUMMARY

Version 1

Address

245 Milton Street
Sydenham
Christchurch



Background

This is a summary of the Quantitative Assessment report for the building structure, and is based on the document 'Guidance on Detailed Engineering Evaluation of Earthquake Affected Non-residential Buildings in Canterbury – Part 2 Evaluation Procedure' (draft) issued by the Engineering Advisory Group (EAG) on 19 July 2011.

A Qualitative Assessment report for the Tyre Bay was issued to CCC on 22 June 2012

The Tyre Bay is located at the City Care Milton St Depot at 245 Milton Street, Sydenham, Christchurch. It is part of the same building which also encompasses the Plant Maintenance Workshop Part 1 and Part 2 (BU 1141-002 EQ2) and consists of steel portal frames with precast concrete shear walls. The structural drawings available indicate the Plant Maintenance Workshop and Tyre Bay were designed in 1979. Calculations have been undertaken as part of the Quantitative Assessment.

Key Damage Observed

Visual inspection on 8 February 2012 indicates the building has suffered only minor damage. Key damage observed include:

- n Cracking of the sealant in the vertical movement joints between concrete panels
- n Horizontal cracking to concrete shear walls

Critical Structural Weaknesses (CSW)

The following Critical Structural Weakness has been identified:

- n Site characteristics due to liquefaction occurring on the Milton St site.

Indicative Building Strength (from Detailed Assessment)

The building has been assessed to have a seismic capacity of 35%NBS, using the New Zealand Society for Earthquake Engineering (NZSEE) Detailed Assessment guideline 'Assessment and

Improvement of the Structural Performance of Buildings in Earthquakes' (AISPBE), 2006. The Tyre Bay is therefore Earthquake Risk and classified as Seismic Grade C.

The structural damage observed is predominantly minor and the seismic capacity is not considered to have materially diminished from its pre-earthquake level.

Our assessment has identified the structural components that have governed/limited the building's seismic performance, and their potential failure mechanisms, are as follows:

- n Overturning capacity of the precast shear walls and foundation achieves 35%NBS under longitudinal (in-plane) loading.
- n RHS door header (tie member) connections under longitudinal (in-plane) loading achieve 36%NBS.
- n Eaves channel (tie member) connections under longitudinal (in-plane) loading achieve 38%NBS.

Recommendations

In order that the owner can make an informed decision about the on-going use and occupancy of their building the following information is presented in line with the Department of Building and Housing document 'Guidance for engineers assessing the seismic performance of non-residential and multi-unit residential buildings in greater Christchurch', June 2012.

The building is considered to be earthquake risk, having an assessed capacity of between 34% and 67% NBS. The risk of collapse of an earthquake risk building is considered to be 5 to 10 times greater than that of an equivalent new building.

No significant damage or hazards were identified to the seismic or gravity load resisting system that would reduce its ability to resist further loads and therefore no restrictions on use or occupancy are recommended.

It is recommended that:

- n A level survey could be carried out to determine the extent of settlement of the building for insurance purposes.
- n According to the recent CCC Instructions to Engineers document (16 October 2012), Council's insurance provides for repairing damaged elements to a condition substantially as new. We suggest you consult further with your insurance advisor.

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1 Background

Beca Carter Hollings & Ferner Ltd (Beca) has been engaged by Christchurch City Council (CCC) to undertake a Quantitative Detailed Engineering Evaluation (DEE) of the Tyre Bay building located at 245 Milton Street, Sydenham, Christchurch.

This report is a Quantitative Assessment of the building structure, and is based on the document 'Guidance on Detailed Engineering Evaluation of Earthquake Affected Non-residential Buildings in Canterbury – Part 2 Evaluation Procedure' (draft) issued by the Engineering Advisory Group (EAG) on 19 July 2011.

A quantitative assessment involves analytical calculations of the building's strength and may involve material testing, geotechnical testing and intrusive investigation. The qualitative assessment previously carried out involved inspections of the building, a desktop review of existing structural and geotechnical information, including existing drawings and calculations, if available and an assessment of the level of seismic capacity against current code using the Initial Evaluation Procedure (IEP).

The purpose of these assessments is to determine the likely building performance and damage patterns, to identify any potential Critical Structural Weaknesses (CSW) or collapse hazards, and to make an assessment of the likely building strength in terms of percentage of New Building Standard (%NBS).

A full set of structural drawings was made available and has been used in our assessment of the building. The building description below is based on a review of the drawings and our visual inspections.

The format and content of this report follows a template provided by CCC, which is based on the EAG document.

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 understood that CERA is adopting the Detailed Engineering Evaluation Procedure document (draft) issued by the Engineering Advisory Group on 19 July 2011, which sets out a methodology for both qualitative and quantitative assessments. We understand this report will be used in response to CERA Section 51.

The qualitative assessment includes a thorough visual inspection of the building coupled with a desktop review of available documentation such as drawings, specifications and IEP's. The quantitative assessment involves analytical calculation of the building's 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:

- n The importance level and occupancy of the building
- n The placard status that was assigned during the state of emergency following the 22 February 2011 earthquake
- n The age and structural type of the building
- n Consideration of any Critical Structural Weaknesses
- n 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.

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:

- n 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
- n 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
- n 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
- n There is a risk that that other property could collapse or otherwise cause injury or death; or

- n 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:

- n A process for identifying, categorising and prioritising Earthquake Prone Buildings, commencing on 1 July 2012;
- n A strengthening target level of 67% of a new building for buildings that are Earthquake Prone;
- n A timeframe of 15-30 years for Earthquake Prone Buildings to be strengthened; and,
- n 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.

It is understood 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:

- n The accessibility requirements of the Building Code.
- n 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.

On 19 May 2011, Compliance Document B1: Structure was amended to include increased seismic design requirements for Canterbury as follows:

- a. Hazard Factor increased from 0.22 to 0.3 (36% increase in the basic seismic design load)
- b. 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 Ultimate Limit State 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).

No consideration has been given at this stage to checking the level of compliance against the increased Serviceability Limit State requirements.

The likely ultimate 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 building's 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 3.1 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 3.1: NZSEE Risk Classifications Extracted from Table 2.2 of the NZSEE 2006 AISPBE Guidelines

Table 3.1 below 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. on average 0.2% in any year). It is noted that the current seismic risk in Christchurch results in a 6% risk of exceedance in the next year.

Table 3.1: %NBS Compared to Relative Risk of Failure

Building Grade	Percentage of New Building Standard (%NBS)	Approx. Risk Relative to a New Building
A+	>100	<1
A	80-100	1-2 times
B	67-80	2-5 times
C	33-67	5-10 times
D	20-33	10-25 times
E	<20	>25 times

4 Building Description

4.1 General

Summary information about the building is given in the following table. The Tyre Bay is part of the same building which contains the Plant Maintenance Workshop.

Table 4.1: Building Summary Information

Item	Details	Comment
Building name	City Care Milton Street Depot – Tyre Bay	
Street Address	245 Milton Street Sydenham Christchurch	
Age	Designed in 1979	From drawings available
Description	Single storey garage facility	
Building Footprint / Floor Area	Approx. 15.5m x 13.2m, 210m ² internally	Excluding Plant Maintenance Workshop area
No. of storeys / basements	1 storey/no basement	
Occupancy / use	Workshop and offices	Importance Level 2
Construction	Steel portal frame with glazed infill's and concrete walls	
Gravity load resisting system	Timber roof supported by steel portal frames	
Seismic load resisting system	The transverse lateral load resisting system comprises steel portal frames. The longitudinal lateral load resisting system comprises of a plywood roof diaphragm which transfers the load through struts/ties at the eaves level into the precast panel shear walls at each end of the building (Tyre Bay and Plant Maintenance Workshop) and vertical bracing in the Plant	The south elevation structures of both the Tyre Bay and Plant Maintenance Workshop have been considered as a single continuous lateral load resisting system for longitudinal loading including precast panels, RHS door header and channel eaves members.

Item	Details	Comment
	Maintenance Workshop.	
Foundation system	Reinforced concrete slab with concrete pads and tie beams.	
Other notable features	None	
External works		
Construction information	Structural drawings by City Engineer's Department and Architectural drawings by City Architectural Division both dated 1979.	
Likely design standard	NZS 4203:1976	Inferred from age of building
Heritage status	No heritage status	
Other		

4.2 Structural 'Hot-spots'

Areas in which damage may be expected to occur from earthquake shaking are outlined below;

- n Cracking of the precast panels.
- n Damage at panel connections and panel interfaces.

5 Site Investigations

5.1 Previous Assessments

It is understood that Opus International Consultants undertook rapid assessments of the buildings on the Milton St Depot site. These reports were not available for review. Visual inspections as part of the Level 4 assessment were undertaken on 8 February 2012. A Qualitative Report was issued to CCC on 22 June 2012.

5.2 Level 5 Intrusive Investigations

No intrusive investigations were carried out as part of the Level 5 Quantitative Assessment.

6 Damage Assessment

6.1 Damage Summary

The table below provides a summary of damage that we observed on our inspection visit. Refer to Appendix A for photographs of the observed damage. The damage described in this report is for the Tyre Bay only.

Table 6.1: Damage Summary

Damage type					Comment
	Unknown	Minor	Moderate	Major	
settlement of foundations	ü				None observed during visual inspection. Level survey may be required to confirm.
tilt of building	ü				None observed during visual inspection. Verticality survey may be required to confirm.
liquefaction		ü			None observed during visual inspection. Contacts on site stated it had occurred in areas throughout the site. The aerial reconnaissance on 24 Feb 2011 indicates the extent was minor.
settlement of external ground					None observed during visual inspection.
lateral spread / ground cracks					None observed during visual inspection.
Frame		ü			Minor cracking of column concrete encasement was observed.
concrete walls		ü			Minor cracking to the concrete shear walls was observed Minor cracking along movement joints between concrete panels was observed
cracking to concrete floors		ü			Cracks in floor slabs were observed.
Bracing	ü				Roof soffit was clad and prevented visual inspection of the roof diaphragm.
Precast flooring seating					Not Applicable
Stairs					Not Applicable
cladding /envelope		ü			Cracking to precast concrete wall panels observed as described above
Internal fit out		ü			Minor plasterboard cracking observed.
building services	ü				No inspection of services. No obvious damage was observed.
Adjacent building					The Plant Maintenance Workshop and the Tyre Bay have been considered as one building.
Other		ü			Cracking to the block work mortar at the oxygen storage area was observed

6.2 Surrounding Buildings

The Tyre Bay is part of the same structure as the Plant Maintenance Workshop (BU 1141-002 EQ2). The Tradesmens Workshop (BU 1141-001 EQ2) is to the north of the Tyre Bay.

6.3 Residual Displacements and General Observations

No evidence of permanent settlement or displacements was observed during our visual inspection, however a global settlement survey may reveal movement that could be described as damage under insurance entitlement.

6.4 Implication of Damage

Based on our visual inspection, the structure appears to be only slightly damaged and therefore we believe the structural capacity has not materially diminished.

7 Generic Issues

The generic issues referred to in Appendix A of the EAG guideline document have been assessed and are not considered applicable to the Tyre Bay.

8 Geotechnical Consideration

No geotechnical information was available for this site. During the inspection, any damage to the surrounding pavement was noted and any affect to the structure was considered.

9 Survey

No level or verticality surveys were carried out as there was no evidence of settlement or displacement observed during the inspection. CCC may wish to undertake a level survey as part of insurance entitlement considerations.

10 Detailed Seismic Capacity Assessment

10.1 Assessment Methodology

The building has had its seismic capacity assessed using the Forced-based Detailed Assessment Procedures in the NZSEE 2006 AISPBE guidelines, based on the drawings and intrusive investigations.

The structure has suffered minor damage. The post-damage capacity is considered to be the same as the original capacity.

The precast concrete panels of the Tyre Bay and Plant Maintenance Workshop, plus associated steel tie members, have been assumed to contribute to the overall longitudinal lateral load resisting system of both structures i.e. they have been considered as one structure when assessing the seismic capacity of the building.

10.2 Assumptions

The following assumptions were used in our quantitative assessment:

- n Reinforcing steel yield strength $f_y = 275$ MPa (as noted on the drawings)
- n Concrete compressive strength $f_c' = 25$ MPa (as noted on the drawings)
- n Structural steel yield strength $f_y = 250$ MPa

- n Soil ultimate bearing strength $q_u = 300$ kPa

10.3 Critical Structural Weaknesses

The following Critical Structural Weakness has been identified:

- n Site characteristics due to liquefaction occurring on the Milton St site

The site characteristics have been identified as a potential CSW in our earlier qualitative report. We note that liquefaction is still considered a potential CSW however it has not been considered in this quantitative assessment as we believe it will not have a direct impact on the structure's ability to resist further loads or cause global failure of the structure.

10.4 Seismic Parameters

The seismic design parameters based on current design requirements from NZS 1170.5:2004 and the NZBC clause B1 for this building are:

- n Site soil class: D – NZS 1170.5:2004, Clause 3.1.3, Soft Soil
- n Site hazard factor, $Z = 0.3$ – NZBC, Clause B1 Structure, Amendment 11 effective from 19 May 2011
- n Return period factor $R_u = 1$ – NZS 1170.5:2004, Table 3.5, Importance Level 2 structure with a 50 year design life.
- n Near fault factor $N(T,D) = 1$ – NZS 1170.5:2004, Clause 3.1.6, Distance more than 20 km from fault line.

10.5 Results of Seismic Assessment

The results of our quantitative assessment indicate the building has a seismic capacity in the order of 35%NBS. This is similar to the IEP assessment of 36%NBS in the previous Qualitative Report. Table 10.1 presents the evaluated seismic capacity in terms of %NBS of the individual structural systems in each building direction.

Table 10.1: Summary of Seismic Assessment of Structural Systems

Item	Loading Direction	Ductility, μ	Seismic Capacity	Notes
Overall %NBS adopted from DEE	Longitudinal	1.25	35%NBS	Governed by precast shear wall overturning.
Portal frames	Transverse	1.25	>100%NBS	
Precast panel, in-plane capacity	Longitudinal	1.25	>100%NBS	Shear and flexure.
Foundations	Longitudinal	1.25	35%NBS	Resistance to overturning of precast panels. Based on combined Tyre Bay and Plant Maintenance Workshop longitudinal load resisting system adopted.
Precast panel, out-of-plane flexural capacity	Both	3	84%NBS	Precast panels have been analysed as a part.

Item	Loading Direction	Ductility, μ	Seismic Capacity	Notes
Precast panel connections	Longitudinal	1.25	66%NBS	Shear capacity under In-plane loading.
RHS door header beam	Longitudinal	1.25	36%NBS	Pull out of connection to the precast panels.
Channel eaves beam	Longitudinal	1.0	38%NBS	Shear capacity of connection to precast panels.

Note: Ductility factors are in accordance with values recommended in the NZSEE 2006 AISPBE guidelines.

10.6 Discussion of results

The key findings of the assessment are as follows:

- n Overturning capacity of the precast shear walls and foundation achieves 35%NBS under longitudinal (in-plane) loading.
- n RHS door header (tie member) connections under longitudinal (in-plane) loading achieve 36%NBS.
- n Eaves channel (tie member) connections under longitudinal (in-plane) loading achieve 38%NBS.

Based on the results of our Quantitative Assessment, the Tyre Bay is considered Earthquake Risk, as the seismic capacity was assessed to be between 34%NBS and 67%NBS and is classified as Seismic Grade C.

11 Recommendations

11.1 Occupancy

In order that the owner can make an informed decision about the on-going use and occupancy of their building the following information is presented in line with the Department of Building and Housing document 'Guidance for engineers assessing the seismic performance of non-residential and multi-unit residential buildings in greater Christchurch', June 2012.

The building is considered to be earthquake risk, having an assessed capacity of between 34% and 67% NBS. The risk of collapse of an earthquake risk building is considered to be 5 to 10 times greater than that of an equivalent new building.

No significant damage or hazards were identified to the seismic or gravity load resisting system that would reduce its ability to resist further loads and therefore no restrictions on use or occupancy are recommended.

11.2 Further Investigations, Survey or Geotechnical Work

A settlement survey could be carried out to determine the extent of settlement of the building for insurance purposes.

11.3 Damage Reinstatement

According to the recent CCC Instructions to Engineers document (16 October 2012), Council's insurance provides for repairing damaged elements to a condition substantially as new. We suggest you consult further with your insurance advisor.

12 Design Features Report

Repairs will be required to reinstate the existing structural system. A repair methodology has not been prepared at this stage. No new load paths are expected as a result of the repairs required.

13 Limitations

The following limitations apply to this engagement:

- n Beca and its employees and agents are not able to give any warranty or guarantee that all defects, damage, conditions or qualities have been identified.
- n Inspections are primarily limited to visible structural components. Appropriate locations for invasive inspection, if required, will be based on damage patterns observed in visible elements, and review of the construction drawings and structural system. As such, there will be concealed structural elements that will not be directly inspected.
- n The inspections are limited to building structural components only.
- n Inspection of building services, pipework, pavement, and fire safety systems is excluded from the scope of this report.
- n Inspection of the glazing system, linings, carpets, claddings, finishes, suspended ceilings, partitions, tenant fit-out, or the general water tightness envelope is excluded from the scope of this report.
- n The assessment of the lateral load capacity of the building is limited by the completeness and accuracy of the drawings provided. Assumptions have been made in respect of the geotechnical conditions at the site and any aspects or material properties not clear on the drawings. Where these assumptions are considered material to the outcome further investigations may be recommended. It is noted the assessment has not been exhaustive, our analysis and calculations have focused on representative areas only to determine the level of provision made. At this stage we have not undertaken any checks of the gravity system, wind load capacity, or foundations.
- n The information in this report provides a snapshot of building damage at the time the detailed inspection was carried out. Additional inspections required as a result of significant aftershocks are outside the scope of this work.

This report is of defined scope and is for reliance by CCC only, and only for this commission. Beca should be consulted where any question regarding the interpretation or completeness of our inspection or reporting arises.

Appendix A

Photographs



Figure 1A: Site Layout (North is to the left of page)



Photo 1: External view of Tyre Bay



Photo 2: Internal view of Tyre Bay (store)



Photo 3: Typical cracking to vertical walls joints

Description of Damage: Cracking to vertical walls joints



Photo 4: Cracks to concrete walls

Description of Damage: Cracking to concrete walls (some cracking may have existed prior to the earthquake and been exacerbated).



Photo 5: Typical cracking to concrete walls

Description of Damage: Cracking to concrete walls.



Photo 6: Typical cracking to concrete walls

Description of Damage: Shear cracking to concrete walls



Photo 7: Typical cracking to concrete shear walls

Description of Damage: Cracking to concrete walls

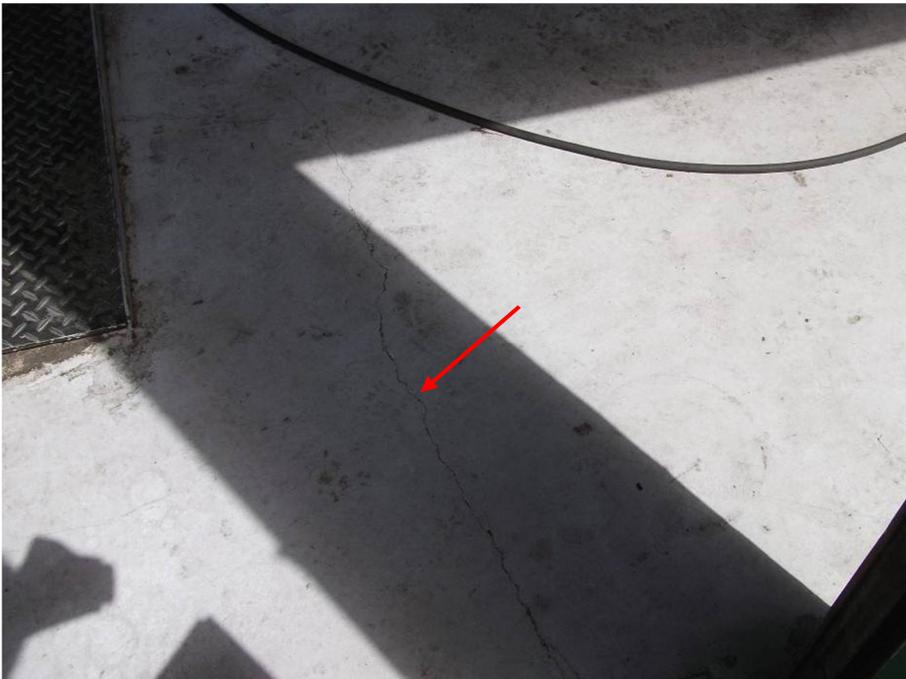
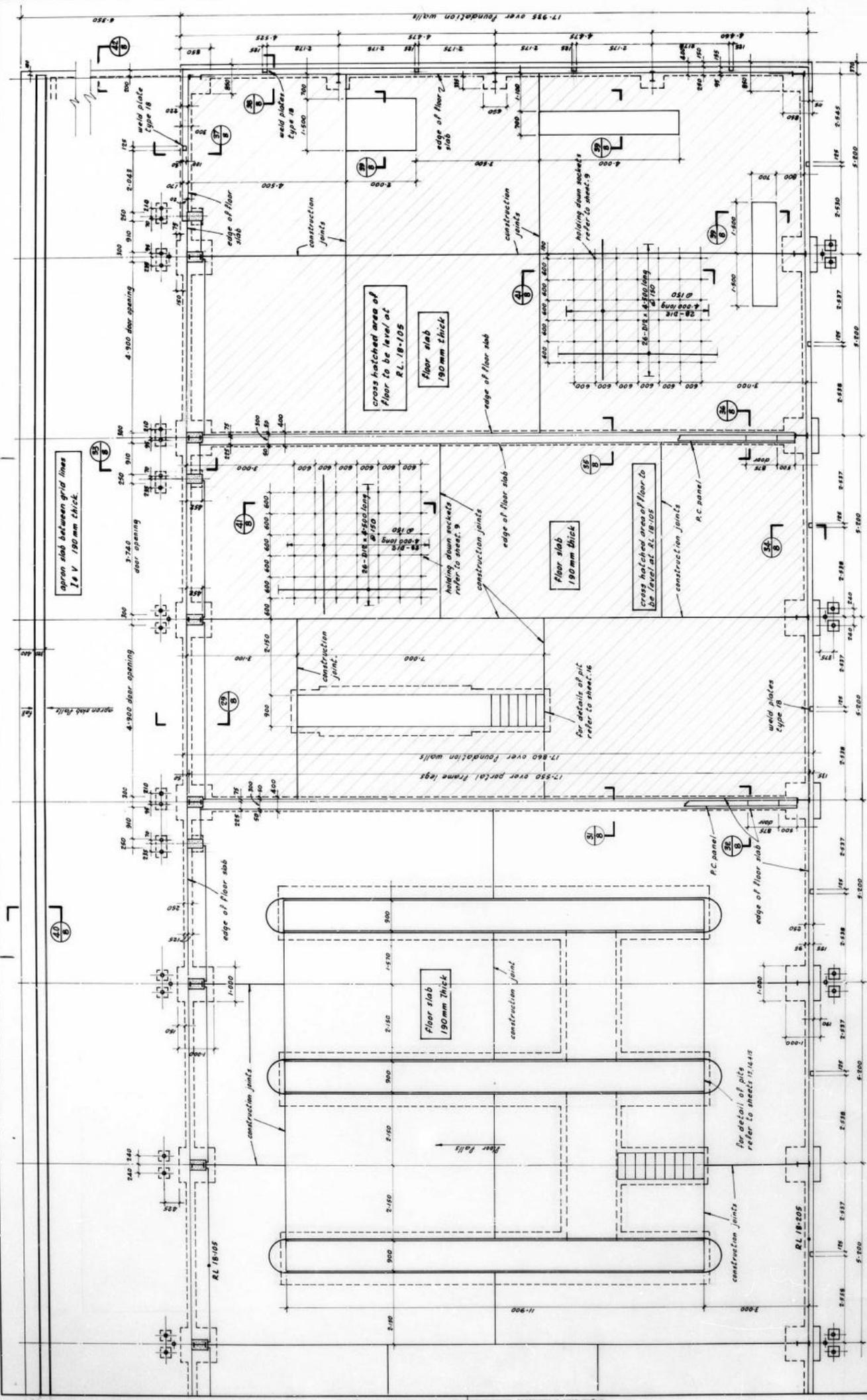


Photo 8: Typical cracking to concrete slab

Description of Damage: Cracking to concrete slab

Appendix B

Existing Drawings



107.030 overall Foundation walls

Notes refer to sheet B.

U

T

S

R

Q

P

O

V

U

T

S

R

Q

P

O

<p>107.030 overall Foundation walls</p>		<p>Notes refer to sheet B.</p>	
<p>CHRISTCHURCH CITY COUNCIL - CITY ENGINEER'S DEPARTMENT</p>			
<p>NEW CENTRAL DEPOT - PLANT MAINTENANCE - STAGE 2 - JOHNSON ST - PART FOUNDATION PLAN - GRID LINES O - V</p>			
<p>Drawn: P. R. B. 1/17</p>	<p>Checked: A. E. 1/17</p>	<p>Authorised: 13.6.79</p>	<p>Scale: 1:50</p>
<p>Design: P. R. B. 1/72</p>	<p>Engineer: A. E. 1/72</p>	<p>City Engineer: A. E. 1/72</p>	<p>Project No: D.2278</p>
<p>Contract No: 107.030</p>	<p>Sheet No: 30</p>	<p>Scale: 1:50</p>	<p>Notes refer to sheet B.</p>



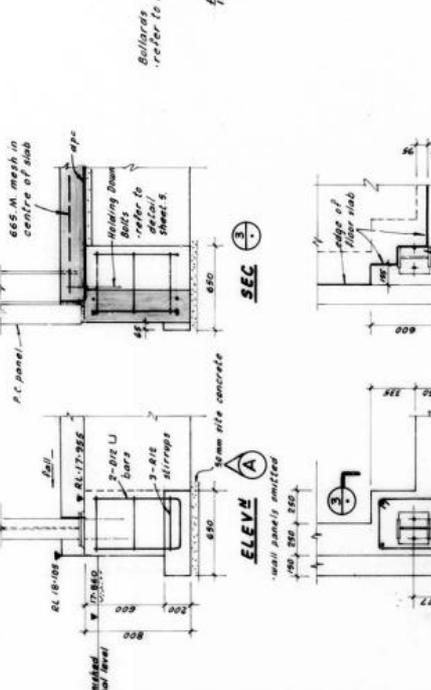
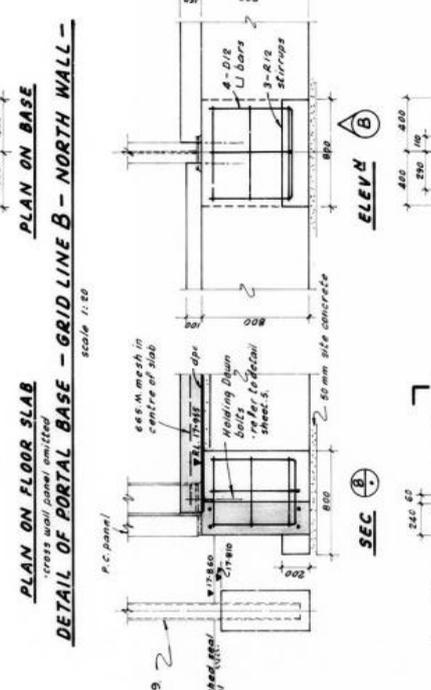
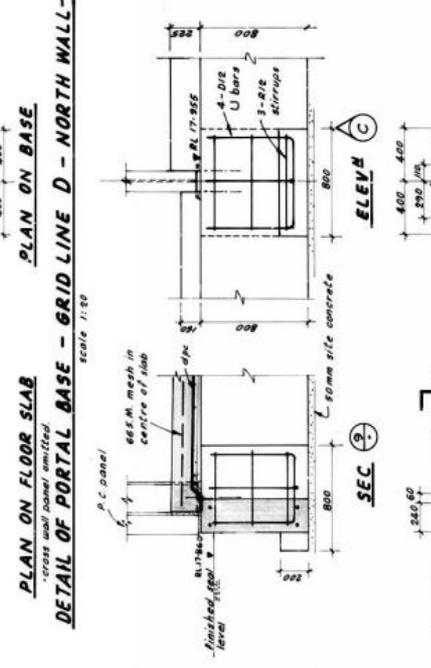
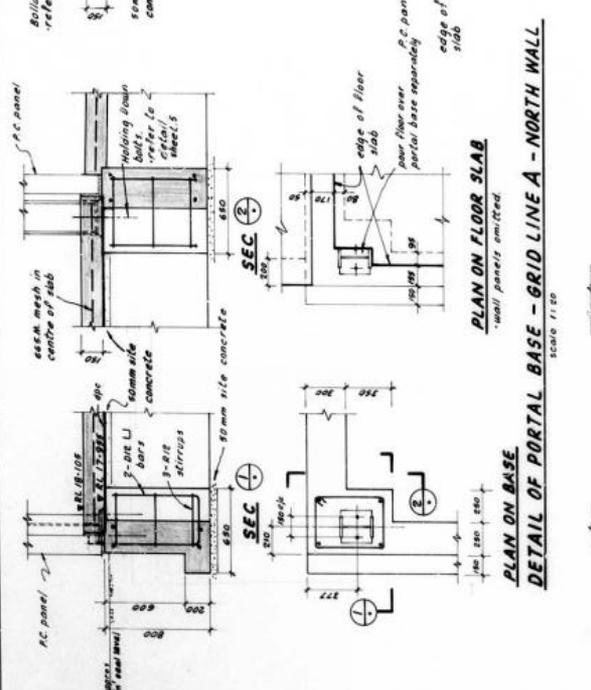
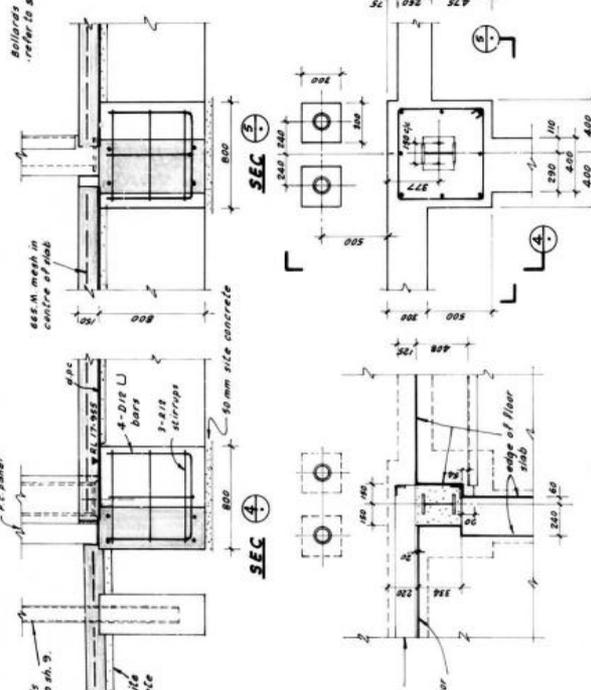
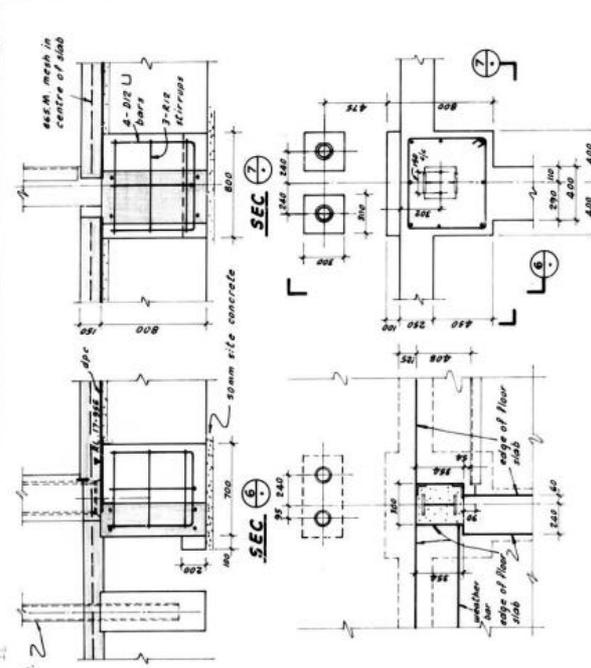
D.2278

1:50

NEW CENTRAL DEPOT - PLANT MAINTENANCE - STAGE 2 - JOHNSON ST - PART FOUNDATION PLAN - GRID LINES O - V

City Engineer's Department

Drawn	Checked	Authorised	Scale
P. R. B. 1/17	A. E. 1/17	13.6.79	1:50
Design	Engineer	City Engineer	Project No
P. R. B. 1/72	A. E. 1/72	A. E. 1/72	D.2278
Contract No	Sheet No	Scale	Notes refer to sheet B.
107.030	30	1:50	Notes refer to sheet B.



Notes refer to notes on sheet 8.

Rev.	Description	Date	By	Checked	Scale	Sheet	Total
1	As Issued	11/17/10	A.C. Bouslog	P. Roper	1:20	4	4
2	Revised	11/17/10	A.C. Bouslog	P. Roper	1:20	4	4
3	Revised	11/17/10	A.C. Bouslog	P. Roper	1:20	4	4
4	Revised	11/17/10	A.C. Bouslog	P. Roper	1:20	4	4

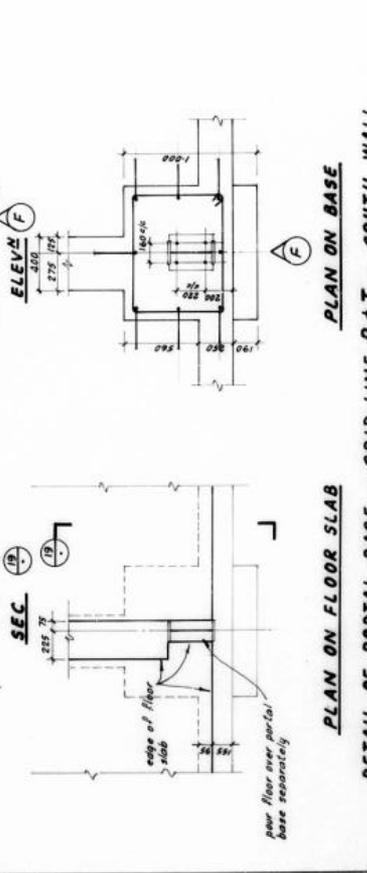
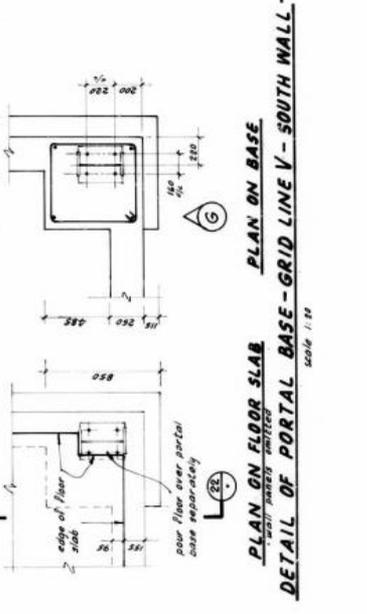
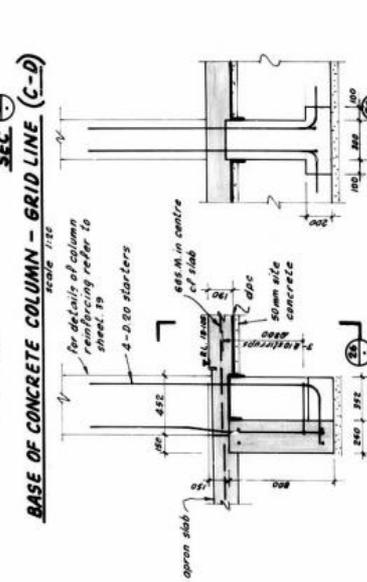
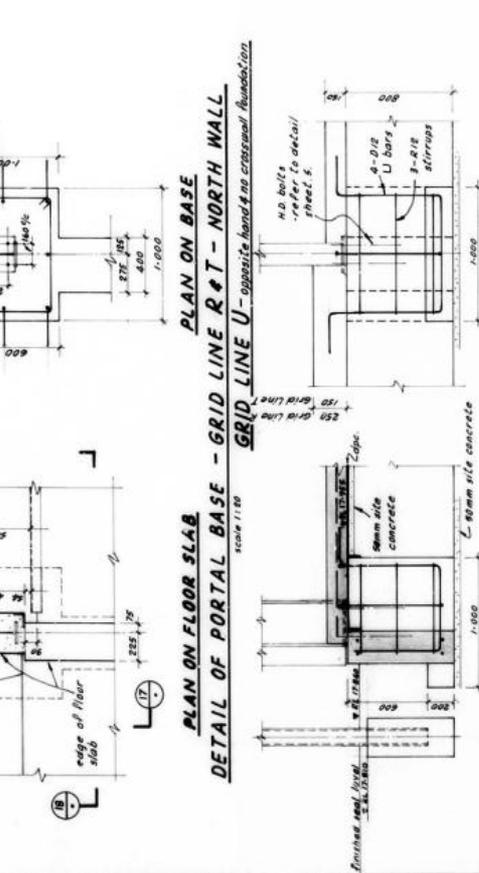
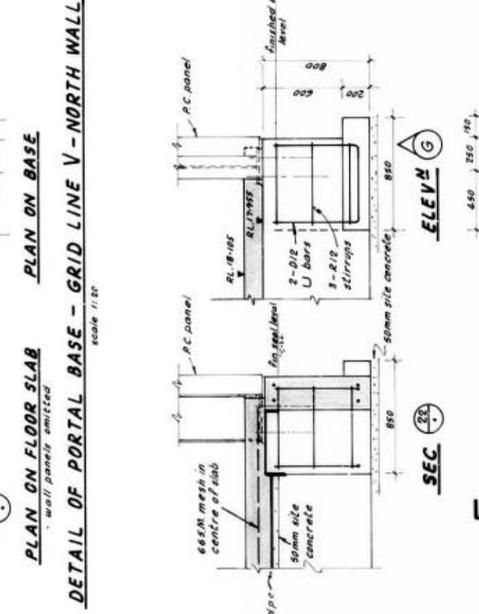
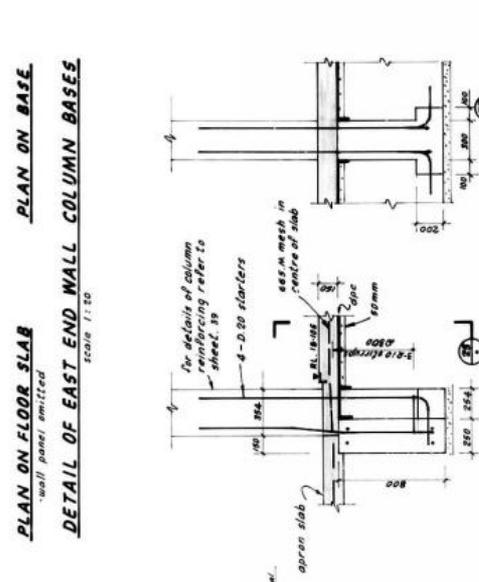
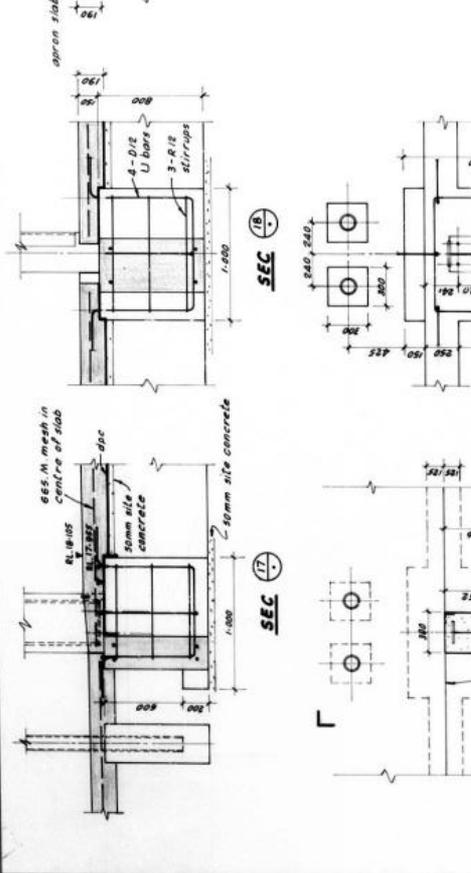
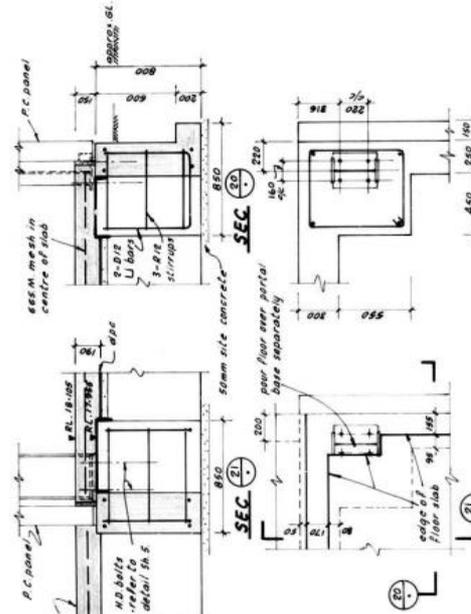
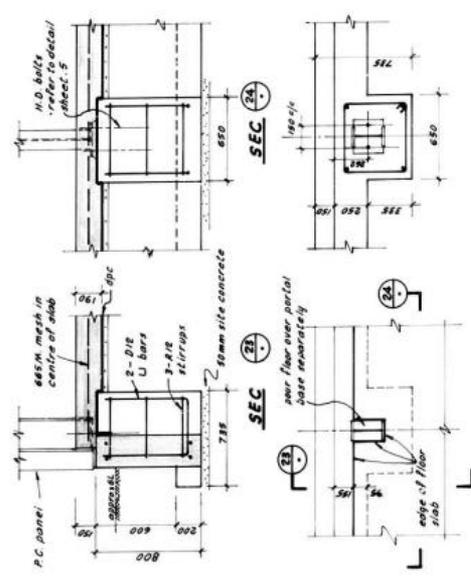
PROJECT: CHRISTCHURCH CITY COUNCIL - CITY ENGINEER'S DEPARTMENT
 DRAWING: NEW CENTRAL DEPOT - PLANT MAINTENANCE - STAGE 2 - JOHNSON ST - DETAILS OF PORTAL BASES - GRID LINES A, B & D -
 DRAWN BY: A.C. Bouslog
 CHECKED BY: P. Roper
 DATE: 11/17/10
 SCALE: 1:20
 SHEET NO: 4 OF 4

D.2278

1:20

Notes refer to notes on sheet 8.





BASE OF CONCRETE COLUMNS - GRID LINES (Q-R) (S-T) (U-V)
Scale 1:20

BASE OF CONCRETE COLUMNS - GRID LINES (Q-R) (S-T) (U-V)
Scale 1:20

BASE OF CONCRETE COLUMNS - GRID LINES (Q-R) (S-T) (U-V)
Scale 1:20

CHRISTCHURCH CITY COUNCIL - CITY ENGINEERS' DEPARTMENT									
NEW CENTRAL DEPOT - PLANT MAINTENANCE - STAGE 2 - JOHNSON ST - DETAILS OF PORTAL BASES - GRID LINES R, T, U & V - EAST WALL COLS -									
Drawn	Checked	Reviewed	Approved	Scale	Sheet	Total	Date	Project	Drawn
P. Rose	A. Lanning	J. P. Rose	J. P. Rose	1:20	17	17	17/10/10	NEW CENTRAL DEPOT - PLANT MAINTENANCE - STAGE 2 - JOHNSON ST - DETAILS OF PORTAL BASES - GRID LINES R, T, U & V - EAST WALL COLS -	P. Rose
P. Rose	A. Lanning	J. P. Rose	J. P. Rose	1:20	18	18	17/10/10	NEW CENTRAL DEPOT - PLANT MAINTENANCE - STAGE 2 - JOHNSON ST - DETAILS OF PORTAL BASES - GRID LINES R, T, U & V - EAST WALL COLS -	P. Rose
P. Rose	A. Lanning	J. P. Rose	J. P. Rose	1:20	19	19	17/10/10	NEW CENTRAL DEPOT - PLANT MAINTENANCE - STAGE 2 - JOHNSON ST - DETAILS OF PORTAL BASES - GRID LINES R, T, U & V - EAST WALL COLS -	P. Rose
P. Rose	A. Lanning	J. P. Rose	J. P. Rose	1:20	20	20	17/10/10	NEW CENTRAL DEPOT - PLANT MAINTENANCE - STAGE 2 - JOHNSON ST - DETAILS OF PORTAL BASES - GRID LINES R, T, U & V - EAST WALL COLS -	P. Rose
P. Rose	A. Lanning	J. P. Rose	J. P. Rose	1:20	21	21	17/10/10	NEW CENTRAL DEPOT - PLANT MAINTENANCE - STAGE 2 - JOHNSON ST - DETAILS OF PORTAL BASES - GRID LINES R, T, U & V - EAST WALL COLS -	P. Rose
P. Rose	A. Lanning	J. P. Rose	J. P. Rose	1:20	22	22	17/10/10	NEW CENTRAL DEPOT - PLANT MAINTENANCE - STAGE 2 - JOHNSON ST - DETAILS OF PORTAL BASES - GRID LINES R, T, U & V - EAST WALL COLS -	P. Rose
P. Rose	A. Lanning	J. P. Rose	J. P. Rose	1:20	23	23	17/10/10	NEW CENTRAL DEPOT - PLANT MAINTENANCE - STAGE 2 - JOHNSON ST - DETAILS OF PORTAL BASES - GRID LINES R, T, U & V - EAST WALL COLS -	P. Rose
P. Rose	A. Lanning	J. P. Rose	J. P. Rose	1:20	24	24	17/10/10	NEW CENTRAL DEPOT - PLANT MAINTENANCE - STAGE 2 - JOHNSON ST - DETAILS OF PORTAL BASES - GRID LINES R, T, U & V - EAST WALL COLS -	P. Rose
P. Rose	A. Lanning	J. P. Rose	J. P. Rose	1:20	25	25	17/10/10	NEW CENTRAL DEPOT - PLANT MAINTENANCE - STAGE 2 - JOHNSON ST - DETAILS OF PORTAL BASES - GRID LINES R, T, U & V - EAST WALL COLS -	P. Rose
P. Rose	A. Lanning	J. P. Rose	J. P. Rose	1:20	26	26	17/10/10	NEW CENTRAL DEPOT - PLANT MAINTENANCE - STAGE 2 - JOHNSON ST - DETAILS OF PORTAL BASES - GRID LINES R, T, U & V - EAST WALL COLS -	P. Rose
P. Rose	A. Lanning	J. P. Rose	J. P. Rose	1:20	27	27	17/10/10	NEW CENTRAL DEPOT - PLANT MAINTENANCE - STAGE 2 - JOHNSON ST - DETAILS OF PORTAL BASES - GRID LINES R, T, U & V - EAST WALL COLS -	P. Rose
P. Rose	A. Lanning	J. P. Rose	J. P. Rose	1:20	28	28	17/10/10	NEW CENTRAL DEPOT - PLANT MAINTENANCE - STAGE 2 - JOHNSON ST - DETAILS OF PORTAL BASES - GRID LINES R, T, U & V - EAST WALL COLS -	P. Rose
P. Rose	A. Lanning	J. P. Rose	J. P. Rose	1:20	29	29	17/10/10	NEW CENTRAL DEPOT - PLANT MAINTENANCE - STAGE 2 - JOHNSON ST - DETAILS OF PORTAL BASES - GRID LINES R, T, U & V - EAST WALL COLS -	P. Rose
P. Rose	A. Lanning	J. P. Rose	J. P. Rose	1:20	30	30	17/10/10	NEW CENTRAL DEPOT - PLANT MAINTENANCE - STAGE 2 - JOHNSON ST - DETAILS OF PORTAL BASES - GRID LINES R, T, U & V - EAST WALL COLS -	P. Rose

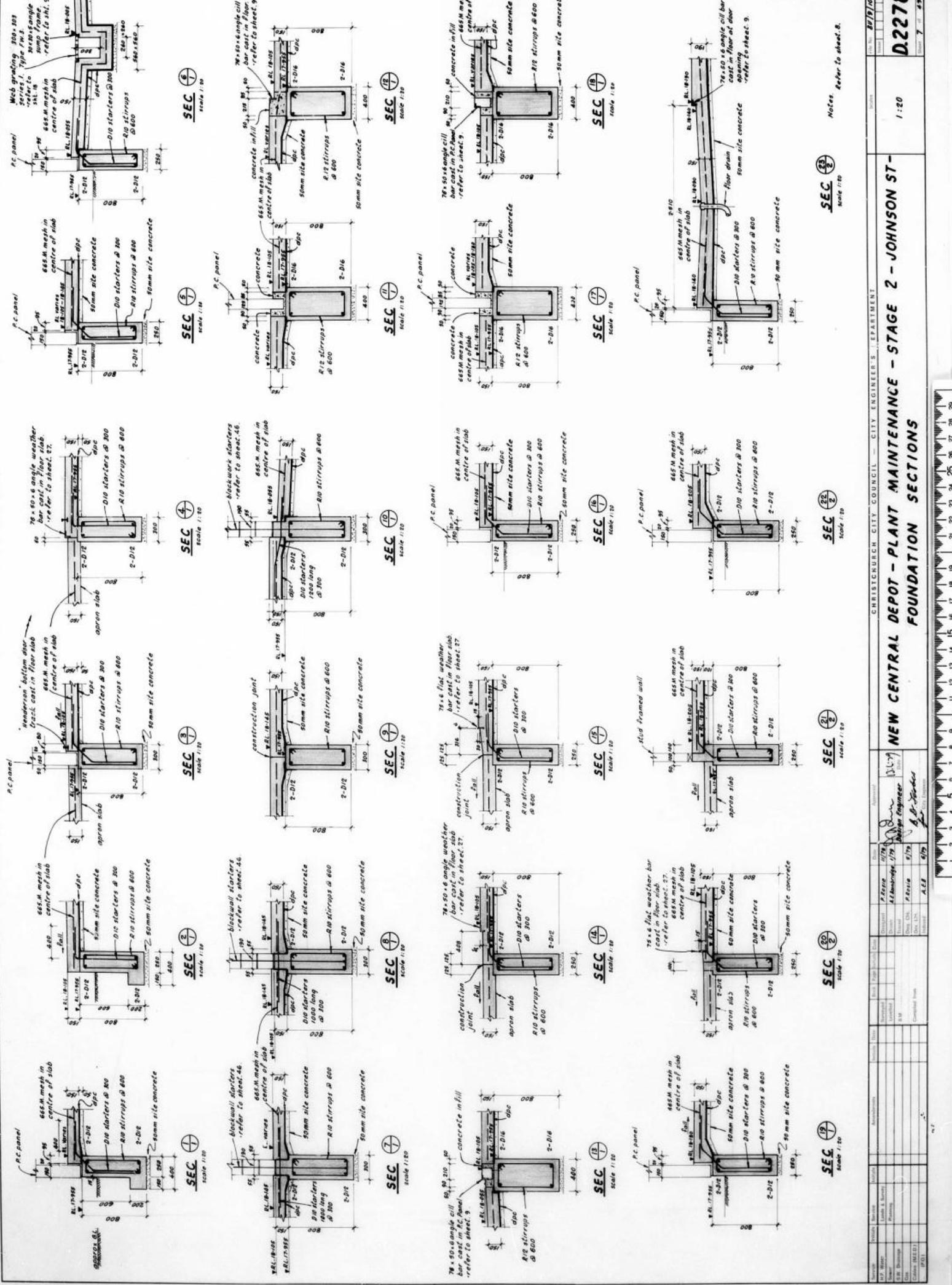


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1:20

17

17



Notes Refer to sheet 8.

SEC 1 SCALE 1:20

SEC 2 SCALE 1:20

SEC 3 SCALE 1:20

SEC 4 SCALE 1:20

SEC 5 SCALE 1:20

SEC 6 SCALE 1:20

SEC 7 SCALE 1:20

SEC 8 SCALE 1:20

SEC 9 SCALE 1:20

SEC 10 SCALE 1:20

SEC 11 SCALE 1:20

SEC 12 SCALE 1:20

SEC 13 SCALE 1:20

SEC 14 SCALE 1:20

SEC 15 SCALE 1:20

SEC 16 SCALE 1:20

SEC 17 SCALE 1:20

SEC 18 SCALE 1:20

SEC 19 SCALE 1:20

CHRISTCHURCH CITY COUNCIL - CITY ENGINEER'S DEPARTMENT									
NEW CENTRAL DEPOT - PLANT MAINTENANCE - STAGE 2 - JOHNSON ST - FOUNDATION SECTIONS									
NO.	DATE	REVISION	BY	CHECKED	SCALE	DESCRIPTION	APPROVED	DATE	BY
1	1/19/10								
2									
3									
4									
5									
6									
7									
8									
9									
10									
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28									
29									
30									

Original scale of millimeters

Scale 1:20

Notes Refer to sheet 8.

SEC 1 SCALE 1:20

SEC 2 SCALE 1:20

SEC 3 SCALE 1:20

SEC 4 SCALE 1:20

SEC 5 SCALE 1:20

SEC 6 SCALE 1:20

SEC 7 SCALE 1:20

SEC 8 SCALE 1:20

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SEC 10 SCALE 1:20

SEC 11 SCALE 1:20

SEC 12 SCALE 1:20

SEC 13 SCALE 1:20

SEC 14 SCALE 1:20

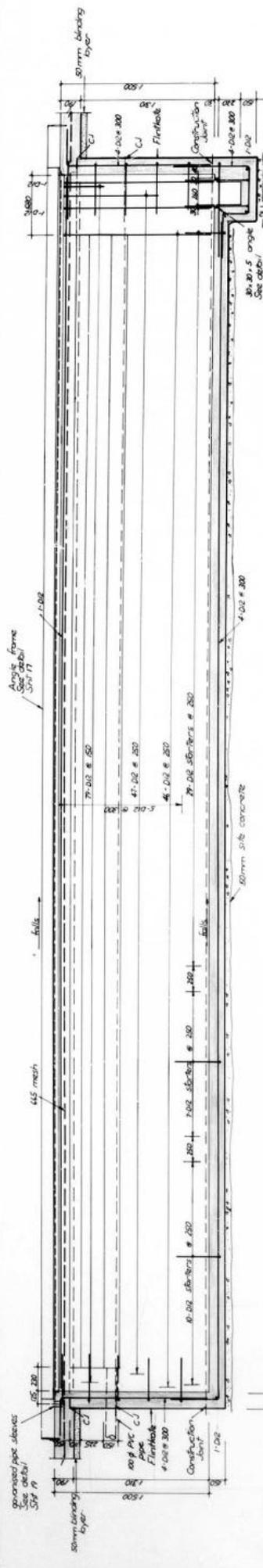
SEC 15 SCALE 1:20

SEC 16 SCALE 1:20

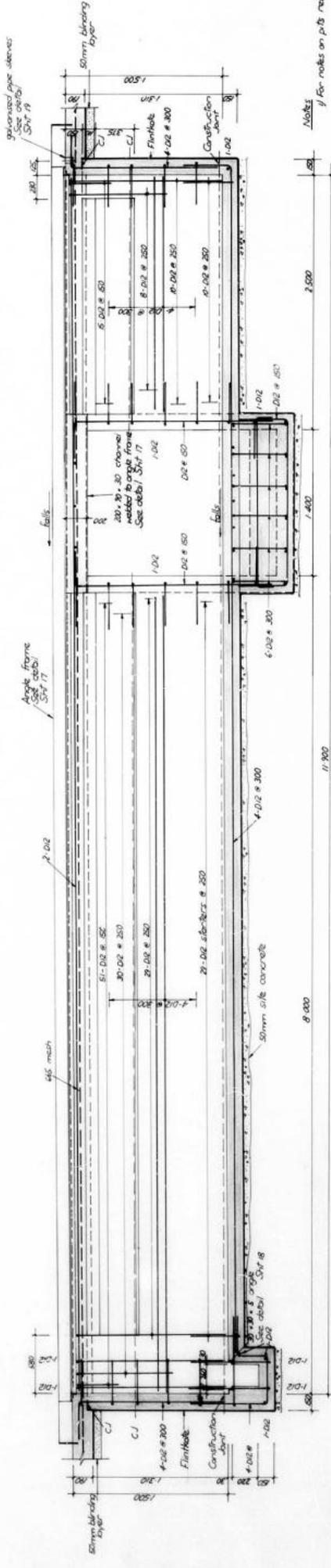
SEC 17 SCALE 1:20

SEC 18 SCALE 1:20

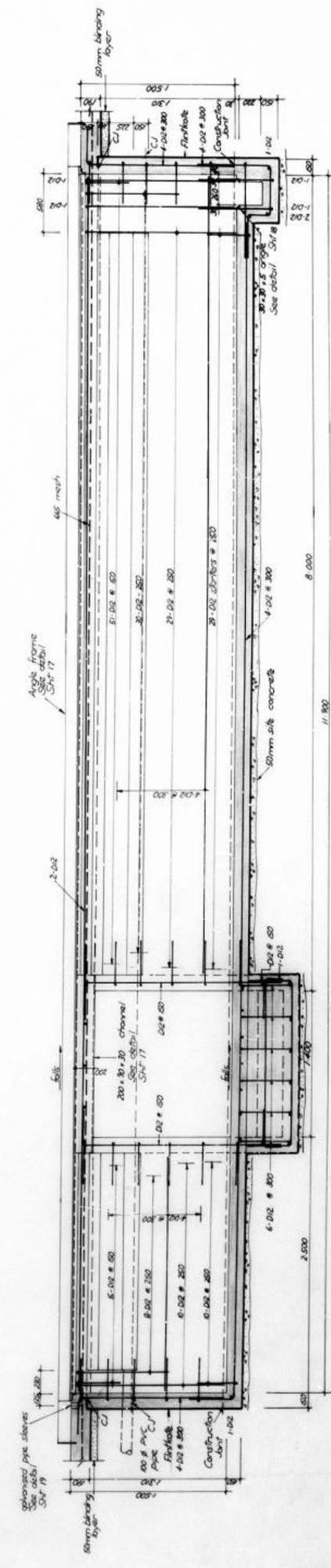
SEC 19 SCALE 1:20



SECTION 1
Scale 1:20



SECTION 2
Scale 1:20



SECTION 3
Scale 1:20

Project No.	8/11/10
Date	1/20
Scale	1:20
Client	CHRISTCHURCH CITY COUNCIL - CITY ENGINEER'S DEPARTMENT
Project Name	NEW CENTRAL DEPOT - PLANT MAINTENANCE - STAGE 2 - JOHNSON ST
Location	PITS - HEAVY MAINTENANCE WORKSHOP
Drawn	AJE
Checked	P.P.
Approved	A.P.
Scale	1:20
Sheet No.	1/1
Total Sheets	1/1

D2278

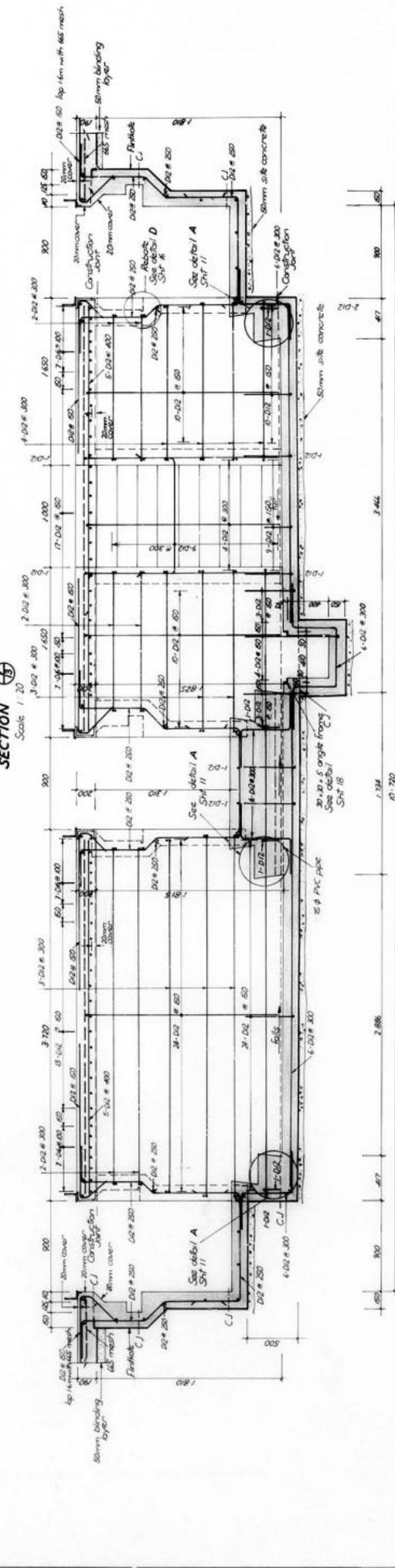
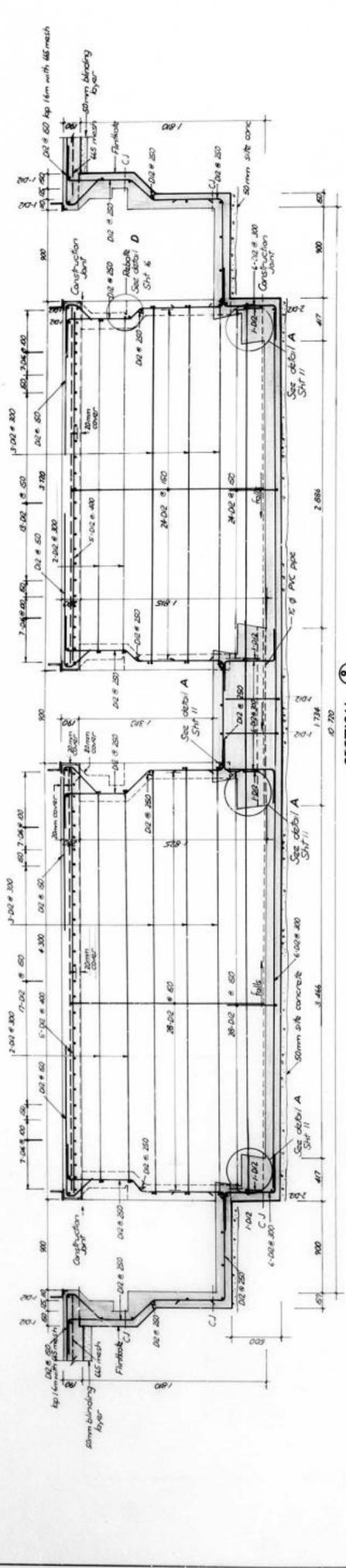
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NEW CENTRAL DEPOT - PLANT MAINTENANCE - STAGE 2 - JOHNSON ST
PITS - HEAVY MAINTENANCE WORKSHOP

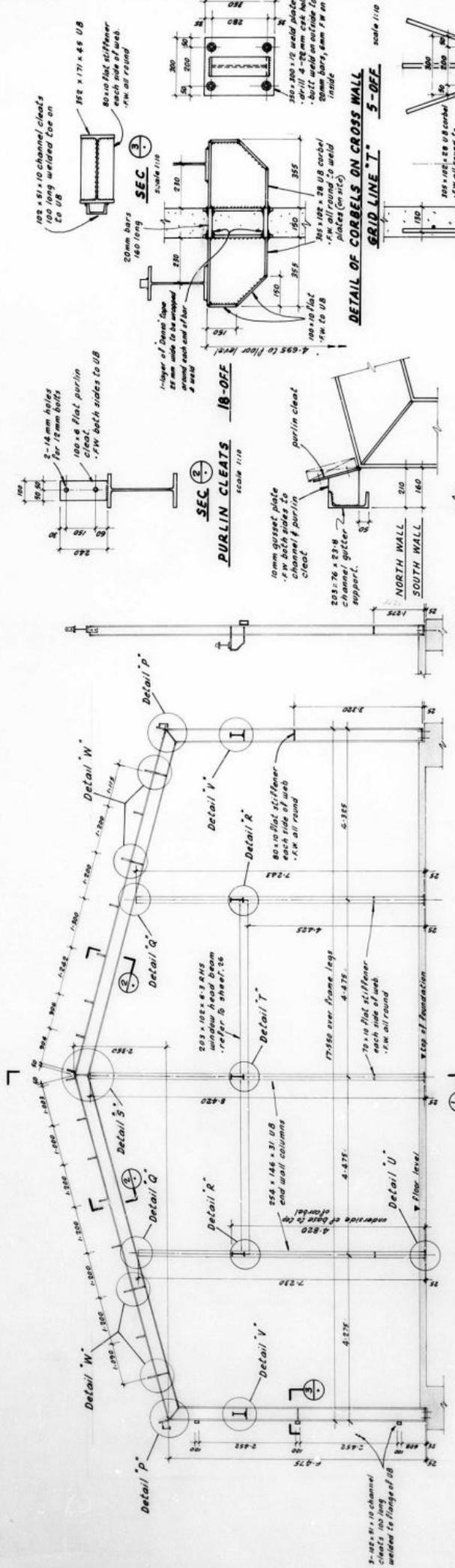
CHRISTCHURCH CITY COUNCIL - CITY ENGINEER'S DEPARTMENT

Scale 1:20

1/1



Notes // for notes on pits refer to sheet 6



ELEVATION OF PORTAL FRAME TYPE 13
 1-OFF
 For all other details & dimensions refer to Frames Type 7.

GRID LINE V
 scale 1:50

SEC
 scale 1:50

DETAIL 'P'
 scale 1:10

DETAIL 'Q'
 scale 1:10

DETAIL 'S'
 scale 1:10

DETAIL 'R'
 scale 1:10

DETAIL 'T'
 scale 1:10

DETAIL 'V'
 scale 1:10

DETAIL 'U'
 scale 1:10

DETAIL OF CORBELS ON CROSS WALL
 GRID LINE 'R' 5-OFF
 scale 1:10

DETAIL 'W' 4-OFF
 scale 1:10

DETAIL 'X' 5-OFF
 scale 1:10

DETAIL 'Y' 6-OFF
 scale 1:10

DETAIL 'Z' 7-OFF
 scale 1:10

DETAIL 'AA' 8-OFF
 scale 1:10

DETAIL 'AB' 9-OFF
 scale 1:10

DETAIL 'AC' 10-OFF
 scale 1:10

DETAIL 'AD' 11-OFF
 scale 1:10

DETAIL 'AE' 12-OFF
 scale 1:10

DETAIL 'AF' 13-OFF
 scale 1:10

DETAIL 'AG' 14-OFF
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DETAIL 'AH' 15-OFF
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DETAIL 'AI' 16-OFF
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DETAIL 'AJ' 17-OFF
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DETAIL 'AK' 18-OFF
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DETAIL 'AL' 19-OFF
 scale 1:10

DETAIL 'AM' 20-OFF
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DETAIL 'AN' 21-OFF
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DETAIL 'AO' 22-OFF
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DETAIL 'AQ' 24-OFF
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DETAIL 'AS' 26-OFF
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DETAIL 'AU' 28-OFF
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DETAIL 'AV' 29-OFF
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DETAIL 'AW' 30-OFF
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DETAIL 'AX' 31-OFF
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DETAIL 'AZ' 33-OFF
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DETAIL 'BA' 34-OFF
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DETAIL 'BB' 35-OFF
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DETAIL 'BC' 36-OFF
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DETAIL 'BE' 38-OFF
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DETAIL 'BF' 39-OFF
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DETAIL 'BX' 57-OFF
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DETAIL 'BY' 58-OFF
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DETAIL 'FZ' 162-OFF
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DETAIL 'GA' 163-OFF
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DETAIL 'GB' 164-OFF
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DETAIL 'GC' 165-OFF
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DETAIL 'GD' 166-OFF
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DETAIL 'GE' 167-OFF
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DETAIL 'GF' 168-OFF
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DETAIL 'GG' 169-OFF
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DETAIL 'GH' 170-OFF
 scale 1:10

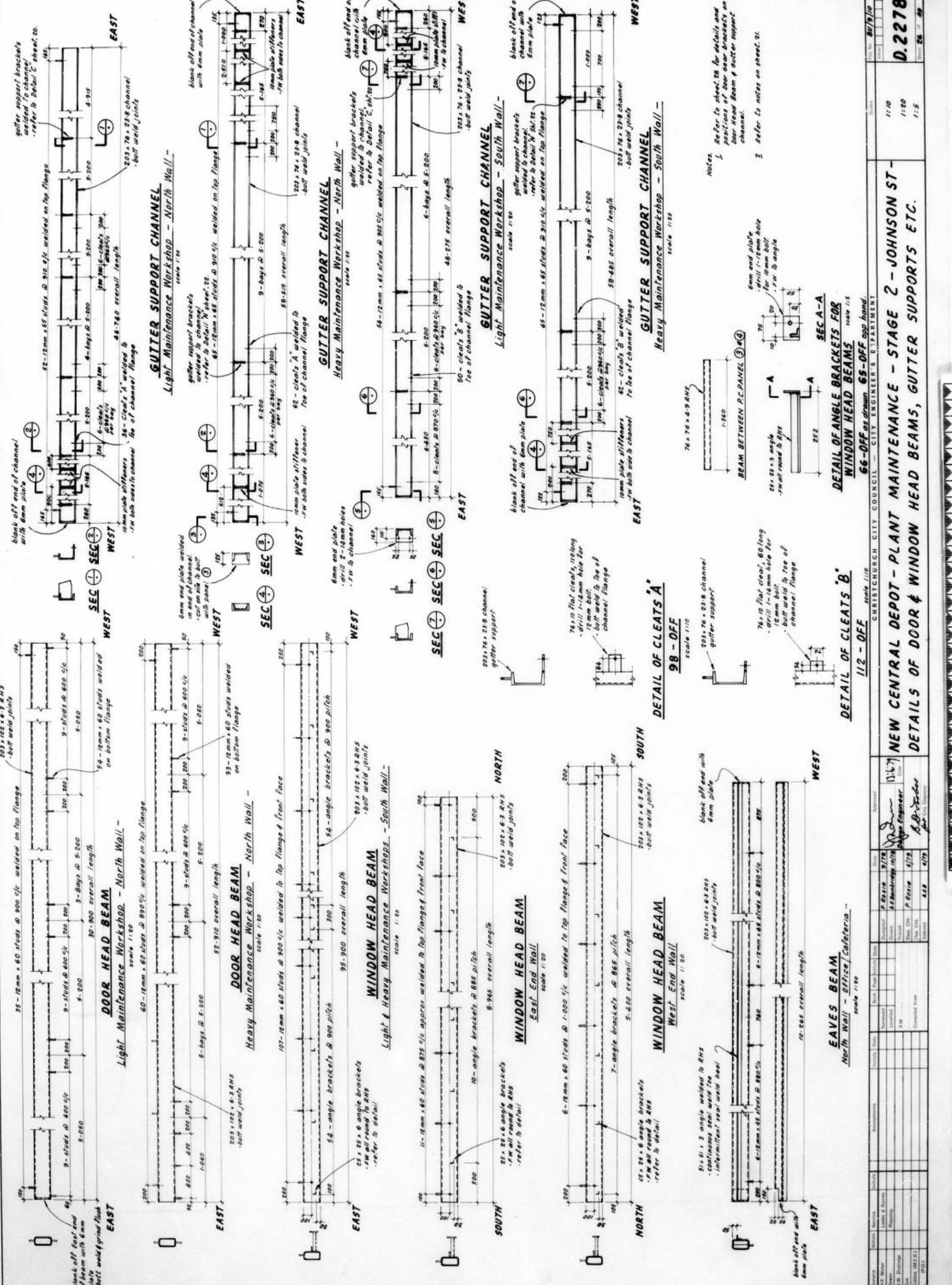
DETAIL 'GI' 171-OFF
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DETAIL 'GJ' 172-OFF
 scale 1:10

DETAIL 'GK' 173-OFF
 scale 1:10

DETAIL 'GL' 174-OFF
 scale 1:10

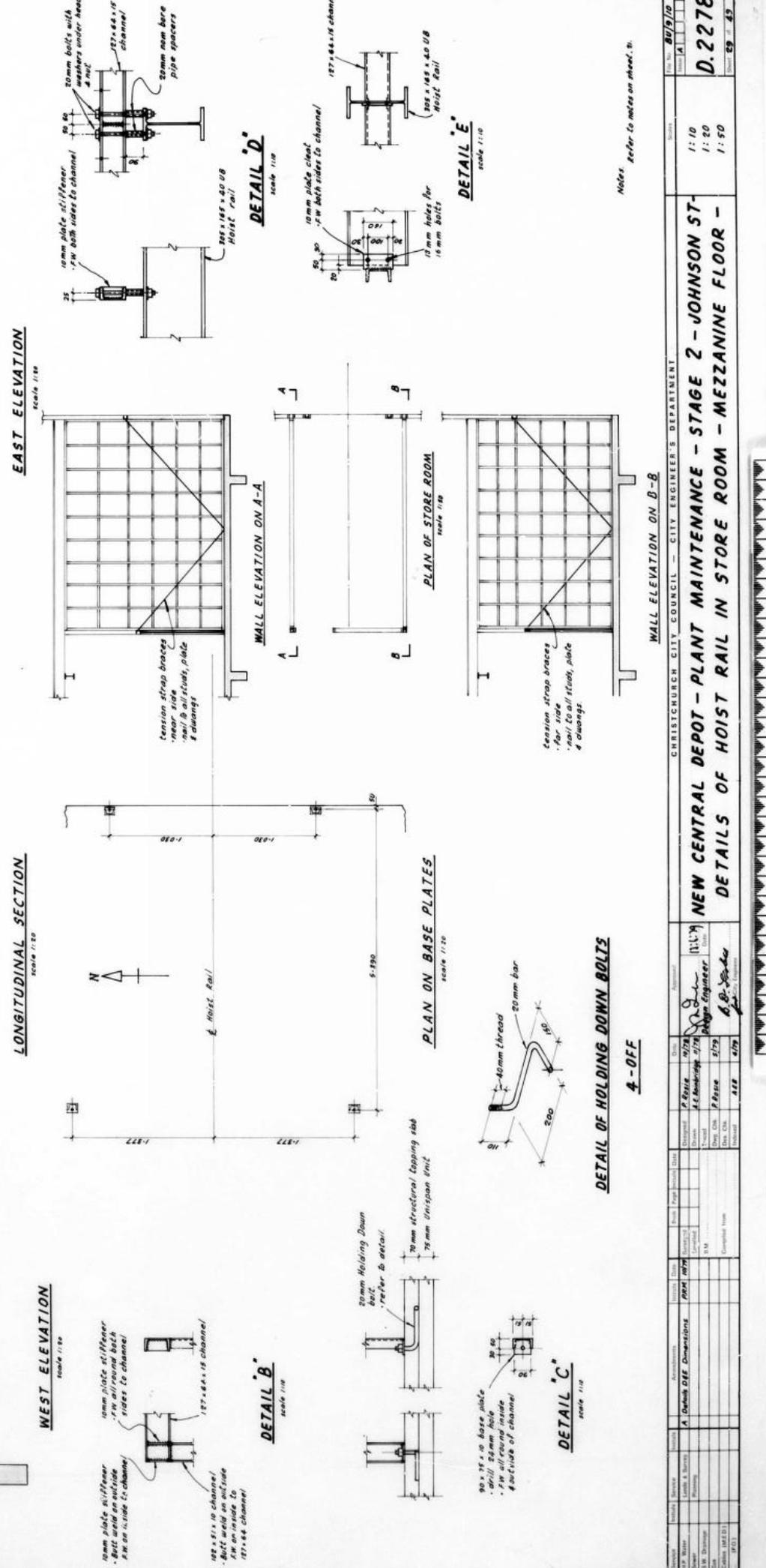
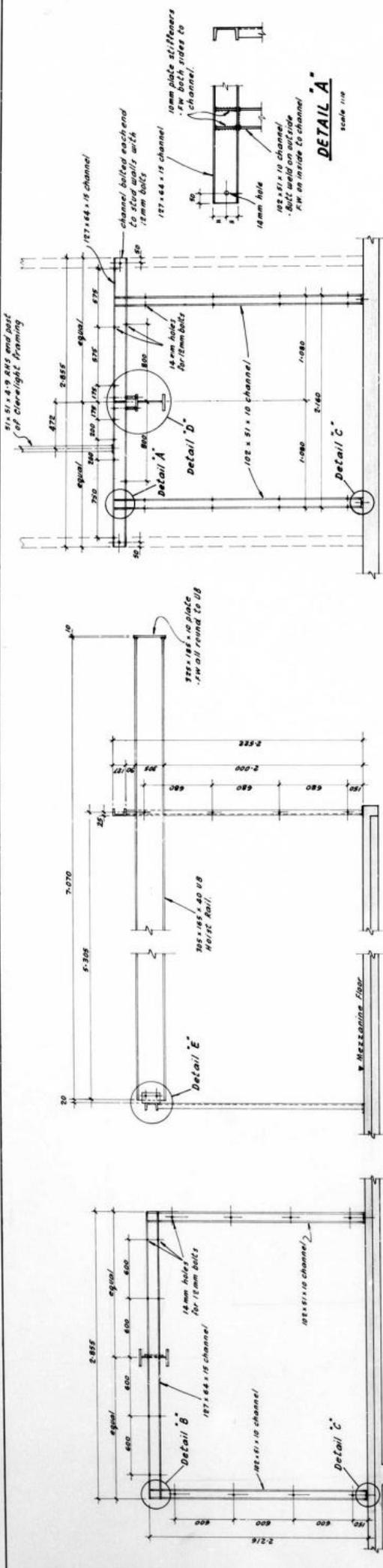
DETAIL 'GM' 175-OFF
 scale 1:10



Client	Christchurch City Council	Department	City Engineer's Department
Project No.	11.7	Drawn	A. R. Jones
Scale	1:10	Checked	A. R. Jones
Date	1/12/78	Approved	A. R. Jones
Author	A. R. Jones	Project Engineer	A. R. Jones
Drawn	A. R. Jones	Checked	A. R. Jones
Scale	1:10	Drawn	A. R. Jones
Date	1/12/78	Checked	A. R. Jones
Author	A. R. Jones	Approved	A. R. Jones
Project No.	11.7	Client	Christchurch City Council
Scale	1:10	Department	City Engineer's Department
Date	1/12/78	Project Engineer	A. R. Jones
Author	A. R. Jones	Checked	A. R. Jones
Drawn	A. R. Jones	Approved	A. R. Jones

D.2278
1:10
1:10
1:5

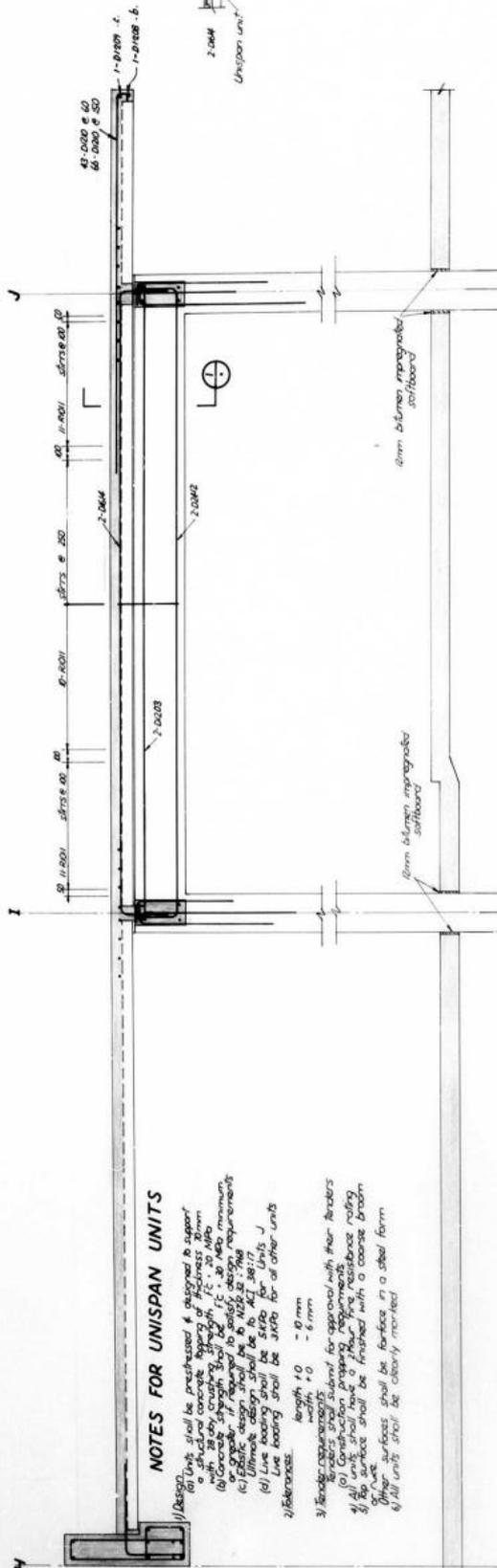
NEW CENTRAL DEPOT - PLANT MAINTENANCE - STAGE 2 - JOHNSON ST -
DETAILS OF DOOR & WINDOW HEAD BEAMS, GUTTER SUPPORTS ETC.



Notes: refer to notes on sheet 3.

CHRISTCHURCH CITY COUNCIL - CITY ENGINEER'S DEPARTMENT NEW CENTRAL DEPOT - PLANT MAINTENANCE - STAGE 2 - JOHNSON ST - DETAILS OF HOIST RAIL IN STORE ROOM - MEZZANINE FLOOR -		No. 8019/10 Date 1:10 1:20 1:50	D.2278 Sheet 59 of 63
Checked Drawn Date	2.8.15 2.8.15 2/15	Design Drawn Date	J. B. S. S. 2/15 2/15
Approved Date	2/15 2/15	Checked Date	2/15 2/15
Author Date	J. B. S. S. 2/15	Checked Date	2/15 2/15
Title Date	Details of Hoist Rail 2/15	Checked Date	2/15 2/15
Author Date	J. B. S. S. 2/15	Checked Date	2/15 2/15
Title Date	Details of Hoist Rail 2/15	Checked Date	2/15 2/15





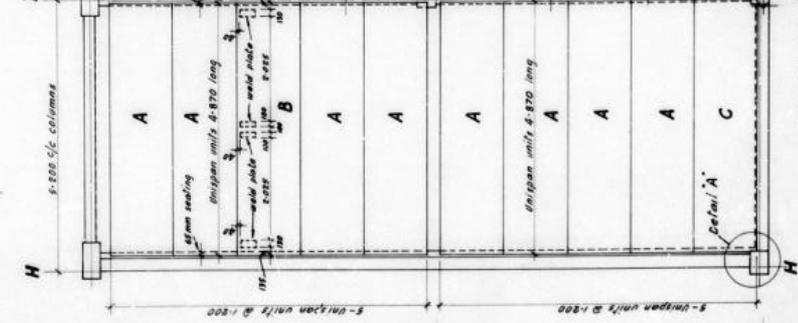
ELEVATION OF CENTRE BEAM
scale 1:10

70mm concrete
10mm concrete

6.300 c/c columns
6.300 c/c columns

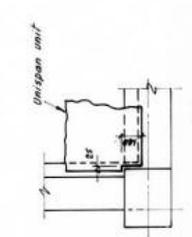
NOTES FOR UNISPAN UNITS

- Design units shall be prestressed & designed to support a structural concrete topping of thickness 70mm with 80% concrete and 20% aggregate. The units shall be designed to carry a minimum of 15 kN/m² dead load and 5 kN/m² live load. If required to satisfy design requirements, the units shall be designed to carry a minimum of 20 kN/m² dead load and 10 kN/m² live load for Units J.
- Live loading shall be 5 kPa for Units J.
- Tolerances: length +0 -6mm width +0 -6mm
- Trade requirements: (a) Reinforcement shall be approved with their barbed ends. (b) Construction program requirements. (c) All units shall have a 7 hour fire resistance rating. (d) All units shall be finished with a coarse brown. (e) Other surfaces shall be finished in a steel form. (f) All units shall be clearly marked.

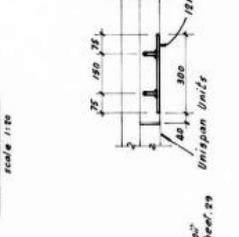


PLAN ON CONCRETE TOPPING SLAB
scale 1:10

PLAN ON UNISPAN UNITS
scale 1:10



DETAIL A
scale 1:10



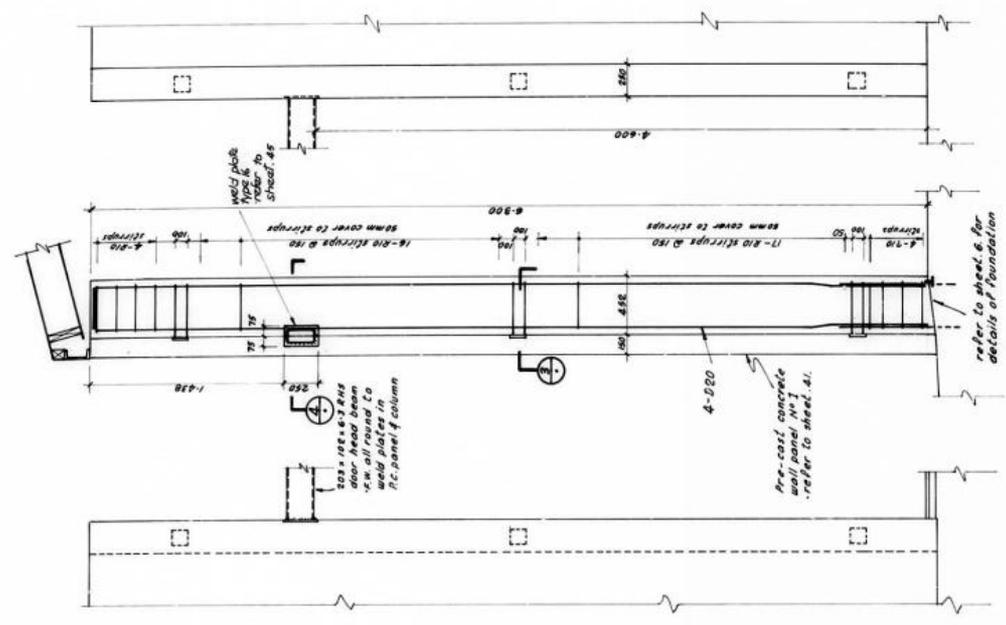
DETAIL OF WELD PLATES
2-OFF 100mm wide
2-OFF 130mm wide
scale 1:10

Revision	Drawn	Checked	Approved	Scale	Sheet No.	Project No.
1	J. B. Sear	J. B. Sear	J. B. Sear	1:10	01/10	02278
2						
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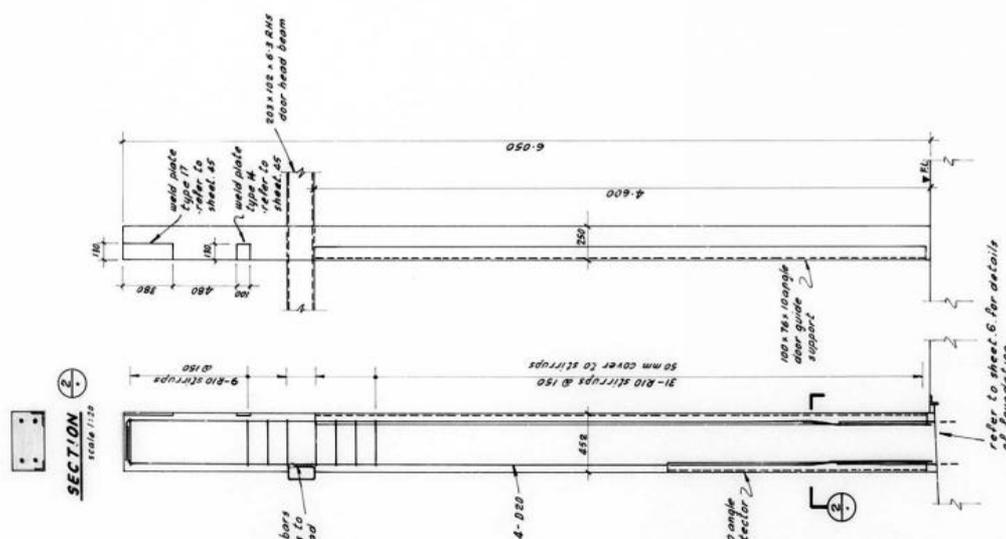
CHRISTCHURCH CITY COUNCIL - CITY ENGINEER'S DEPARTMENT
NEW CENTRAL DEPOT - PLANT MAINTENANCE - STAGE 2 - JOHNSON ST
MEZZANINE FLOOR - CENTRE BEAM & FLOOR SLAB - REINFORCING

Notes: Refer to sheet. 16.

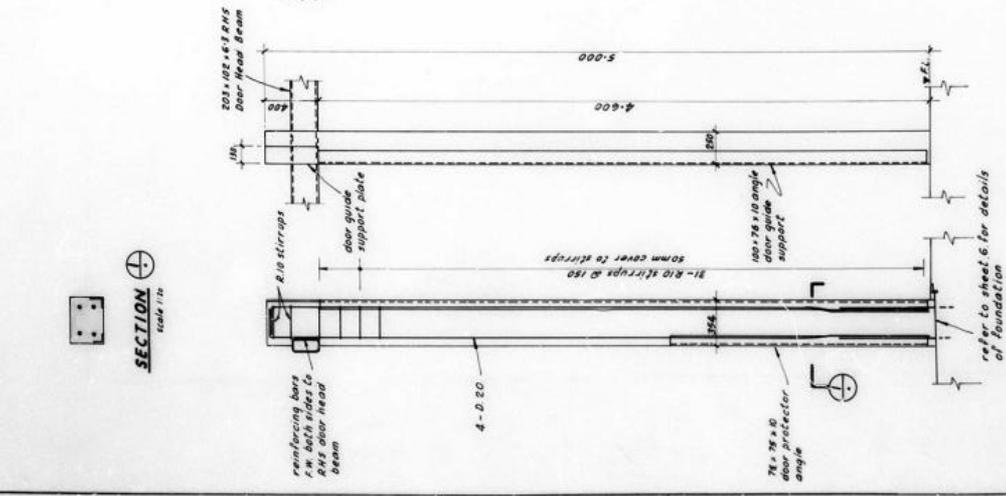
Original scale of millimetres



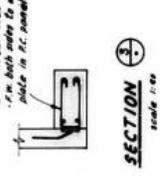
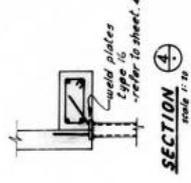
DETAIL OF CONCRETE COLUMN AT DOOR OPENING - GRID LINE (U-V)
Scale 1:20



DETAILS OF CONCRETE COLUMN AT DOOR OPENING - GRID LINE (Q-R) (S-T)
Scale 1:20



DETAILS OF CONCRETE COLUMN AT DOOR OPENING - GRID LINE (C-D)
Scale 1:20

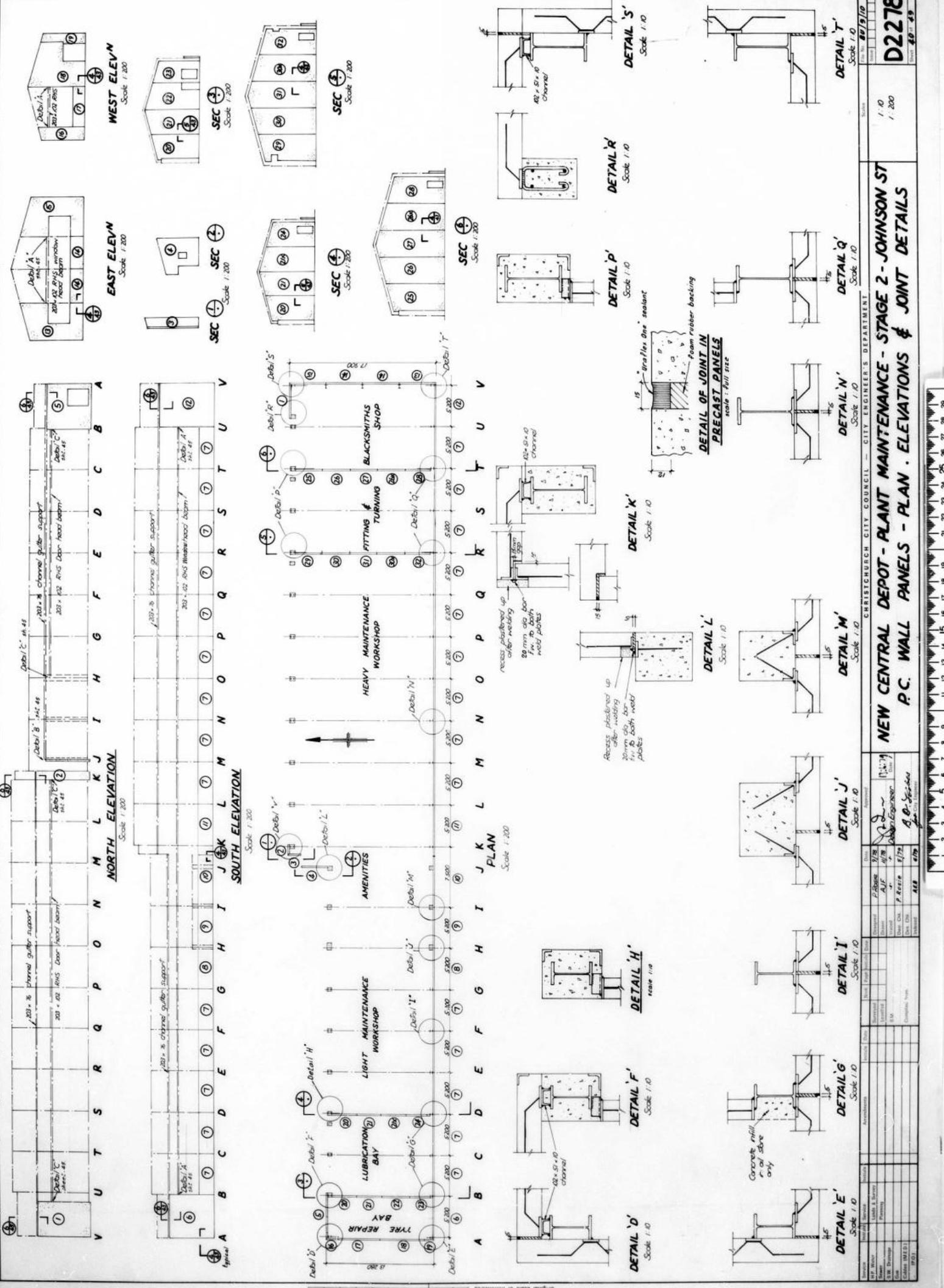


NOTES FOR CONCRETE COLUMNS

- 1 Concrete strength $f_c = 85 \text{ MPa}$
- 2 Reinforcing
 - (a) All bars except stirrups shall be deformed Grade 275
 - (b) Stirrups shall be plain round Grade 275
 - (c) Reinforcing shall be continuous throughout. Laps shall be 20mm - #80
 - (d) Cover to stirrups 50mm

<p>NEW CENTRAL DEPOT - PLANT MAINTENANCE - STAGE 2 - JOHNSON ST - DETAILS OF CONCRETE COLUMNS AT DOOR OPENINGS - NORTH WALL -</p>		<p>Scale: 1:20</p>	<p>Project No: 80/5/10</p>
<p>Client: CHRISTCHURCH CITY COUNCIL - CITY ENGINEER'S DEPARTMENT</p>	<p>Drawn: A. G. [Signature]</p>	<p>Checked: P. [Signature]</p>	<p>Scale: 1:20</p>
<p>Author: A. G. [Signature]</p>	<p>Project: NEW CENTRAL DEPOT - PLANT MAINTENANCE - STAGE 2 - JOHNSON ST -</p>	<p>Sheet: 22 of 29</p>	<p>Project No: 80/5/10</p>



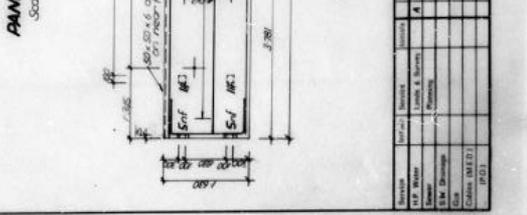
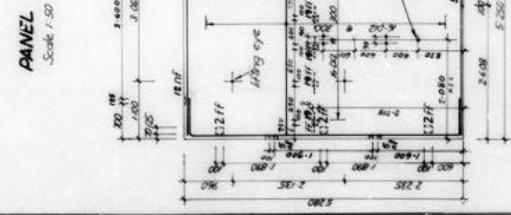
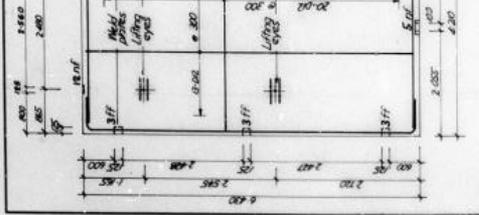
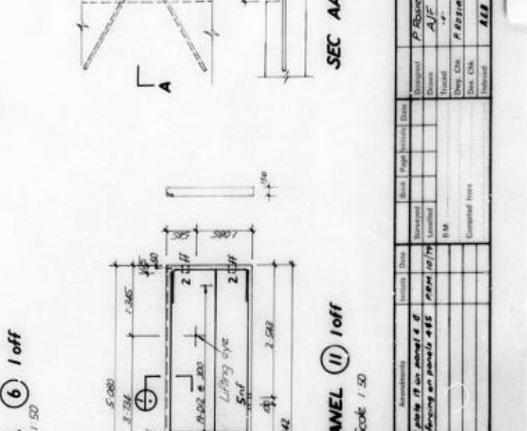
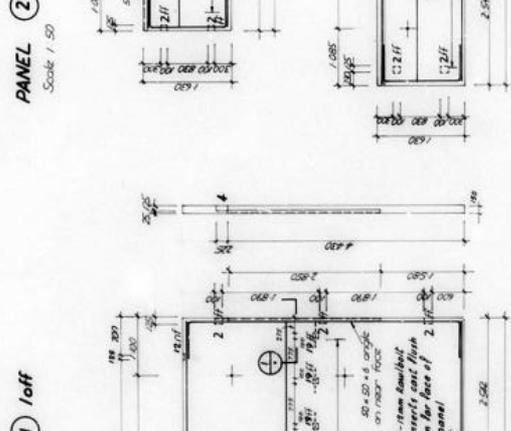
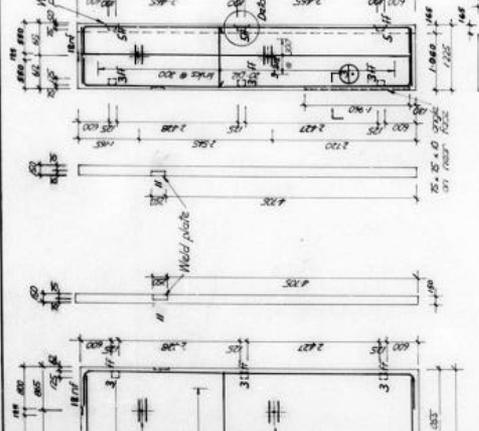
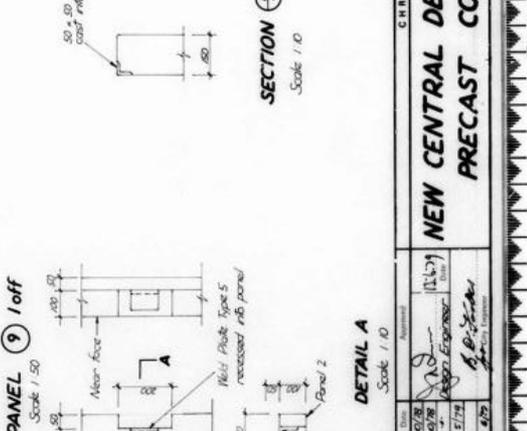
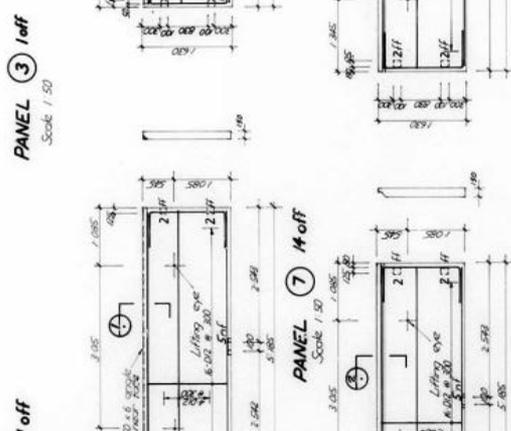
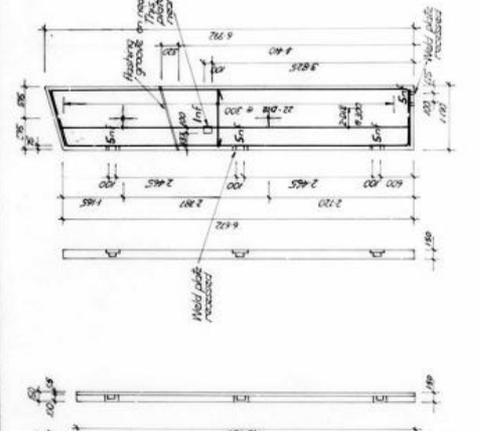
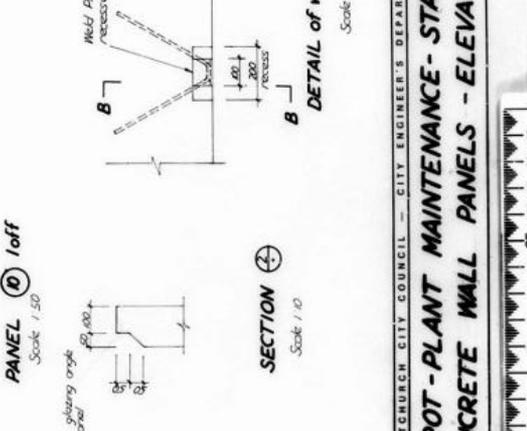
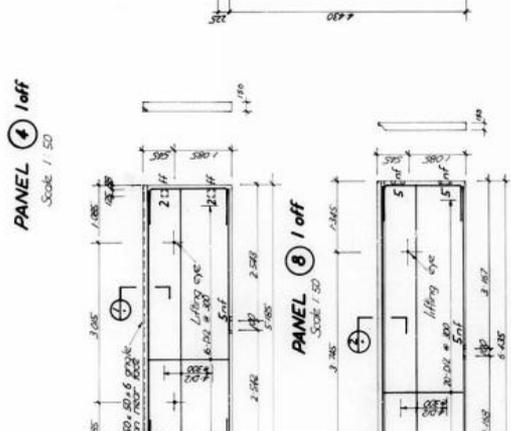
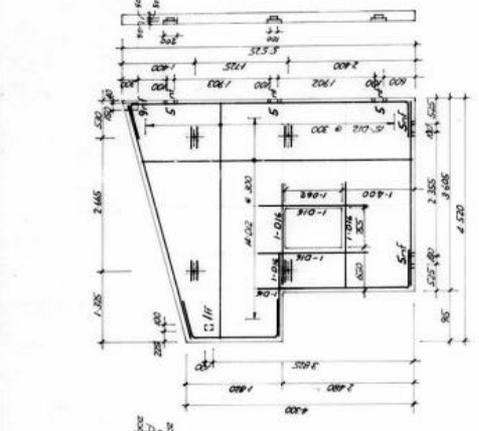
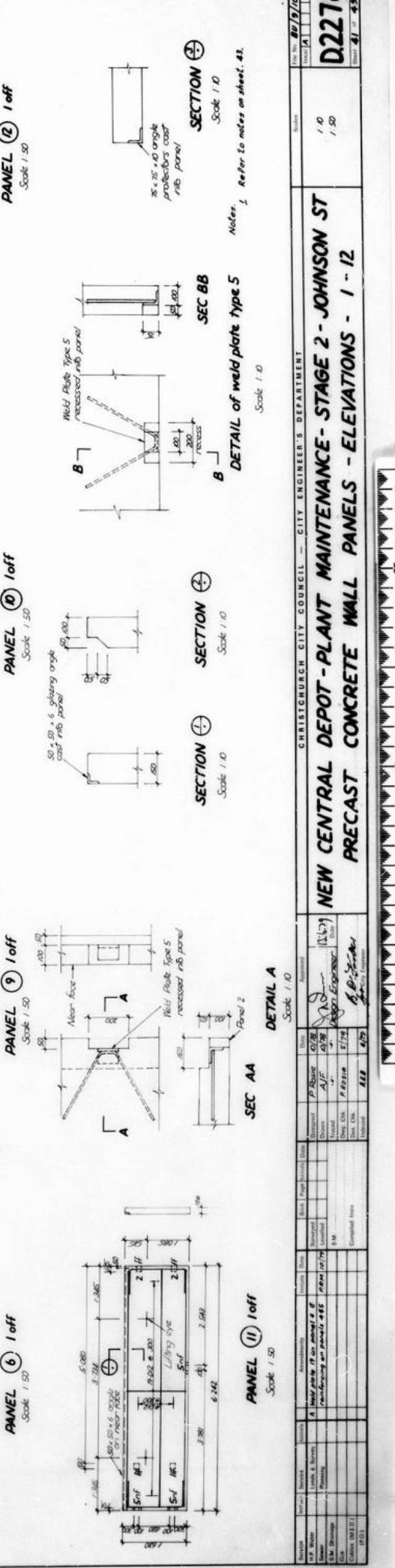
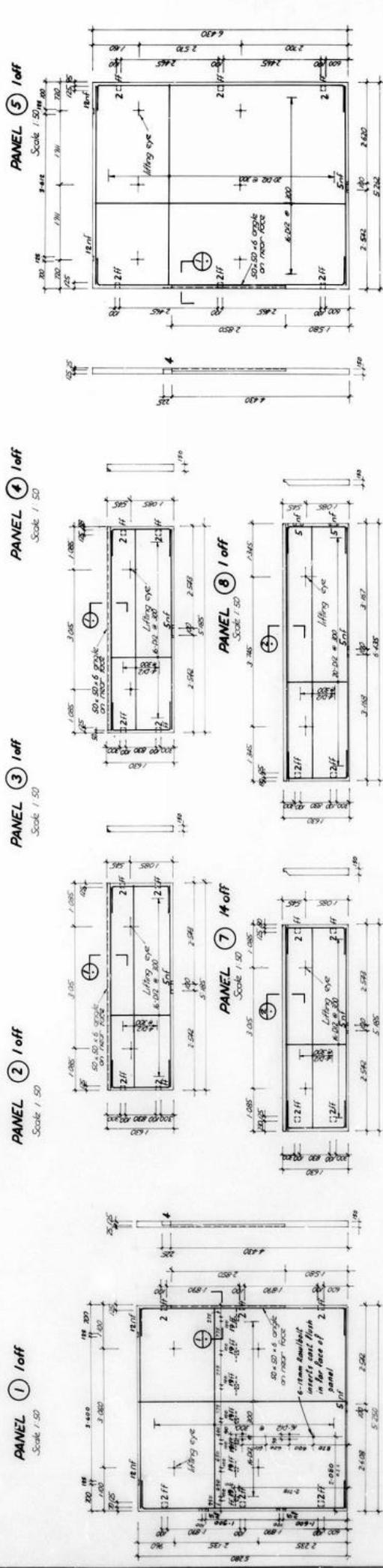
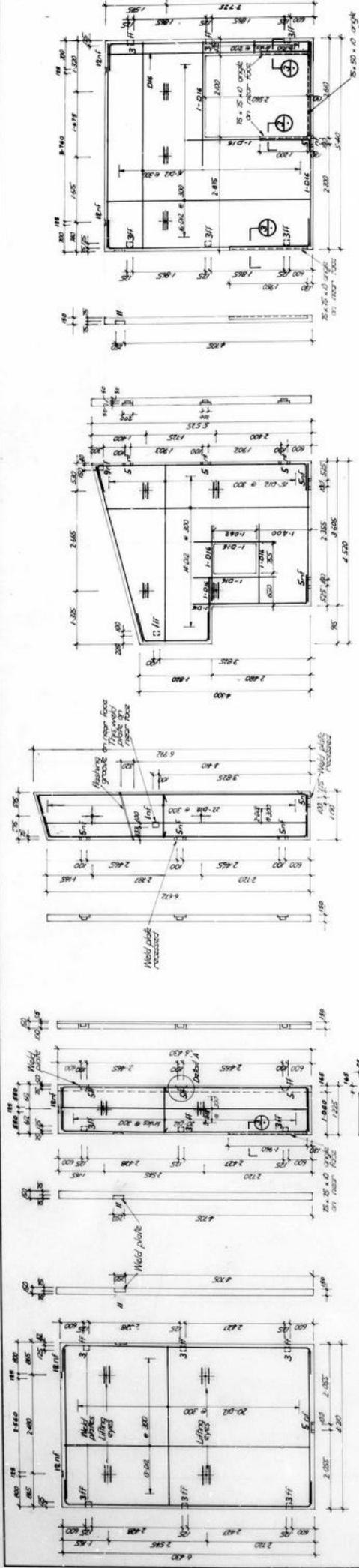


REVISIONS		DATE		BY		CHECKED		APPROVED	
No.	Description								
1	As Issued								

Project No.	1015/10
Scale	1:200
Sheet No.	D2278
Scale	1:200

Client	CHRISTCHURCH CITY COUNCIL - CITY ENGINEER'S DEPARTMENT
Project Name	NEW CENTRAL DEPOT - PLANT MAINTENANCE - STAGE 2 - JOHNSON ST
Project Location	P.C. WALL PANELS - PLAN - ELEVATIONS & JOINT DETAILS
Architect	A.B. Spencer
Structural Engineer	A.B. Spencer
Scale	1:200





Original scale of millimetres

Notes: 1. Refer to notes on sheet 41.

CHRISTCHURCH CITY COUNCIL - CITY ENGINEER'S DEPARTMENT

NEW CENTRAL DEPOT - PLANT MAINTENANCE - STAGE 2 - JOHNSON ST

PRECAST CONCRETE WALL PANELS - ELEVATIONS - 1 - 12

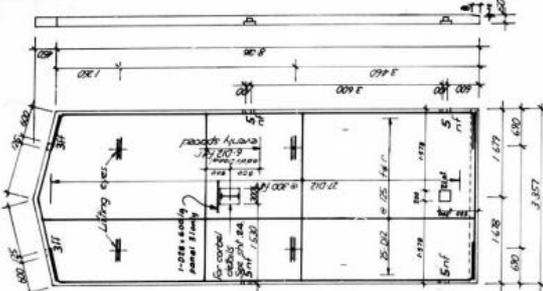
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DATE: 19/10

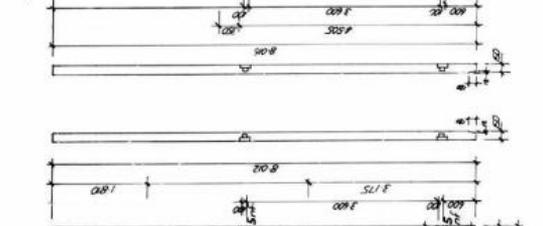
PROJECT: 1/0

D2278

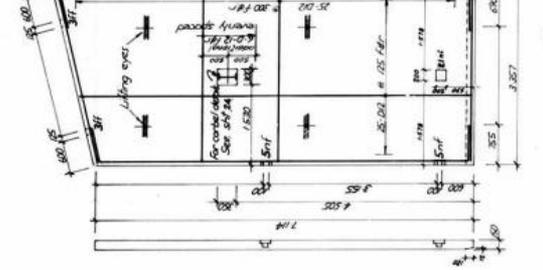
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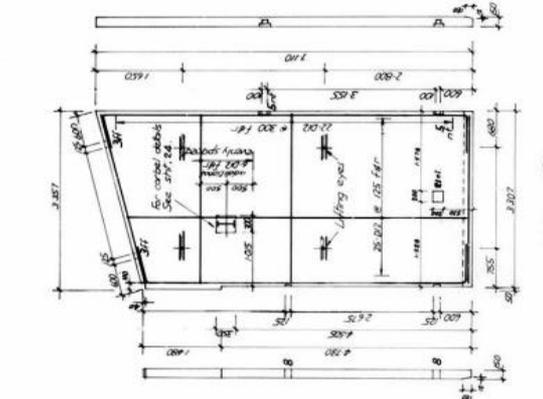
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Scale 1/50



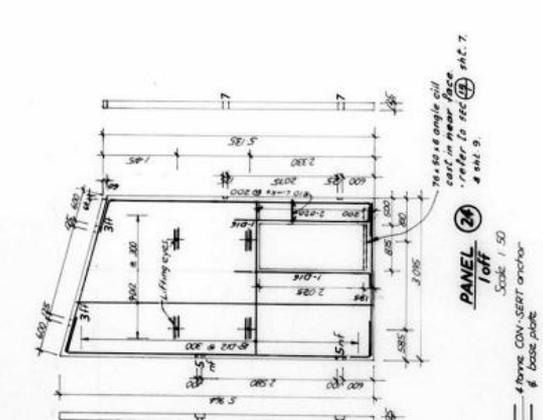
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Scale 1/50



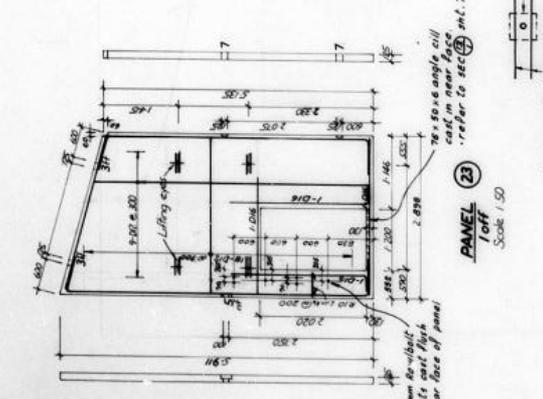
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Scale 1/50



PANEL 26 / off
Scale 1/50



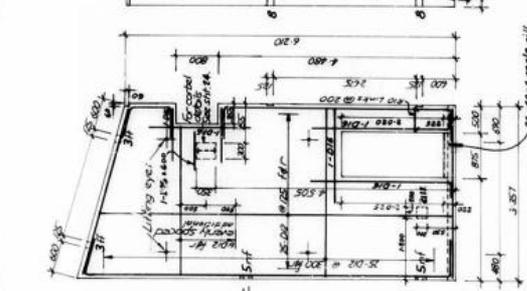
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PANEL 28 / off
Scale 1/50

PANEL 29 / off
Scale 1/50

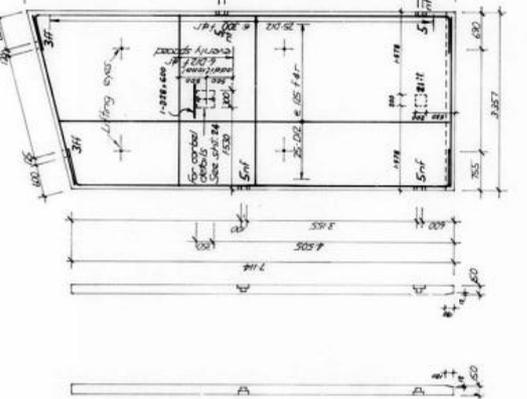
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Scale 1/50



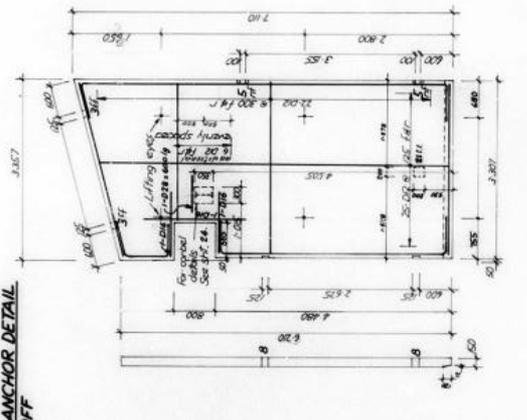
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Scale 1/50



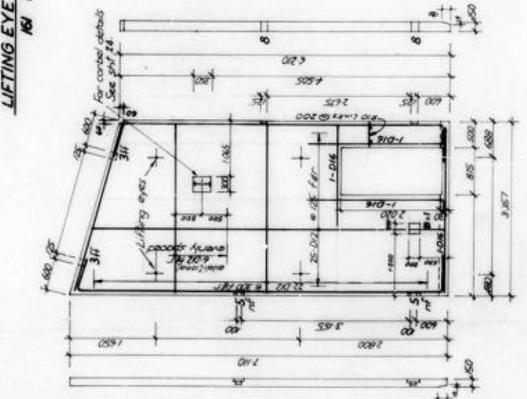
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Scale 1/50



PANEL 31 / off
Scale 1/50



PANEL 32 / off
Scale 1/50



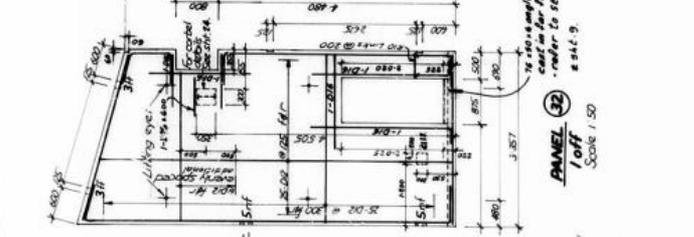
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Scale 1/50

PANEL 34 / off
Scale 1/50

NOTES FOR PC PANELS

- 1) Cast in situ concrete strength f_c = 30 MPa before lifting of panels commences.
- 2) Reinforcing rods to be assigned grade 235.
- 3) All steel to be placed centrally.
- 4) Cover for panels to be 40mm.
- 5) Cover for near face panels to be 20mm.
- 6) All reinforcement to be 10mm diameter.
- 7) Spacing: length = 200mm, height = 200mm.
- 8) Refer to Architect's drawings for details of reinforcement.
- 9) All lifting eyes are on face of panels.
- 10) All lifting eyes are on near face of panels.
- 11) All lifting eyes are on near face of panels.
- 12) All lifting eyes are on near face of panels.
- 13) All lifting eyes are on near face of panels.
- 14) All lifting eyes are on near face of panels.
- 15) All lifting eyes are on near face of panels.
- 16) All lifting eyes are on near face of panels.
- 17) All lifting eyes are on near face of panels.
- 18) All lifting eyes are on near face of panels.
- 19) All lifting eyes are on near face of panels.
- 20) All lifting eyes are on near face of panels.

SECTION 1/10



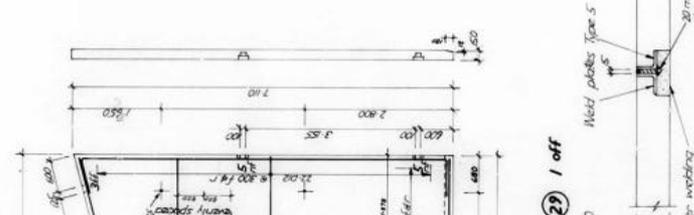
SECTION 2/10



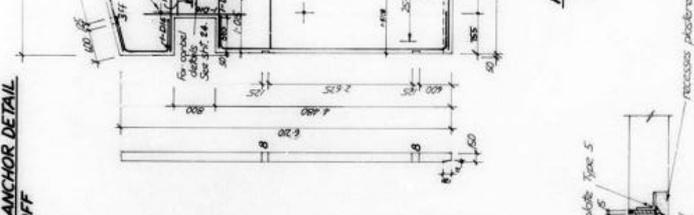
SECTION 3/10



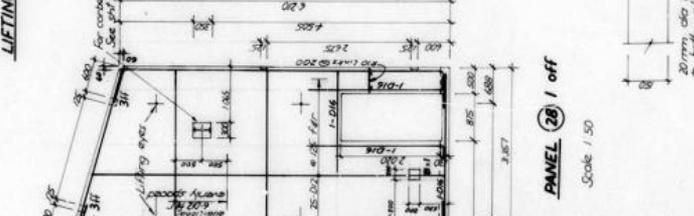
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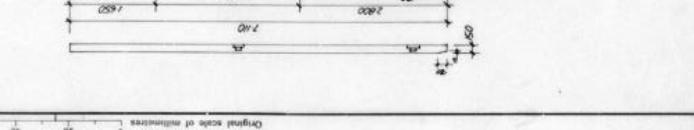
SECTION 5/10



SECTION 6/10



SECTION 7/10



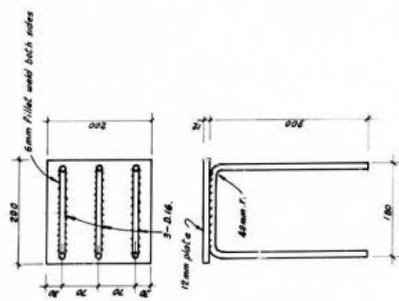
NEW CENTRAL DEPOT - PLANT MAINTENANCE - STAGE 2 - JOHNSON ST
PRECAST CONCRETE WALL PANELS - ELEVATIONS - 23 - 32

CHRISTCHURCH CITY COUNCIL - CITY ENGINEER'S DEPARTMENT

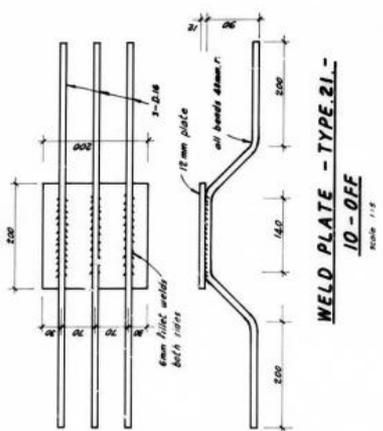
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Rev.	By	Date	Description
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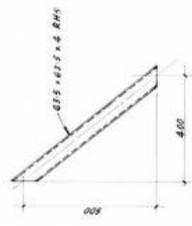
D2278
23 of 29



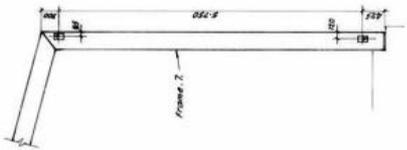
WELD PLATE - TYPE 20 -
10-OFF
 Scale 1:5



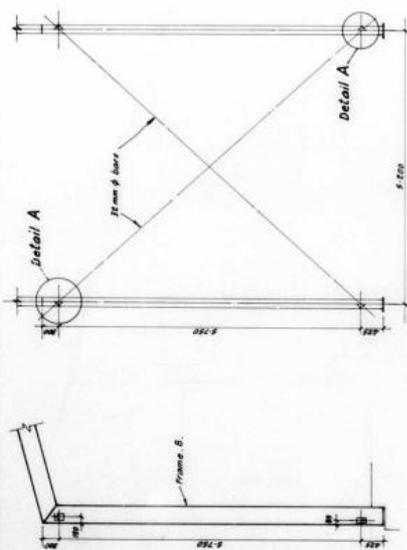
WELD PLATE - TYPE 21 -
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 Scale 1:5



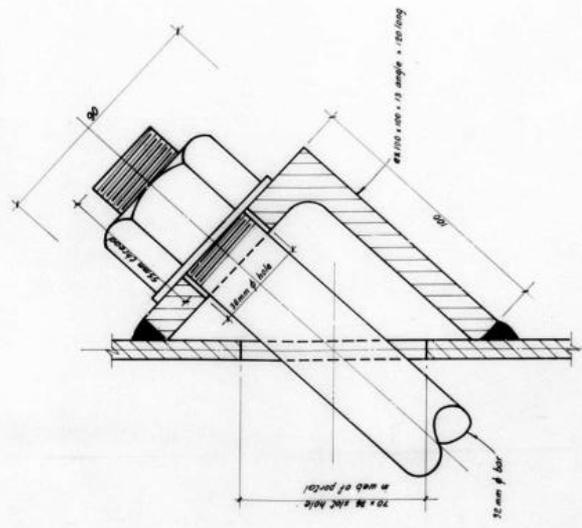
PANEL SUPPORTS
10-OFF
 Scale 1:10



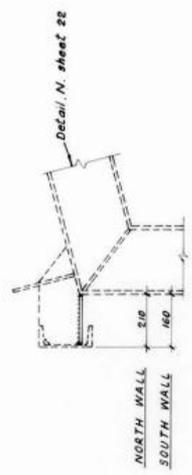
Frame 2



ELEVATION OF DIAGONAL BRACING
NORTH WALL
 South wall similar
 Scale 1:20



DETAIL A.
 Scale 1:20



Detail N sheet 22

additional 10 x 10 stiffener
 to be added at chimney joint
 - see to project

ADDITIONAL STIFFENER TO DETAIL N
GRID LINES K & L ONLY
 Scale 1:10

NOTES
 Refer to sheets 43/44

CHRISTCHURCH CITY COUNCIL - CITY ENGINEER'S DEPARTMENT									
Drawn	Checked	Reviewed	Approved	Scale	Sheet	NEW CENTRAL DEPOT - PLANT MAINTENANCE - STAGE 2 - JOHNSON ST - DETAILS OF DIAGONAL BRACING ETC			
1:20	1:5	1:10	1:10	1:10	43/44	D.2278			
centimetres									
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30

Appendix C

CERA DEE Summary Data

Location		Building Name: Milton St Depot - Tyre Bay	Unit: _____	No: _____	Street: _____	Reviewer: David Whittaker
Building Address: _____	Legal Description: _____	245 Milton Street			CPEng No: 123089	Company: Beca
GPS south: _____			Degrees: _____	Min: _____	Sec: _____	Company project number: 5323355
GPS east: _____			_____			Company phone number: 03 3663521
Building Unique Identifier (CCC): BU 1411-011 EQ2			_____			Date of submission: _____
_____			_____			Inspection Date: 1/02/2012
_____			_____			Revision: _____
_____			_____			Is there a full report with this summary? yes

Site		Site slope: flat	Max retaining height (m): 0
Soil type: _____	Soil Profile (if available): _____	Site Class (to NZS1170.5): D	_____
Proximity to waterway (m, if <100m): _____	If Ground improvement on site, describe: _____	Proximity to cliff top (m, if < 100m): _____	_____
Proximity to cliff base (m, if <100m): _____	Approx site elevation (m): _____	_____	_____

Building		No. of storeys above ground: 1	single storey = 1	Ground floor elevation (Absolute) (m): _____
Ground floor split? no	Ground floor elevation above ground (m): 0.00	Stores below ground: 0	_____	_____
Foundation type: other (describe)	_____	Building height (m): 5.00	if Foundation type is other, describe: shallow foundations assumed	_____
Floor footprint area (approx): 165	height from ground to level of uppermost seismic mass (for IEP only) (m): 4.5	Age of Building (years): 32	Date of design: 1976-1992	_____
Strengthening present? no	_____	Use (ground floor): other (specify)	_____	_____
Use (upper floors): commercial	_____	Use notes (if required): Workshop	_____	_____
Importance level (to NZS1170.5): IL2	_____	Importance level (to NZS1170.5): IL2	_____	_____

Gravity Structure		Gravity System: frame system	rafter type, purlin type and cladding: steel, unknown and profiled metal
Roof: steel framed	Floors: _____	Beams: steel non-composite	beam and connector type: portal frame, welded
Columns: structural steel	Walls: non-load bearing	_____	typical dimensions (mm x mm): concrete encased one side

Lateral load resisting structure		Lateral system along: single level tilt panel	Note: Define along and across in detailed report!	note total length of wall at ground (m): 9
Ductility assumed, μ: 1.25	Period along: 0.40	0.00		wall thickness (m): 0.15
Total deflection (ULS) (mm): _____	maximum interstorey deflection (ULS) (mm): _____	Lateral system across: welded and bolted steel moment frame	_____	_____
Ductility assumed, μ: 1.25	Period across: 0.40	0.00	note typical bay length (m): 6	_____
Total deflection (ULS) (mm): _____	maximum interstorey deflection (ULS) (mm): _____	_____	_____	_____

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

Non-structural elements		Stairs: exposed structure	describe: none
Wall cladding: Metal	Roof Cladding: aluminium frames	Glazing: light tiles	describe: concrete walls and glazing
Ceilings: lighting, roller door mechanical	_____	_____	describe: profiled metal sheeting

Available documentation		Architectural: none	original designer name/date: none available
Structural: none	Mechanical: none	Electrical: none	original designer name/date: none available
Geotech report: none	_____	_____	original designer name/date: none available

Damage		Site performance: slight	Describe damage: some liquefaction and pavement cracking
Settlement: none observed	Differential settlement: none observed	Liquefaction: 0-2 m ² 100m ⁺	_____
Lateral Spread: none apparent	Differential lateral spread: 0-20mm/20m	Ground cracks: slight	_____
Damage to area: slight	_____	_____	_____

Building:		Current Placard Status: green	Describe how damage ratio arrived at: _____
Along	Damage ratio: 0%	Describe (summary): _____	$\text{Damage Ratio} = \frac{(\% \text{ NBS (before)} - \% \text{ NBS (after)})}{\% \text{ NBS (before)}}$
Across	Damage ratio: 0%	Describe (summary): _____	
Diaphragms	Damage?: no	Describe: roof diaphragm not able to be seen	_____
CSW's:	Damage?: no	Describe: _____	_____
Pounding:	Damage?: no	Describe: N/A	_____
Non-structural:	Damage?: no	Describe: _____	_____

Recommendations		Level of repair/strengthening required: minor structural	Describe: concrete wall crack repair
Building Consent required: no	Interim occupancy recommendations: full occupancy	_____	Describe: _____
Along	Assessed %NBS before: 35%	Assessed %NBS after: 35%	##### %NBS from IEP below
Across	Assessed %NBS before: 100%	Assessed %NBS after: 100%	##### %NBS from IEP below
_____		If IEP not used, please detail assessment methodology: Forced-based quantitative assessment	

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): 1976-1992

h_n from above: 4.5m

Seismic Zone, if designed between 1965 and 1992:

not required for this age of building
not required for this age of building

along across
0.4 0.4
Period (from above):
(%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 buildings 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_{max} 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

Assessed ductility (less than max in Table 3.2)
Ductility scaling factor: =1 from 1976 onwards; or =k_u, if pre-1976, from Table 3.3:

along across
Ductility 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: #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	Separation	Severe	Significant	Insignificant/none
	0<sep<.005H	0.7	0.8	1
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	Separation	Severe	Significant	Insignificant/none
	0<sep<.005H	0.4	0.7	1
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

For ≤3 storeys, max value =2.5, otherwise max value =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 Baseline %NBS: #DIV/0! #DIV/0!

4.4 Percentage New Building Standard (%NBS), (before)

#DIV/0!

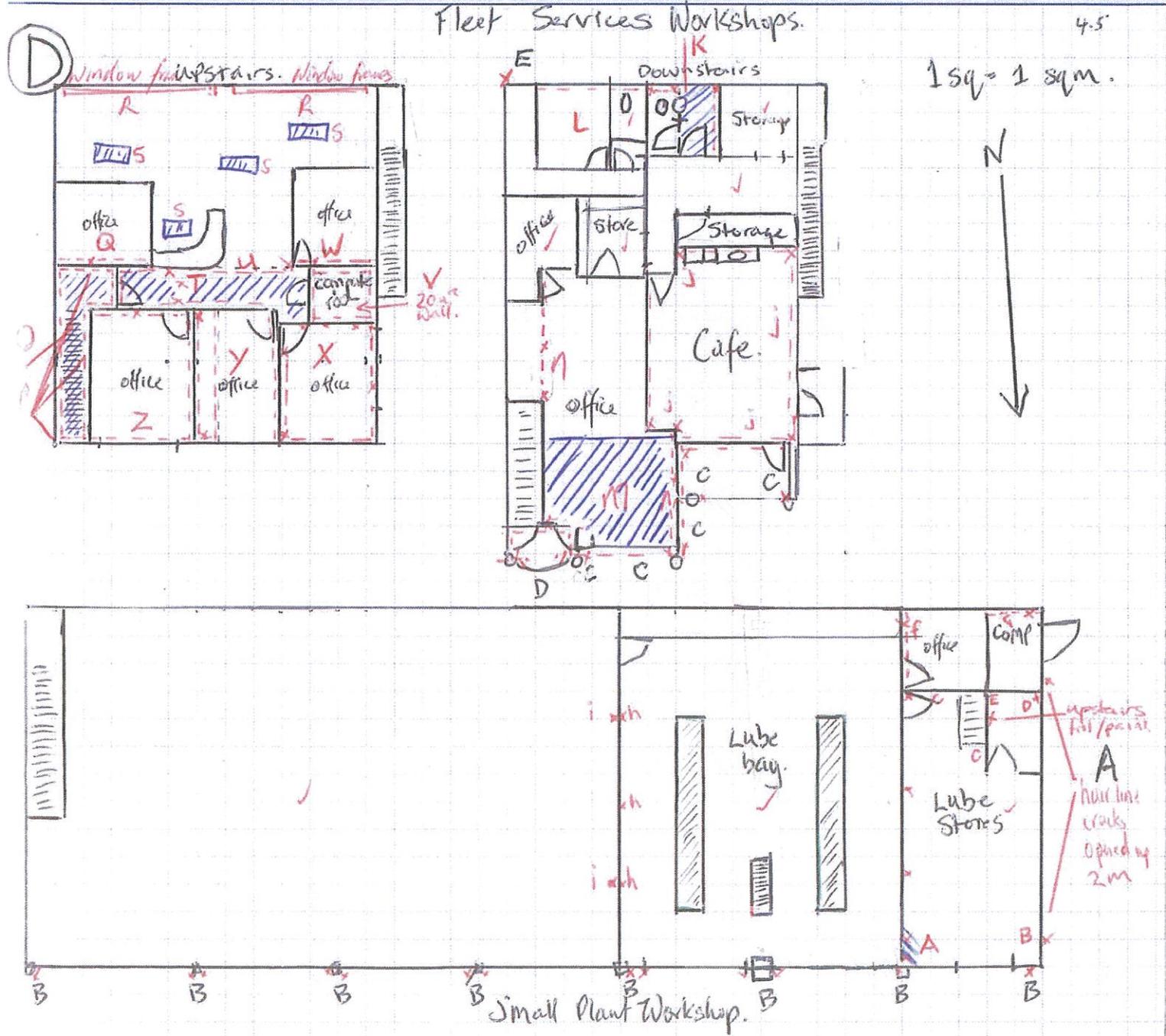
Official Use only:

Accepted By:
Date:

Appendix D

Previous Reports and Assessments

Project: SHEET D Job No/File Ref: _____
 Description: BU 1141-001 EQ2 Prepared by: _____
 Date: ____/____/____ Sheet No: ____ of ____
 Site Instruction: Memo: Meeting: File Note: Variation / Detail:



Approved: _____ Client: _____ Contractor: _____
 Date: ____/____/____ Date: ____/____/____
 Distribution: Principal: Contractor: Site Copy: Engineer: Sub-Contractor: Job File: