CityCare Pages Road – Super Shed
Detailed Engineering Evaluation
BU 0879-017 EQ2
Quantitative Report

Prepared for Christchurch City Council (Client)

By Beca Carter Hollings & Ferner Ltd (Beca)

31 January 2014

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Revision History

Revision Nº	Prepared By	Description	Date
A	George El-Haddad/ Andrew Sporn	Draft for CCC review	27 August 2013
B	George El-Haddad/ Andrew Sporn	Final Issue	31 January 2014

Document Acceptance

Action	Name	Signed	Date
Prepared by	George El-Haddad/ Andrew Sporn		31 January 2014
Reviewed by	Nicholas Charman		31 January 2014
Approved by	David Whittaker		31 January 2014
on behalf of	Beca Carter Hollings & Ferner Ltd		

CityCare Pages Road – Super Shed
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Detailed Engineering Evaluation
Quantitative Report – SUMMARY
Version 1

Address
Shuttle Drive
Bromley
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) Revision 7 issued by the Engineering Advisory Group (EAG) in 2012.

A Qualitative Report for the Supershed was issued to CCC on 9 October 2012.

The Super Shed building is located at CityCare Pages Road, Shuttle Drive, Bromley, Christchurch. The building consists of steel portal frames in one direction and braced bays in the other direction, with a combination of precast concrete panel and profile metal wall cladding. It was originally built between 1982 and 1990 according to aerial photographs available. The approximate floor area is 1200m^2 internally. No architectural or structural drawings were available. Calculations have been undertaken as part of the Quantitative Assessment.

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

Key Damage Observed

Visual inspections on 7 August 2012 indicate the building has suffered moderate damage. The key damage observed includes:

- Cracking to the north eastern concrete wall panels at panel joints.
- Vertical cracking to the north eastern wall panels at the middle of the panels.
- Significant cracking and spalling at concrete wall panel connections to the superstructure.
- Failure of bolts at the top concrete wall panel connections at the north and south corner of the building (it is likely that other connections have also failed that were not able to be inspected). A temporary repair and strengthening solution has been provided, refer to Appendix C.
- Local web bending of steel column at brace connection at south corner of the building.
- Cracking to concrete floor slab around columns.
- Cracking to asphalt pavement at columns.

Critical Structural Weaknesses (CSW)

The following potential Critical Structural Weaknesses have been identified:

- Site Characteristics, significant liquefaction potential due to widespread liquefaction that occurred in the surrounding area. However, liquefaction is unlikely to result in global collapse of the building.
- Inadequate precast wall panel connections/supports for in-plane and out-of-plane load effects. A temporary repair solution was provided to CCC on 10 January 2013. This temporary repair provides restraint to the panels under out of plane loading, to reduce the potential collapse hazard.

Indicative Building Strength (from Detailed Assessment)

The building has been assessed to have a seismic capacity of 15%*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, and is therefore potentially Earthquake Prone and classified as Seismic Grade E. The building score has been provided based on the assessment of the superstructure, pending confirmation of the foundation sizes.

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:

- Foundations, 10% NBS, governed by bearing capacity of the soil beneath foundations. Initial site investigations indicated a foundation size of 600 x 600 x 400mm deep. This size is small for a structure of this type and it is possible that this is a pedestal and that there may be a larger foundation pad beneath. Further intrusive investigations appear to be warranted given the current assessed score.
- Braced bay columns, 15%*NBS*, governed by minor axis bending due to eccentricity between roof eaves member and vertical bracing connection.
- Mezzanine portal frame columns, 16%*NBS*, governed by major axis bending.
- Mezzanine portal frame knee connections, 17%NBS, governed by the strength of weld.
- Wall bracing, 24%*NBS*, governed by axial compression of 125 x 4 SHS.
- Wall bracing connection, 15%*NBS*, governed by localised bending of the column web due to axial forces in the bracing.
- Connections of the precast concrete cladding panels to the superstructure were considered to be less than 20%*NBS* based on their original detailing. However based on the installation of the temporary restraint details provided 10 January 2013 they have been assessed to be greater than 100%*NBS* for out of plane loading.

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 prone, having an assessed capacity less than 33%NBS, and is classified as Seismic E. The risk of collapse of an earthquake prone building of this grade is considered to be more than 25 times greater than that of an equivalent new building.

For greater Christchurch the definition of a “dangerous” building in the Building Act has been extended (by the Canterbury Earthquake (Building Act) Order 2011) to include buildings at risk of collapsing in a moderate earthquake, that is earthquake prone buildings with a capacity at or below 33%NBS. Where council requires a dangerous building or an earthquake prone building to be upgraded, it may prohibit the use of the building until the works are carried out.

No significant damage or hazards were identified to the seismic or gravity load resisting system that would further reduce its ability to resist further loads, however the precast concrete wall panels are potential collapse hazards with assessed capacities of less than 20% as previously noted. A temporary repair solution to ‘make safe’ the precast panels was provided to CCC on 10 January 2013 to reduce the potential collapse hazard.

It is recommended that:

- A full damage assessment is carried out for insurance purposes.
- Based on CERA published ground elevation changes (refer Photo 16 in Appendix A) it is estimated that the ground level of the Supershed changed in the order of 200 – 300 mm. Aerial reconnaissance of the site on 24 February 2011 indicates widespread liquefaction occurred in the surrounding area, but our visual inspection found no signs of major differential settlement. A verticality and level survey could be carried out to determine the extent of settlement of the building for insurance purposes.
- Immediate and temporary repairs completed to the connections between the precast concrete cladding panels and steel portal frames, that have been installed to address the immediate falling hazard, should be reviewed and replaced, as required, with an appropriate long term solution.
- Intrusive investigations should be conducted to confirm the foundation pad size under the portal columns.
- The support connection for the precast mezzanine floor units and floor seating is determined.
- Intrusive investigations should be conducted to determine if there is vertical (wall) bracing below the mezzanine floor structure.
- A repair methodology should be developed for the braced columns where damage has occurred.

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Appendices

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 Super Shed building located at CityCare Pages Road at Shuttle Drive, Bromley, 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) Revision 7 issued by the Engineering Advisory Group (EAG) in 2012.

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*).

The building description below is based on our visual inspections and site measurements only, as drawings were not available.

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) Revision 7 issued by the Engineering Advisory Group in 2012, 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:

- The importance level and occupancy of the building
- The placard status that was assigned during the state of emergency following the 22 February 2011 earthquake
- 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*.

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 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.

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:

- 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.

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.

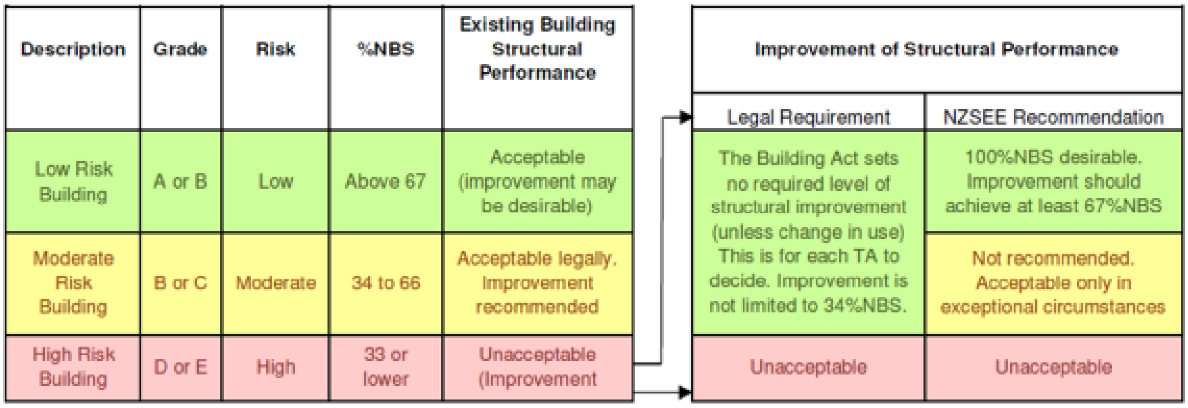
3 Earthquake Resistance Standards

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. No drawings of the structure were available, therefore the building information is assumed from our visual inspection only

Table 4.1: Building Summary Information

Item	Details	Comment
Building name	City Care Pages Road – Super Shed	
Street Address	Shuttle Drive Bromley Christchurch	
Age	1982 - 1990	No drawings available, the construction date is assumed based on aerial photographs.
Description	Warehouse with offices	
Building Footprint / Floor Area	Approx. 35m x 35m/1200m^2	
No. of storeys / basements	Mostly one storey / no basement	Mezzanine floor in corner of warehouse.
Occupancy / use	Warehouse and offices	Importance Level 2
Construction	Steel portal frames with metal wall cladding and approximately half height precast concrete wall panel cladding. Mezzanine floor consists of precast concrete flat slab units with in-situ topping supported on beams and columns and load bearing walls.	Based on visual inspection. No drawings available. Steelwork connections appear to be typically welded. This is likely to have required considerable site welding during the initial construction. Beams and columns have been advised to be steel members. Refer section 10.2.
Gravity load resisting system	Metal roof on steel purlins which are supported by steel portal frames.	No drawings available. Roof structure includes steel transfer beams.

Item	Details	Comment
	Concrete mezzanine floor is supported on steel (assumed) beams and columns.	
Seismic load resisting system	Steel portal frames transversely, steel SHS tension/compression bracing in roof and walls in the longitudinal direction. The bottom of a flat vertical (wall) diagonal brace was observed in the south west corner of the internal mezzanine wall. No bracing was observed to the other mezzanine walls. It was assumed that lateral loads from the mezzanine are supported by the main superstructure.	No drawings available. Significant eccentricities exist between wall bracing connection 'work points' and roof eaves members, and column bases.
Foundation system	Unknown but assumed to be shallow foundations with a concrete slab on grade in the northern part of the building and asphalt pavement in the southern part of the building	No drawings available. Site investigations suggest a 600 x 600 x 400 deep footing to columns typically.
Stair system	Steel stairs to upstairs office	Supported by cantilever steel beams.
Other notable features	None	
External works	Asphalt pavement	
Construction information	Visual inspection	No drawings available
Likely design standard	NZS4203:1976 or NZS4203:1984	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:

- Precast concrete panel fixings to steel portal frames.
- Columns and connections of tension and compression bracing due to large detailing eccentricities and inadequate stiffeners.
- Seating of precast/concrete floor units in mezzanine structure.
- Lateral support of mezzanine floor. Further investigation required to confirm lateral load resisting system and floor seating connections.

5 Site Investigations

5.1 Previous Assessments

The building had a Level 2 rapid assessment undertaken following the February 2011 and June 2011 earthquake events (refer to Appendix E).

Visual inspections as part of the Level 4 damage assessment were undertaken on 7 August 2012. A Qualitative Report was issued to CCC on 9 October 2012.

5.2 Level 5 Intrusive Investigations

The following intrusive investigations were carried out as part of the Level 5 quantitative assessment of CityCare Pages Road Super Shed:

- General site measurements and obtaining member setouts and sizes.
- Excavation under a typical column to determine the foundation system. CCC advised that the foundations comprised of a 600 x 600 x 400 concrete pad.
- Determination of the mezzanine column and beam section sizes.
- Determination of the connection between the supporting beams and columns of the mezzanine structure.
- Determination of the roof transfer beam member section, running north-south.
- Determination of the roof bracing section and connection details.

Refer to section 10.2 and Appendix B for the results of the intrusive investigations.

6 Damage Assessment

6.1 Damage Summary

The table below provides a summary of damage observed during our inspection. Refer to Appendix A for photographs.

Table 6.1: Damage Summary

Damage type	Unknown	Minor	Moderate	Major	Comment
settlement of foundations	✓				None observed during the visual inspection. Level survey may be required
tilt of building	✓				None observed during visual inspection. Vertical survey may be required to confirm.
liquefaction	✓				None observed during visual inspection. The aerial reconnaissance on 24 February 2012 indicates widespread liquefaction in surrounding areas. Volume is unknown.
settlement of external ground	✓				None observed during visual inspection.
lateral spread / ground cracks		✓			Cracks in asphalt pavement observed.
frame		✓			Local damage to steel column at brace connection at south corner of the building.
concrete walls			✓		Cracking adjacent to joints of precast panels. Minor vertical cracks to the north eastern wall panels.

Damage type	Unknown	Minor	Moderate	Major	Comment
					Significant cracking and spalling at panel connections to superstructure. Broken/missing bolts at top panel connections in north and south corner of building. Connections have failed in pull out/shear.
cracking to concrete floors		✓			Cracking to concrete floor slab around columns
bracing					No damage to bracing members observed during visual inspection. Refer to frame for damage at location of brace connection to column.
precast flooring seating	✓				Not inspected due to linings in place.
stairs					No damage observed during visual inspection.
cladding /envelope					No damage observed during visual inspection. Refer above for precast wall panels.
internal fit out					No damage observed during visual inspection.
building services	✓				No inspection of services was carried out.
other					

6.2 Surrounding Buildings

There are no adjacent buildings that are close enough to affect the Super Shed building during an earthquake.

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 limited visual inspection, the structure appears to have only suffered minor damage and therefore we believe the structural capacity has not materially diminished.

7 Generic Issues

The following generic issues referred to in Appendix A of the EAG guideline document have been identified as applicable to the Super Shed building:

Single level tilt panel

- Brittle panel connections and cracked panels at the connections.
- Steel bracing connections inadequate.

Damage observed at multiple connections.

Precast concrete floor systems (mezzanine structure)

- Inadequate support of precast units. Not able to be inspected without intrusive investigation.
- Inadequate connection of floor diaphragm to the vertical structure. Not able to be inspected without intrusive investigation.

Steel concentric braced frames

- Connections inadequate for capacity of braces

Damage observed at some connections.

Portal frames

- Inadequate stiffness of the structure as a whole meaning that the building may exceed drift limits.
- Column sidesway mechanism results in excessive ductility demand on columns.
- Inadequate connections – welded connections in particular.

8 Geotechnical Consideration

No Geotechnical information is currently available for this site.

During the inspection, any damage to the surrounding ground was noted and any effect to the structure was considered in the quantitative assessment. The aerial reconnaissance on 24 February 2011 indicates widespread liquefaction in surrounding areas.

It should be noted that CERA published LiDAR information shows that global settlement of 200-300 mm has occurred across the site. No signs of differential settlement were observed during our visual inspection however settlement and verticality surveys could be conducted on the structure to determine if there are any potential structural impacts.

9 Survey

No level or verticality surveys were carried out as there was no evidence of differential 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 Detailed Assessment Procedures in the NZSEE 2006 AISPBE guidelines, based on the site measurements and intrusive investigations undertaken.

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

10.2 Assumptions

The following assumptions were used in our quantitative assessment:

- Structural steel yield strength (Open Sections), fy = 300 MPa
- Structural steel yield strength (Hollow Sections); fy = 300 MPa
- Reinforcing steel yield strength, fy = 275 MPa
- Concrete compressive strength, f'c = 25 MPa
- Welds, unless specified, are assumed to be 5mm Continuous Fillet Welds, structural category GP (General Purpose), electrode type E41XX.
- Soil bearing capacity of 150 kPa. (includes ϕ = 0.5)
- Soil weight of 18 kN/m^3.

Probable material strengths as described in the NZSEE AISPBE guidelines have been used in determining structural capacities.

The following information has been provided by CCC (refer Appendix B):

- Longitudinal bay spacing 5 m.
- Transverse bay spacing of 6.86 m for the two outer bays, and 10.34m for the two inner bays.
- Portal frame ridge height of 6.76 m
- Portal frame rafter size of 250UB31.
- Portal frame column of 250UB (250UB31 assumed). For external columns only.
- Internal columns are 150 SHS. (5 mm wall thickness assumed). For the two end frames the internal columns are 250UB31.
- Eaves beam of 200 x 150 mm (200UB25 assumed).
- Roof bracing size of 100 x 4 SHS. Connection is 4mm weld all round.
- Longitudinal wall bracing size of 125 x 4 SHS.
- Transfer beam size of 450 x 190 x 10 mm (460UB67 assumed)
- Mezzanine support beam of 305 x 165 mm (310UB46 assumed)
- Pad footing size under portal frames of 600 mm x 600 mm x 400 mm – no ground beams.
- Ground slab thickness of 100 mm.
- Reinforcement for precast concrete cladding panels is 12 mm diameter bars, spaced at 300 mm centres vertically and horizontally and located centrally. This was determined from a Ferroscan. Precast panels are 130mm thick typically.

10.3 Critical Structural Weaknesses

The following potential Critical Structural Weaknesses have been identified:

- Site Characteristics, significant liquefaction potential due to widespread liquefaction that occurred in the surrounding area. However, liquefaction is unlikely to result in global collapse of the building.
- Inadequate precast wall panel connections/supports for in-plane and out-of-plane load effects. A temporary repair solution was provided to CCC on 10 January 2013. This temporary repair

provides restraint to the panels under out of plane loading, to reduce the potential collapse hazard.

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:

- Site soil class: D – NZS 1170.5:2004, Clause 3.1.3, Soft Soil
- Site hazard factor, Z = 0.3 – NZBC, Clause B1 Structure, Amendment 11 effective from 19 May 2011
- Return period factor Ru = 1 – NZS 1170.5:2004, Table 3.5, Importance Level 2 structure with a 50 year design life.
- 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 15*%NBS*. The building score has been provided based on the assessment of the superstructure, pending confirmation of the foundation sizes. This is lower than the IEP assessment of 37*%NBS* in the previous Qualitative Report. Table 10.1 presents the evaluated seismic capacity in terms of *%NBS* of the individual structural systems and components 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**		**15%*NBS***	**Governed by minor axis bending due to eccentricity between roof eaves member and vertical bracing connection (mezzanine end governs).**
Overall *%NBS* adopted from DEE	**Transverse**		**16%*NBS***	**Governed by major axis bending of the mezzanine portal frame columns.**
Typical portal frame rafter (250UB31)	Transverse	1.25	50%*NBS*	Governed by major axis bending.
Typical portal frame column (250UB31)			69%*NBS*	Governed by major axis bending.
Typical frame knee connection			34%*NBS*	Governed by the weld capacity. 6CFW (GP) welding assumed.
Typical frame ridge connection			>100%*NBS*	Governed by the weld capacity. 6CFW (GP) welding assumed.
Mezzanine portal frame rafter (250UB31)	Transverse	1.25	36%*NBS*	Governed by major axis bending.
Mezzanine portal frame external columns (250UB31)			16%*NBS*	Governed by major axis bending.
Mezzanine frame knee connection			*17%NBS*	Governed by the weld capacity 6CFW (GP) welding assumed
Mezzanine frame ridge connection			*>100%NBS*	Governed by the weld capacity 6CFW (GP) welding assumed
Internal columns (150 SHS)			47%*NBS*	Governed by flexure.
Internal column connection to rafter			>100%*NBS*	Assumed to be 5CFW (GP)

Item	Loading Direction	Ductility, µ	Seismic Capacity	Notes
Purlin (strut) DHS150 or similar	Longitudinal	1.25	>100%*NBS*	
Wall bracing (125 x 4 SHS)	Longitudinal	1.25	24%*NBS*	Governed by axial compression of 125 x 4 SHS.
Braced Bay Columns			15%*NBS*	Governed by minor axis bending due to eccentricity between roof eaves member and vertical bracing connection (mezzanine end governs).
Wall bracing connection			39%*NBS*	Governed by strength of weld. 5CFW (GP) assumed.
Capacity of the column web for brace connection			15%*NBS*	Governed by localised bending of the column web due to axial forces in the bracing.
Roof bracing (100 x 4 SHS)	Longitudinal	1.25	55%*NBS*	Governed by axial compression of the bracing.
Roof bracing connection			>100%*NBS*	Governed by strength of 4CFW (GP) weld as per intrusive investigation.
Precast cladding panel connections	Longitudinal	1.0	>100%*NBS*	Based on temporary connections issued to CCC on January 10 2013.
Foundations (Braced bay)	Longitudinal	1.25	10%*NBS*	600 x 600 x 400 pad footing as per site investigations. Governed by bearing capacity of soil beneath the foundations (braced bay mezzanine end). Details of the connection between the column and foundation are unknown. Connection assumed to be a HERA BPP30.

Item	Loading Direction	Ductility, µ	Seismic Capacity	Notes
Foundations (Typical internal Column) (Typical external column)	Both	1.25	20%*NBS* 64%NBS	Based on a 600 x 600 x 400 pad footing – we have assumed all foundations are the same size as determined by the braced bay site investigation. Governed by bearing capacity of soil beneath the foundations (braced bay mezzanine end). Details of the connection between the column and foundation are unknown. Connection assumed to be a HERA BPP30.

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:

- Foundations, 10% NBS, governed by bearing capacity of the soil beneath the foundations. Initial site investigations indicated a foundation size of of 600 x 600 x 400mm deep. This size is small for a structure of this type and it is possible that this is a pedestal and that there may be a larger foundation pad beneath. Further intrusive investigations appear to be warranted given the current assessed score.
- Braced bay columns, 15%*NBS*, governed by minor axis bending due to eccentricity between roof eaves member and vertical bracing connection.
- Mezzanine portal frame columns, 16%*NBS*, governed by major axis bending.
- Mezzanine portal frame knee connections, 17%NBS, governed by the strength of weld.
- Wall bracing, 24%*NBS*, governed by axial compression of 125 x 4 SHS.
- Wall bracing connection, 15%*NBS*, governed by localised bending of the column web due to axial forces in the bracing.
- Connections of the precast concrete cladding panels to the superstructure were considered to be less than 20%*NBS* based on their original detailing. However based on the installation of the temporary restraint details provided 10 January 2013 they have been assessed to be greater than 100%*NBS* for out of plane loading.

Based on the results of our Quantitative Assessment, the Super Shed is considered potentially Earthquake Prone as the seismic capacity was assessed to be less than 33%, and is classified as Seismic Grade E.

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 potentially earthquake prone, having an assessed capacity less than 33*%NBS*, and is classified as Seismic E. The risk of collapse of an earthquake prone building of this grade is considered to be more than 25 times greater than that of an equivalent new building.

For greater Christchurch the definition of a “dangerous” building in the Building Act has been extended (by the Canterbury Earthquake (Building Act) Order 2011) to include buildings at risk of collapsing in a moderate earthquake, that is earthquake prone buildings with a capacity at or below 33*%NBS*. Where council requires a dangerous building or an earthquake prone building to be upgraded, it may prohibit the use of the building until the works are carried out.

No significant damage or hazards were identified to the seismic or gravity load resisting system that would further reduce its ability to resist further loads, however the precast concrete wall panels are potential collapse hazards with assessed capacities of less than 20% as previously noted. A temporary repair solution to ‘make safe’ the precast panels was provided to CCC on 10 January 2013 to reduce the potential collapse hazard.

11.2 Further Investigations, Survey or Geotechnical Work

It is recommended that:

- A full damage assessment is carried out for insurance purposes.
- Based on CERA published ground elevation changes (refer Photo 16 in Appendix A) it is estimated that the ground level of the Supershed changed in the order of 200 – 300 mm. Aerial reconnaissance of the site on 24 February 2011 indicates widespread liquefaction occurred in the surrounding area, but our visual inspection found no signs of major differential settlement. A verticality and level survey could be carried out to determine the extent of settlement of the building for insurance purposes.
- Immediate and temporary repairs completed to the connections between the precast concrete cladding panels and steel portal frames, that have been installed to address the immediate falling hazard, should be reviewed and replaced, as required, with an appropriate long term solution.
- Intrusive investigations should be conducted to confirm the foundation pad size under the portal columns.
- The support connection for the precast mezzanine floor units and floor seating is determined.
- Intrusive investigations should be conducted to determine if there is vertical (wall) bracing below the mezzanine floor structure.
- A repair methodology should be developed for the braced columns where damage has occurred.

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, however may be developed as a result of the strengthening options.

13 Limitations

The following limitations apply to this engagement:

- 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.
- 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.
- The inspections are limited to building structural components only.
- Inspection of building services, pipework, pavement, and fire safety systems is excluded from the scope of this report.
- 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.
- 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.
- 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 A1: Aerial Photograph of site showing various buildings (Source: Google Maps, North to top of page).

Photo 1: Exterior view of North West elevation.

Photo 2: Exterior view of North East elevation.

Photo 3: Exterior view of South East elevation.

Photo 4: Exterior view of South West elevation.

Photo 5: Interior view warehouse.

Photo 6: Interior view warehouse and mezzanine floor.

Photo 7: Interior view office.

Photo 8: Typical cracking to concrete wall panel.

Damage Description: Cracking to concrete wall panel adjacent to joint.

Photo 9: Tension/Compression brace with large connection eccentricities at each end.

Photo 10: Panel connection with missing bolt at north corner of building.

Damage Description: Possible shear failure of bolt.

Photo 11: Panel connection with concrete spalling.

Damage Description: Possible shear/pull out failure of bolt/concrete panel.

Photo 12: Panel connection with missing bolt at southern corner of building.

Damage Description: Possible shear failure of bolt.

Photo 13: Panel connection with concrete spalling at southern corner of building.

Damage Description: Possible shear failure of bolt/panel.

Photo 14: Panel connection with concrete cracking at southern corner of building.

Damage Description: Possible shear failure of bolt/concrete panel.

Photo 15: Tension/compression brace connection at southern corner of building.

Damage Description: Local bending of web and flange.

Photo 16: Typical cracking to concrete slab.

Damage Description: Cracking to concrete slab at column locations.

Photo 17: Cracking to asphalt pavement.

Damage Description: Cracking to asphalt pavement at column location.

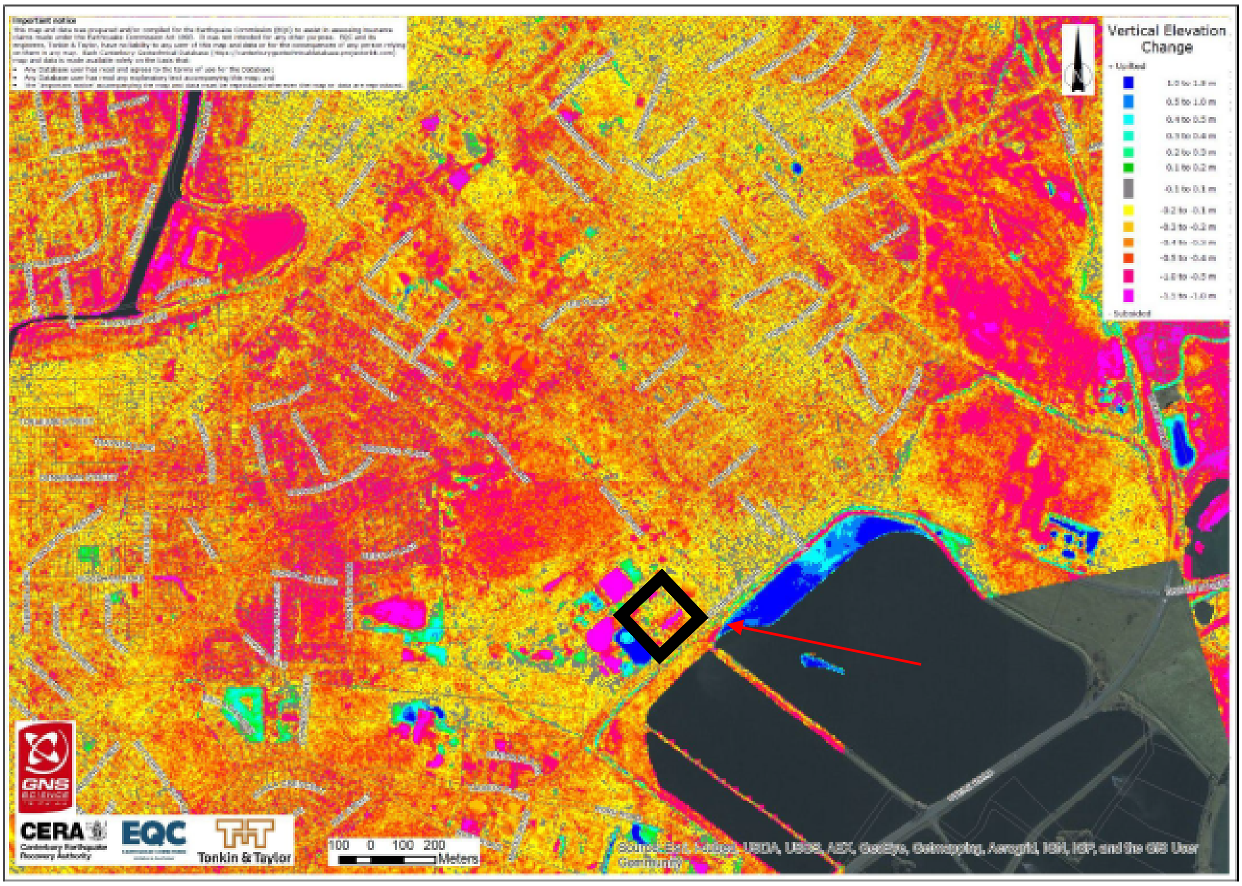
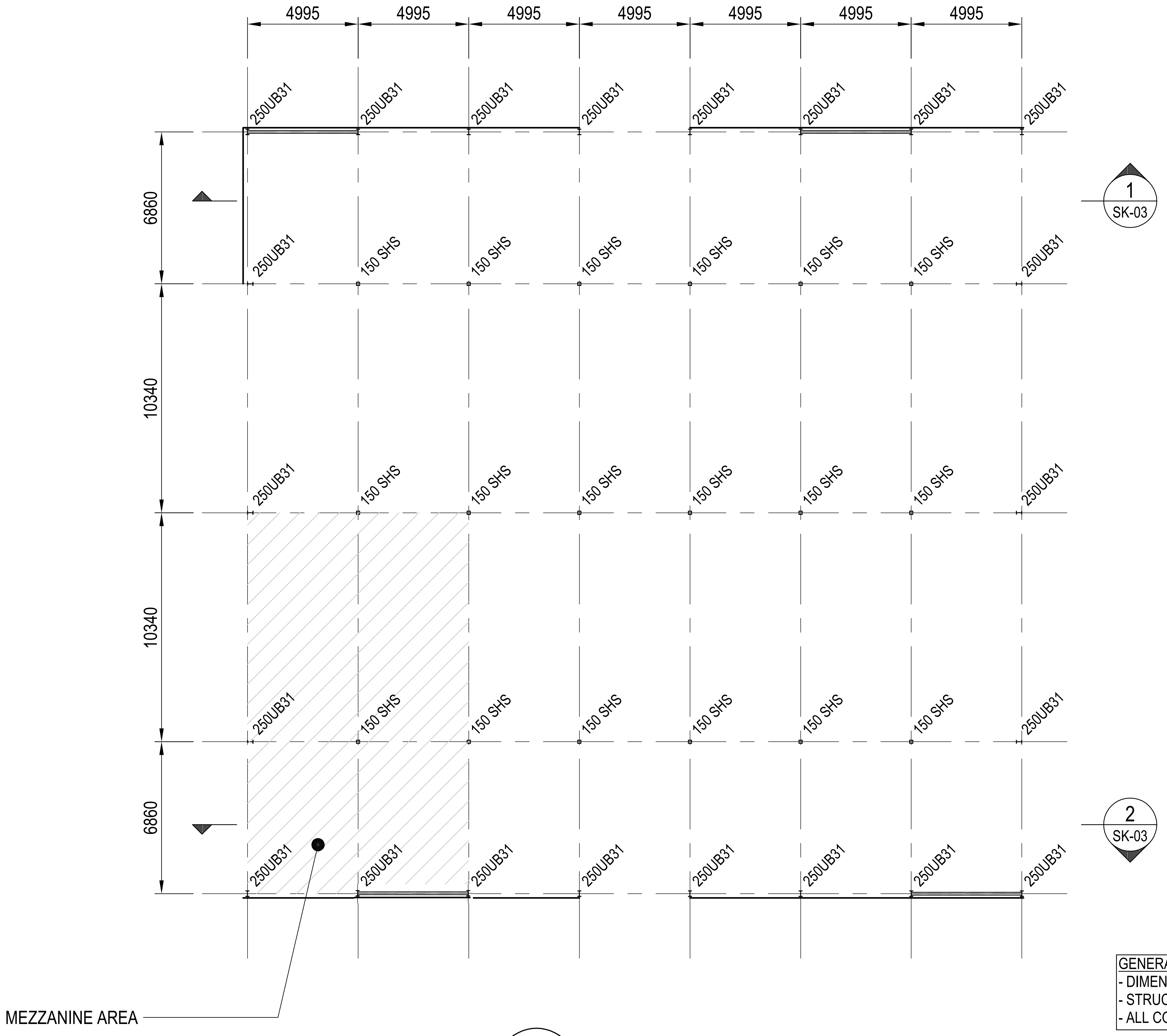


Photo 18: CERA published change in ground elevation between LiDAR in July 2003 and February 2012, with regional tectonic component of ground displacement removed. Approximate location of Supershed shown.

Appendix B

Site Survey Results



A
-

SUPERSHED FLOOR PLAN

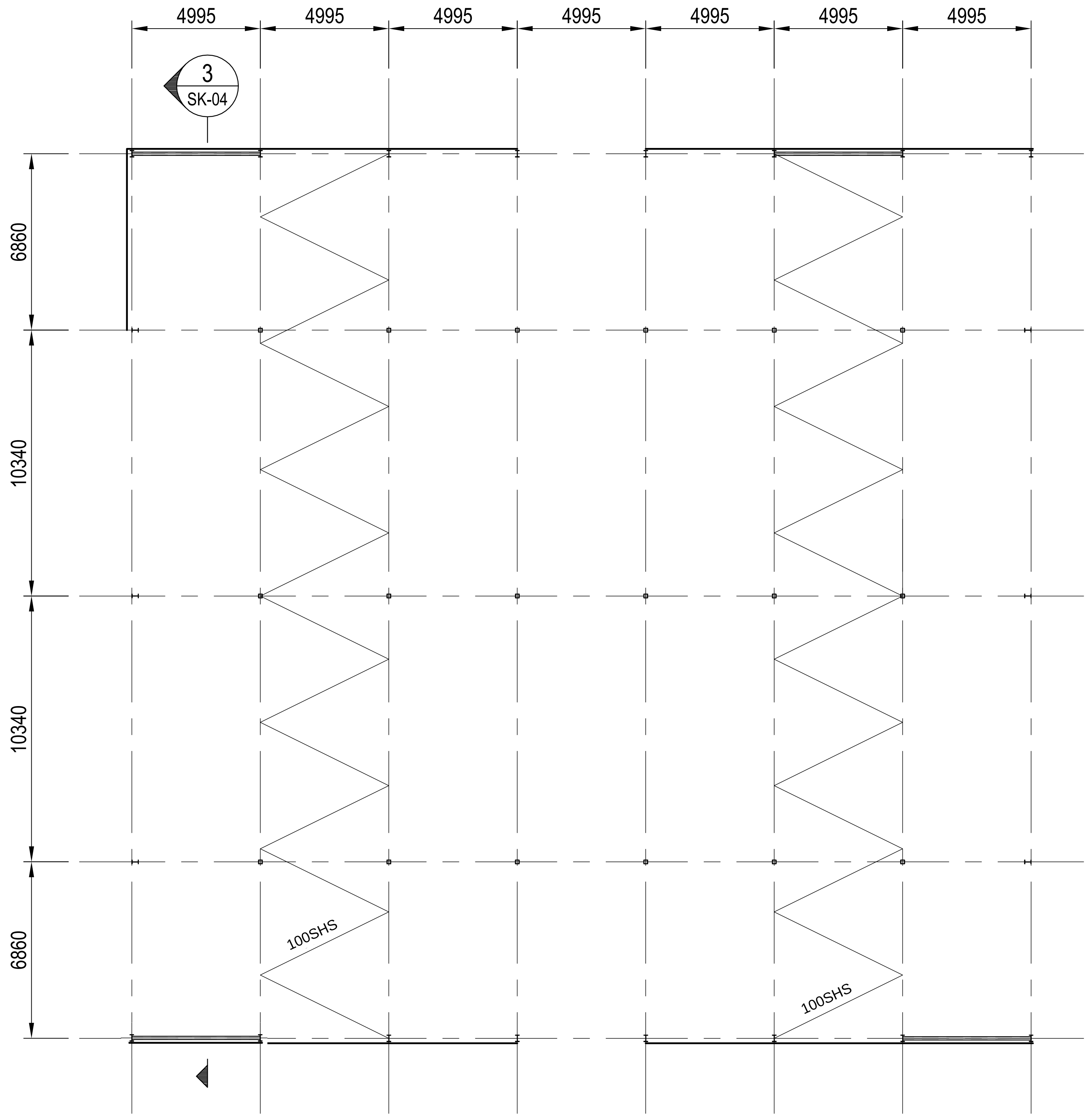
NTS

GENERAL NOTE:
- DIMENSIONS APROXIMATE ONLY, CONFIRM ON SITE
- STRUCTURAL SECTIONS APPROXIMATE ONLY, BASED ON SITE MEASUREMENTS
- ALL CONNECTIONS WELDED TYPICALLY

PROJECT TITLE: CITY CARE PAGES ROAD SUPERSHED (BU 0879-017)
DRAWING TITLE: SITE MEASUREMENT - GROUND FLOOR PLAN

Beca

DRAWN: C. ANDREWS
CHECK: M. BRANSFIELD
ISSUED DATE: ??/04/2013
APPD: L. CHEN
SCALE AT A1 SIZE: NOT TO SCALE
SCALE AT A3 SIZE:
BECA DRG No: 5323355-143 SK-01
JOB No: 5323355-143
SHT No: SK-01
REV: -



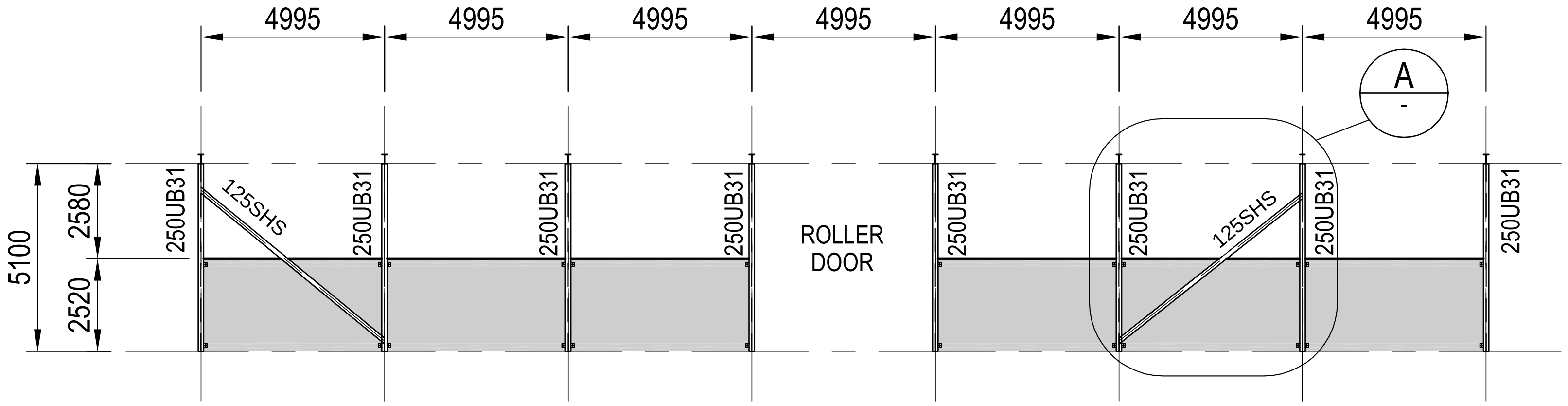
B
-

SUPERSHED ROOF PLAN

NTS

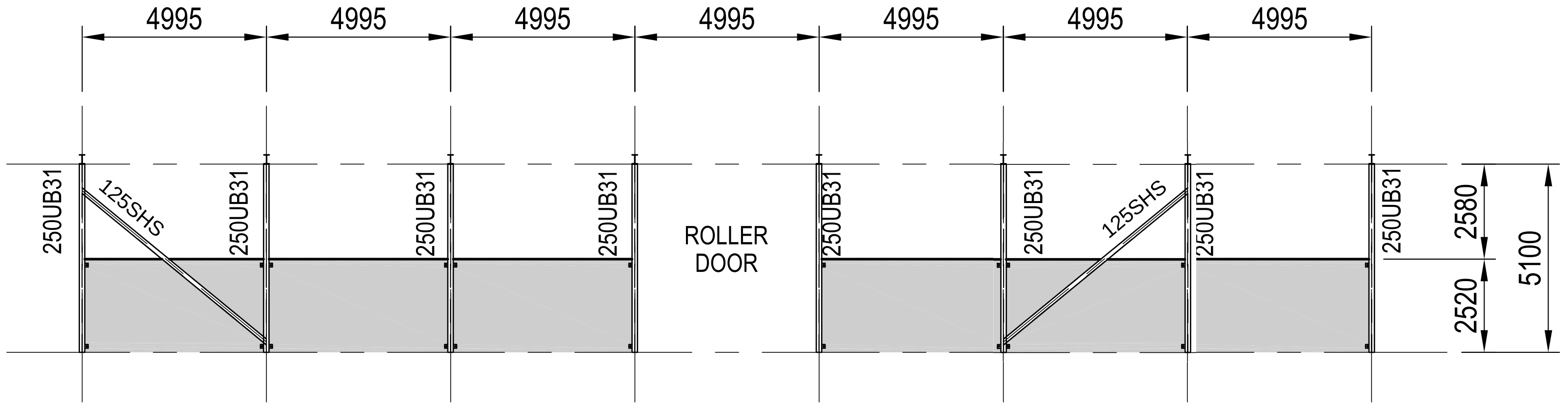
GENERAL NOTE:
- DIMENSIONS APROXIMATE ONLY, CONFIRM ON SITE
- STRUCTURAL SECTIONS APPROXIMATE ONLY, BASED ON SITE MEASUREMENTS
- ALL CONNECTIONS WELDED TYPICALLY

PROJECT TITLE: CITY CARE PAGES ROAD SUPERSHED (BU 0879-017)
DRAWING TITLE: SITE MEASUREMENT - ROOF PLAN
Beca
DRAWN: C. ANDREWS
CHECK: M. BRANSFIELD
ISSUED DATE: ??/04/2013
APPD: L. CHEN
SCALE AT A1 SIZE: NOT TO SCALE
SCALE AT A3 SIZE:
BECA DRG No: 5323355-143 SK-02
REV: -
JOB No: SHT No:



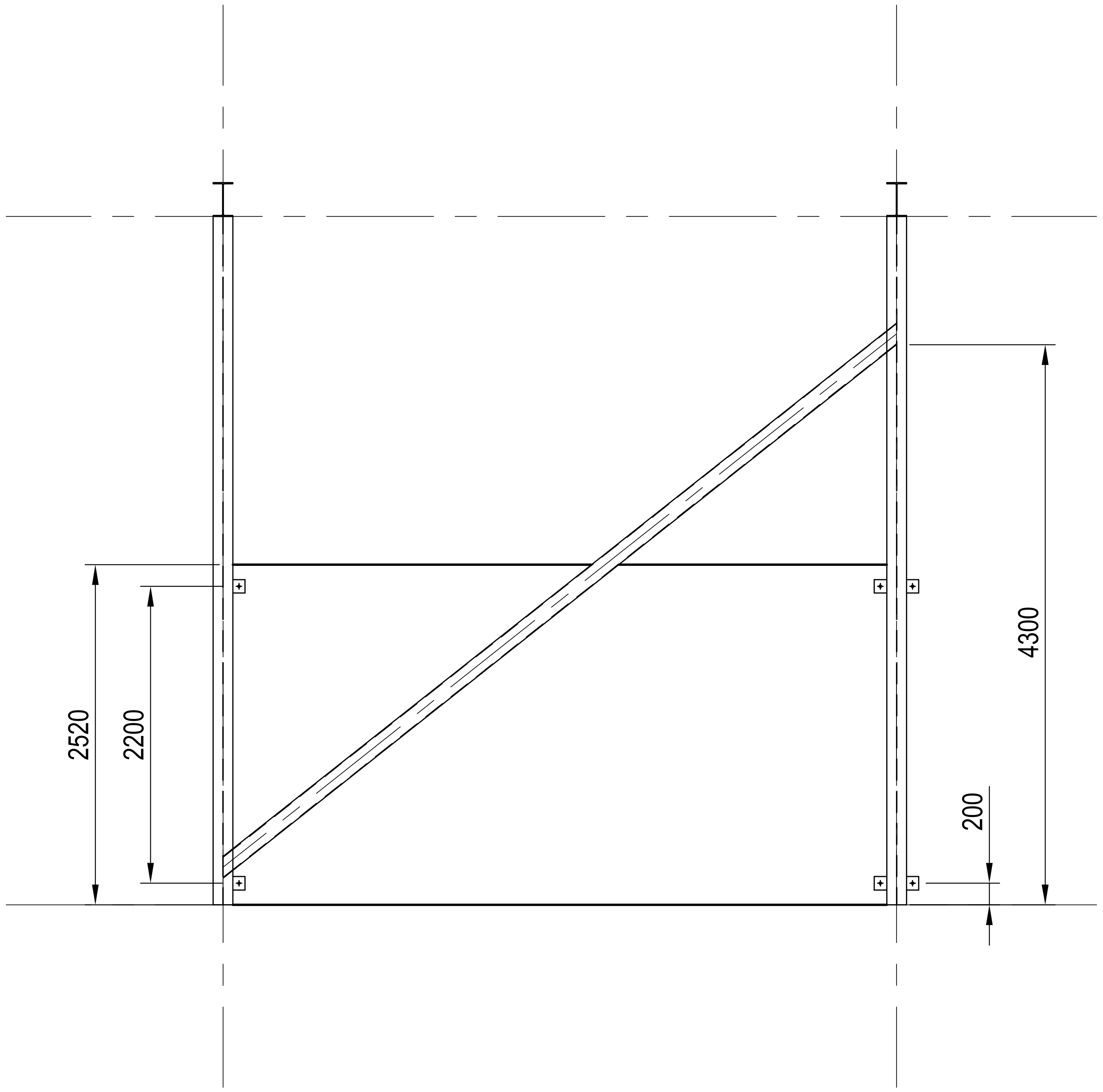
1 SK-01 WALL ELEVATION

NTS



2 SK-01 WALL ELEVATION

NTS

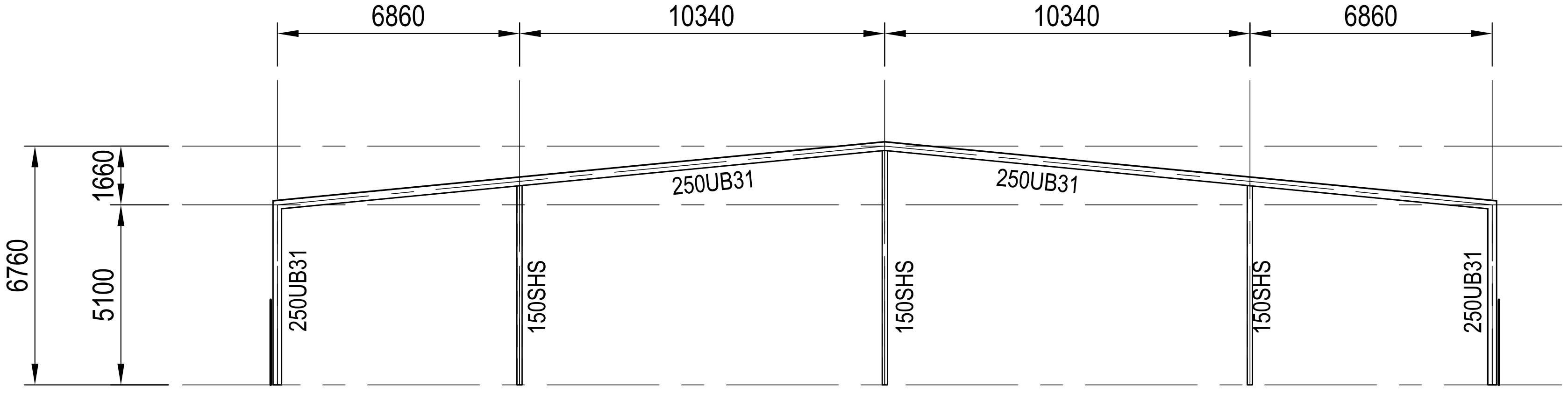


A - DETAIL

NTS

GENERAL NOTE:
- DIMENSIONS APROXIMATE ONLY, CONFIRM ON SITE
- STRUCTURAL SECTIONS APPROXIMATE ONLY, BASED ON SITE MEASUREMENTS
- ALL CONNECTIONS WELDED TYPICALLY

PROJECT TITLE: CITY CARE PAGES ROAD SUPERSHED (BU 0879-017)
DRAWING TITLE: SITE MEASUREMENT - ELEVATIONS AND DETAILS
Beca
DRAWN: C. ANDREWS
CHECK: M. BRANSFIELD
ISSUED DATE: ??/04/2013
APPD: L. CHEN
SCALE AT A1 SIZE: NOT TO SCALE
SCALE AT A3 SIZE:
BECA DRG No: 5323355-143 SK-03
JOB No:
SHT No:
REV: -



3
SK-02

PORTAL FRAME ELEVATION

NTS

GENERAL NOTE:
- DIMENSIONS APROXIMATE ONLY, CONFIRM ON SITE
- STRUCTURAL SECTIONS APPROXIMATE ONLY, BASED ON SITE MEASUREMENTS
- ALL CONNECTIONS WELDED TYPICALLY

PROJECT TITLE: CITY CARE PAGES ROAD SUPERSHED (BU 0879-017)
DRAWING TITLE: SITE MEASUREMENT - PORTAL FRAME SECTION

Beca

DRAWN: C. ANDREWS
CHECK: M. BRANSFIELD
ISSUED DATE: ??/04/2013
APPD: L. CHEN
SCALE AT A1 SIZE: NOT TO SCALE
SCALE AT A3 SIZE:
BECA DRG No: 5323355-143 SK-04
REV: -
JOB No:
SHT No:

Alarm Code. 9588

Beca CALCULATION SHEET

ABN 85 004 974 341

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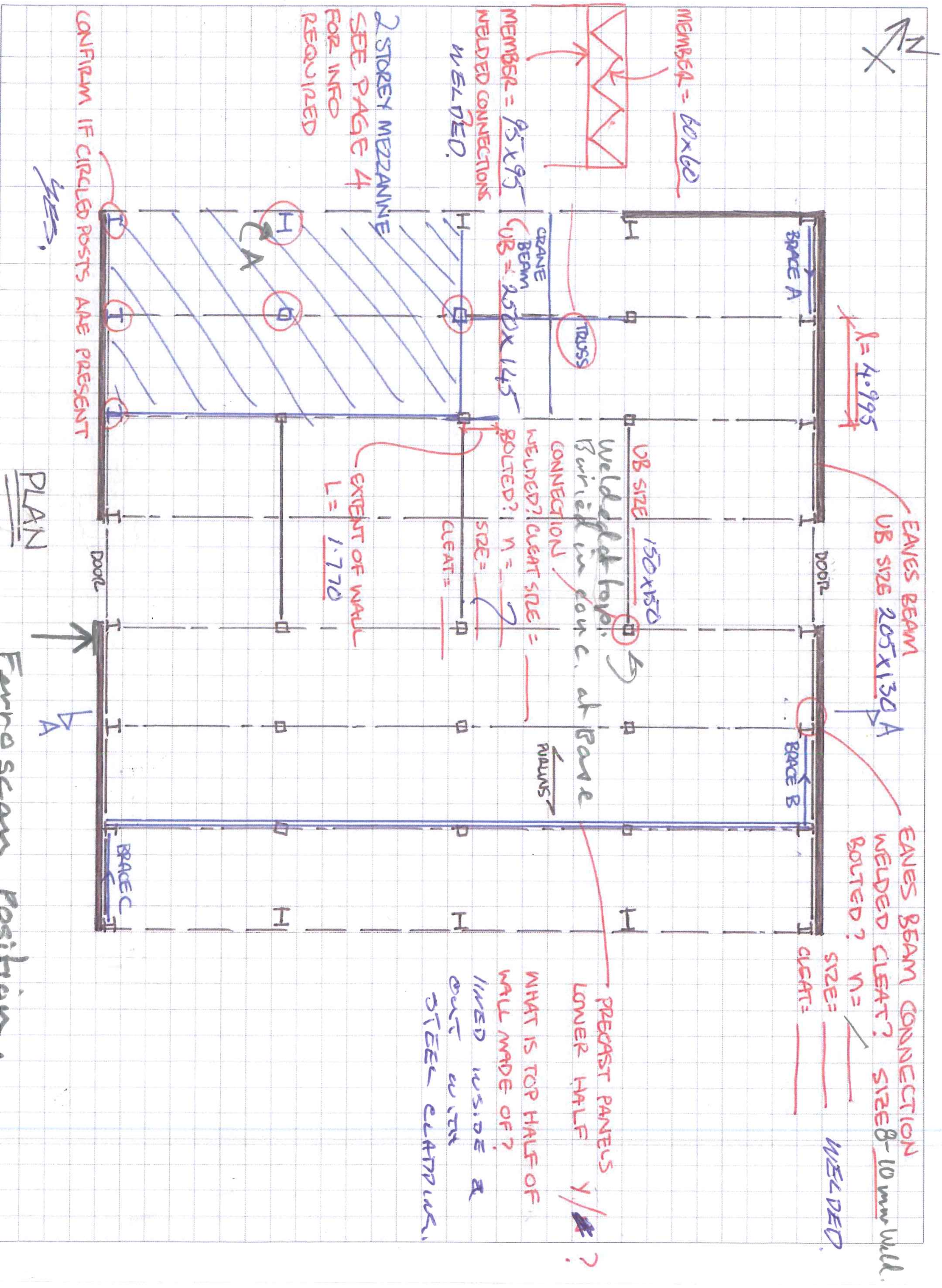
SUBJECT: INFORMATION REQUIRED.
DESIGNER/DATE: LZC CHECK DATE: ....
JOB NO: ....
PAGE NO: 1 OF: 5
SECTION: .... FILE: ....



Beca **CALCULATION SHEET** ABN 85 004 974 34

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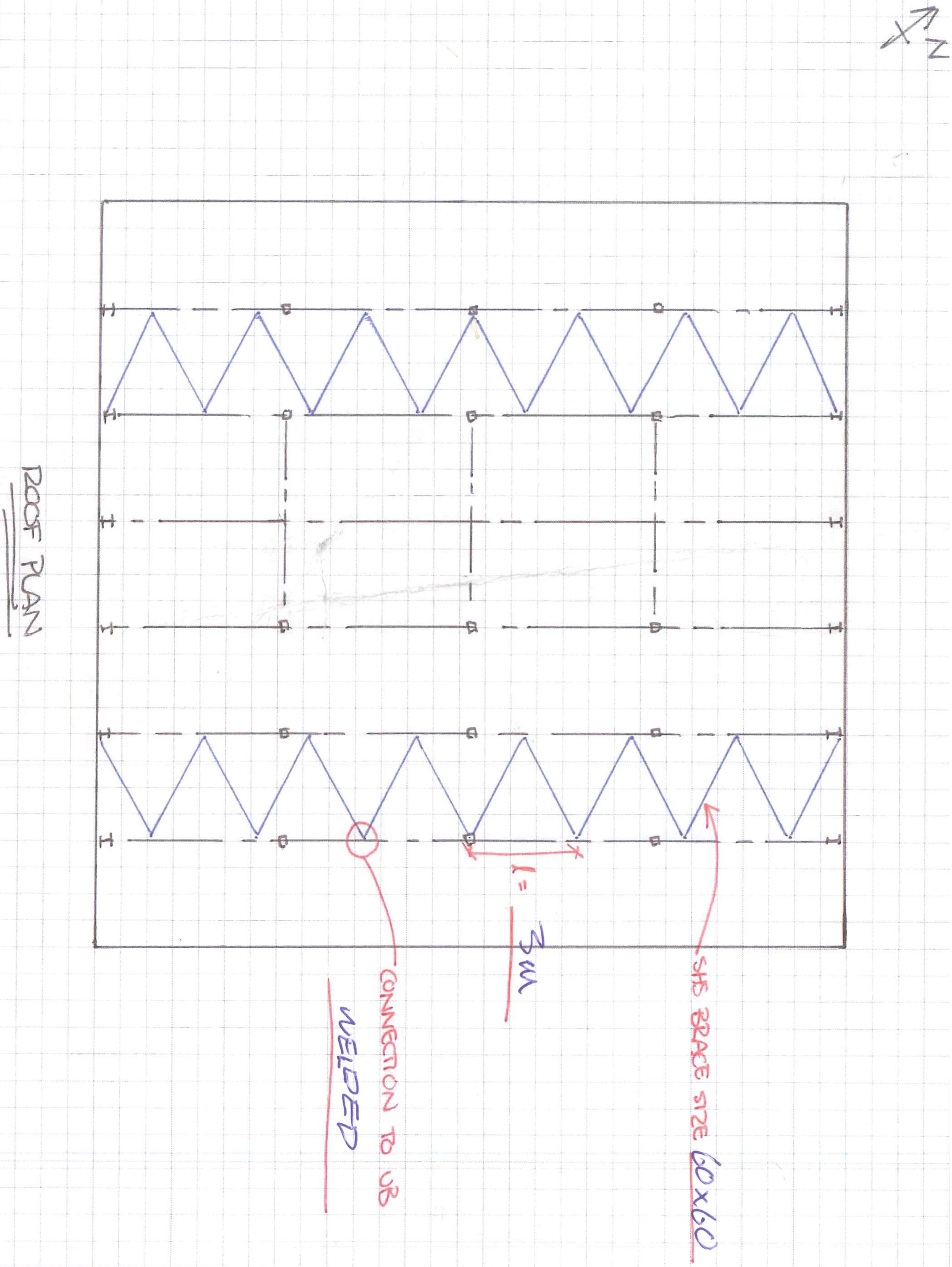
SECTION: .... FILE: ....



Beca CALCULATION SHEET ABN 85 004 974 341

JOB TITLE:
SUBJECT:
DESIGNER/DATE: CHECK DATE:

JOB NO:
PAGE NO: 3 OF: 5
SECTION: FILE:

SHS TO UB CONNECTION
WELDED? WELDED 8-10mm.
~~BOLTED? n=~~
~~SIZE~~
STIFFENERS ? SIZE = None.
CONFIGURATION?

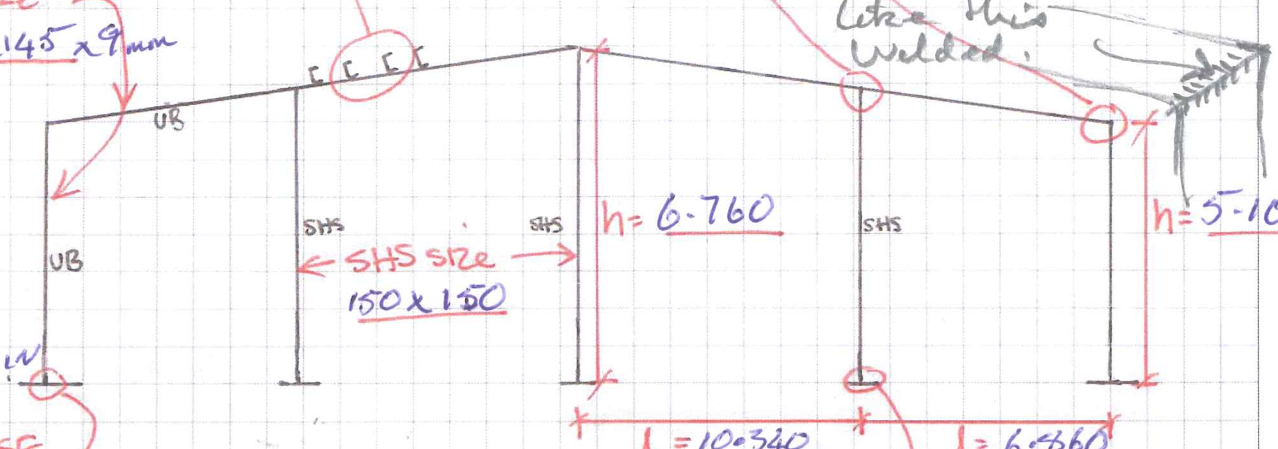
STEEL PURLIN SIZE 150 x 50
SPACING 1.160

TIMBER ON TOP SIZE 50 x 50

UB KNEE CONNECTION
STIFFENER SIZE=
CONFIGURATION

Like this Welded.

UB SIZE
250x145x9mm



SHS SIZE 150 x 150

CONCRETED IN

UB BASE CONNECTION
WELDED ? ?
BOLTED ? n= ?
SIZE= ?
LAYOUT=
PLATE SIZE =

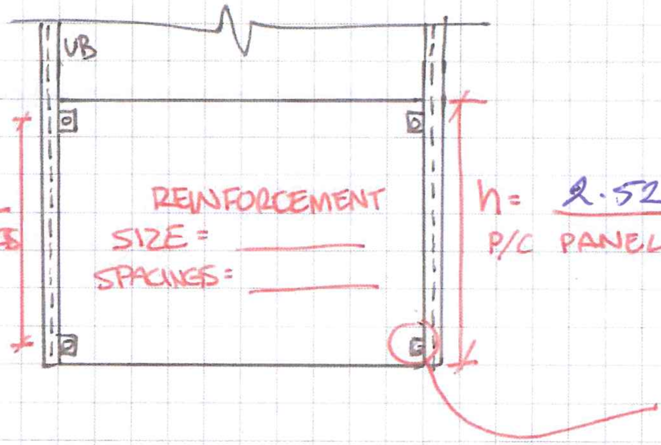
SECTION A-A

SHS BASE CONNECTION
WELDED ?
BOLTED ? n= ?
SIZE =
LAYOUT =
PLATE SIZE =

** NOTE POSITION AND SIZE OF ANY STIFFENERS ALONG UB **
Nil.

** PLEASE TAKE PHOTOS OF ALL CONNECTIONS **

JOB TITLE: ....
SUBJECT: ....
DESIGNER/DATE: .... CHECK DATE: ....
JOB NO: ....
PAGE NO: 4 OF: 5
SECTION: .... FILE: ....



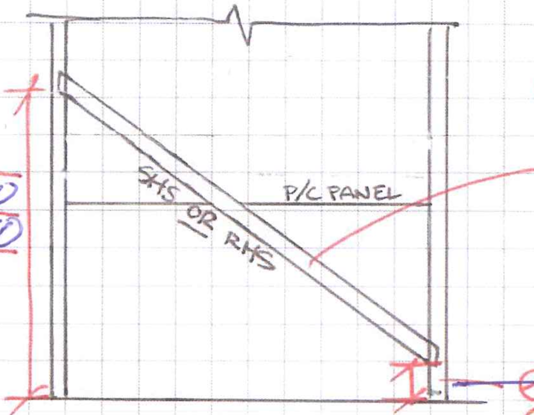
l = 2·2 BETWEEN BOLTS

REINFORCEMENT
SIZE = ______
SPACINGS = ______

h = 2·520 P/C PANEL

BOLT SIZE = 15mm DIA
BOLT GRADE = ?
PLATE SIZE = 100 x 90
THICKNESS = ·6mm

TYPICAL PANEL



BRACES ARE DIFFERENT SIZES:
(LABELLED A, B & C ON PLAN)

h_A = 4·3
h_B = 4·150
h_C = 4·250

SIZE A = 125x125
B = 125x125
C = 125x125

e_A = ·200
e_B = ?
e_C = ?

BRACED BAYS

Beca CALCULATION SHEET ABN 85 004 974 341

JOB TITLE: ....
SUBJECT: ....
DESIGNER/DATE: .... CHECK DATE: ....

JOB NO: ....
PAGE NO: 5 OF: 5
SECTION: .... FILE: ....

MEZZANINE INFORMATION REQUIRED:

- LOWER STOREY WALLS – CONCRETE PANELS ? ~~Y~~/NO
- UPPER STOREY WALLS – TIMBER FRAMED ? ~~Y/N~~ YES.
- ANY POSTS IN OFFICE AND GARAGE AREAS ? YES.
- CONCRETE FLOOR ? ~~Y/N~~ YES.
- GARAGES: DO STEEL COLUMNS (IF ANY) LINE UP CORRECTLY WITH FRAMES ON THE PLAN SKETCH?

  YES (AS FAR AS I CAN SEE)
- HOW IS THE MEZZANINE SUPPORTED ?

984 2

Samantha Brown

From:	alf swan <agsengineeringcontractor@gmail.com>
Sent:	Friday, 15 March 2013 1:00 p.m.
To:	Samantha Brown
Subject:	Fwd: FW: Pages Rd Depot - Supershed

---------- Forwarded message ----------
From: "Mike Okey" <mike.okey@citycare.co.nz>
Date: 14/03/2013 1:50 PM
Subject: FW: Pages Rd Depot - Supershed
To: "Alf Swan Enigneering (agsengineeringcontractor@gmail.com)"
<agsengineeringcontractor@gmail.com>

Hi Alf

Please can you have a look at this list of information requests

1 are you interested in find out this information for the engineers?

2 as usual we are all in a hurry to deliver. Please can you give a time frame this it will take you to source the information.

Mike okey

In addition to below, and as requested, the information we require is as follows:

(Please refer to the attached email with sketches/photos etc. if there are any items that are unclear).

Pages Road City Care – Supershed (refer to marked up photos and sketches for locations etc)

- Mezzanine Column size of steel member
- Mezzanine Column concrete encasement dimensions
- Mezzanine Beams supporting mezzanine slab steel member size
- Mezzanine beam to column connection
- Typical foundation pad size ✓
- Foundation size under braced bay ✓

Square hollow Section

- Wall thickness of SHS brace members 4 mm
- Eaves beam connection to column detail – is it bolted or welded Welded
- Size of transfer beams running N-S (360UB?) 250 UB 150×10
- Confirm size of roof bracing and size of weld (60x60 or larger?) 125 x 125 x mm

Pages Road City Care – Depot (refer to marked up photos and sketches for locations etc)

- For both sections of the mezzanine:
    - Mezzanine column sizes – steel member inside plasterboard/gib boxing? – member size.
    - Mezzanine beams supporting concrete mezzanine slab member sizes and setout
    - Mezzanine beams supporting ceiling sizes and set out (or is it hung from the main roof over?)
    - Connections between mezzanine beams and columns
- Wall thickness of SHS brace members
- Typical portal frame pad size
- Foundation size under braced bay

If it is possible please confirm the precast flooring type on both sections of the depot mezzanine, we have this to be hollowcore at present.

Cheers,

Mike

From: David Lees [mailto:dlees@cequent.co.nz]
Sent: Wednesday, 13 March 2013 4:02 p.m.
To: Mike Bransfield
Cc: Laura Chen; Mike Okey
Subject: Pages Rd Depot - Supershed

Hi Mike,

Further to our meeting on site this afternoon at the Pages Rd Depot, I have recorded the following action items:

- Beca to produce strengthening detail for poor weld connections throughout the pages rd depot - URGENT
- Mike Okey to then price the works to strengthen the building to >34% NBS
- Beca to update the L5 DEE with damaged welds and poor weld connection allowances/reduction factor

Beca CALCULATION SHEET ABN 85 C04 974 341

JOB TITLE: CITYCARE PAGES RD - SUPERSHED JOB NO: 5323355 / 143

SUBJECT: INSPECTION LIST PAGE NO: .... OF ....

DESIGNER/DATE: GEH 06/03/13 CHECKED/DATE: .... SECTION: 256 FILE: DE ___

① ARE MEZZANINE COLUMNS THE SAME AS TYPICAL PORTAL COLUMNS (150SHS INTERNAL & 250UB EXTERNAL) BUT ENCASED WITH CONCRETE? MAY NEED TO BREAKOUT ENCASEMENT. REFER TO SKETCH ①

② WHAT ARE THE SIZE OF THE BEAMS SUPPORTING THE MEZZANINE CONCRETE SLAB. REFER TO SKETCH ① & PHOTO ①. AND WHAT IS THE CONNECTION BETWEEN THE BEAMS AND COLUMNS? - Welded

③ CONFIRM FOUNDATION TYPE (PAD, PILED) AND SIZE UNDER BRACE Ⓒ AND TYPICAL EXTERNAL PORTAL COLUMNS. REFER TO SKETCH ①

Pad - Size 600x600 x400 deep

floor pad thickness 100mm

④ IS THE EAVES BEAM CONNECTION TO COLUMN BOLTED OR WELDED? REFER TO SKETCH ①

⑤ CONFIRM SIZE OF TRANSFER BEAMS RUNNING N/S MARKUP'S BY MIKE OKEY SAY 150x150 BUT LOOKS TO BE ± 360 UB FROM PHOTOS. REFER TO SKETCH ①

↑ 450x190 x 10mm

⑥ CONFIRM SIZE OF ROOF BRACING AND SIZE OF WELD. MARKUP'S BY MIKE OKEY SAY 60x60 BUT LOOKS LARGER IN PHOTO'S. REFER TO SKETCH ②

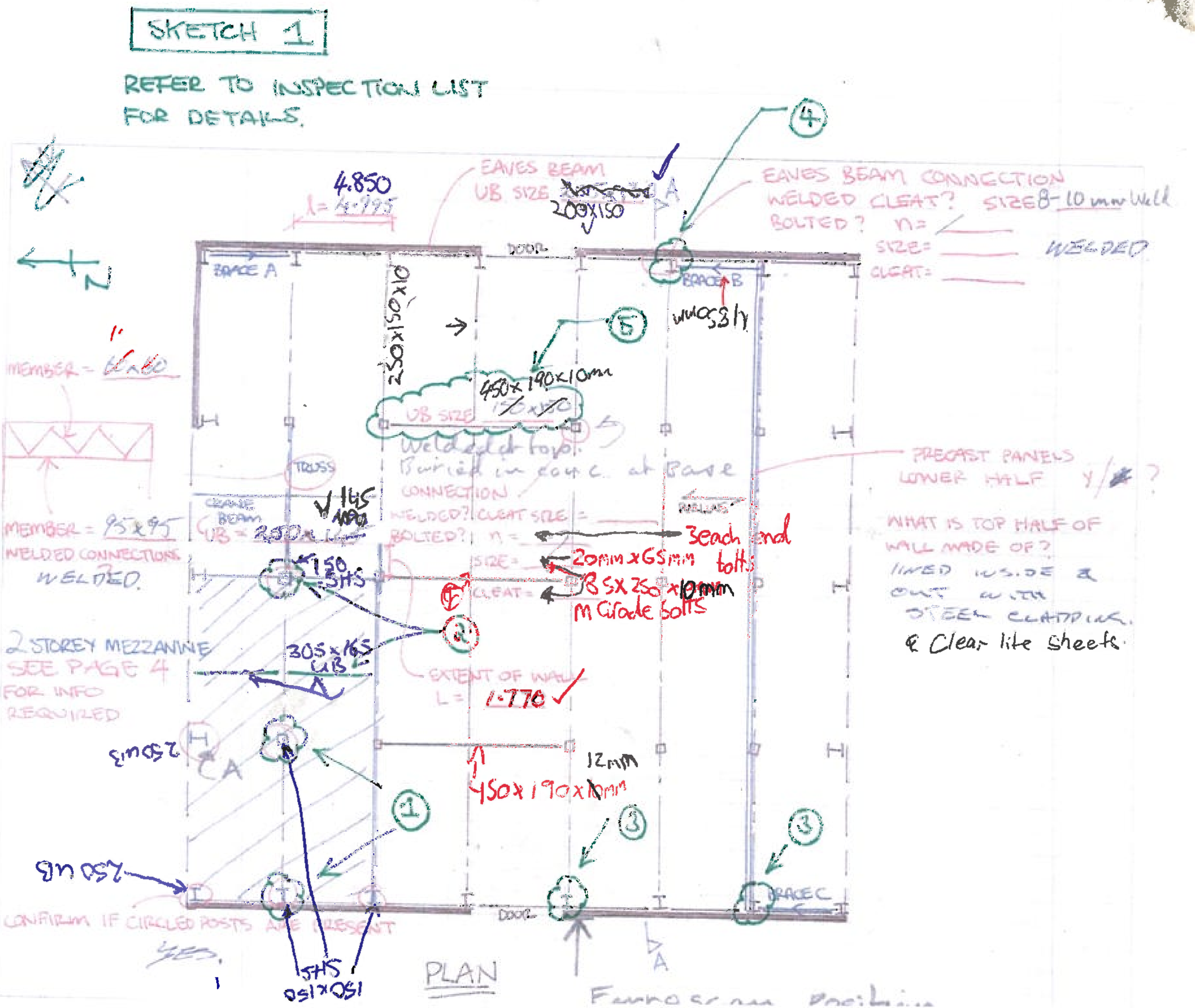
↑ 100x100 SHS.

Alarm Code 9555

Beca CALCULATION SHEET

ABN 85 004 974 341

JOB TITLE: CITYCARE PAGES RD - SUPERSHED
SUBJECT: INFORMATION REQUIRED
DESIGNER/DATE: L3C
CHECK DATE:
JOB NO.:
PAGE NO.: 1 OF: 5
SECTION:
FILE:



① not welded underneath,
weld on Top poor

JOB TITLE:

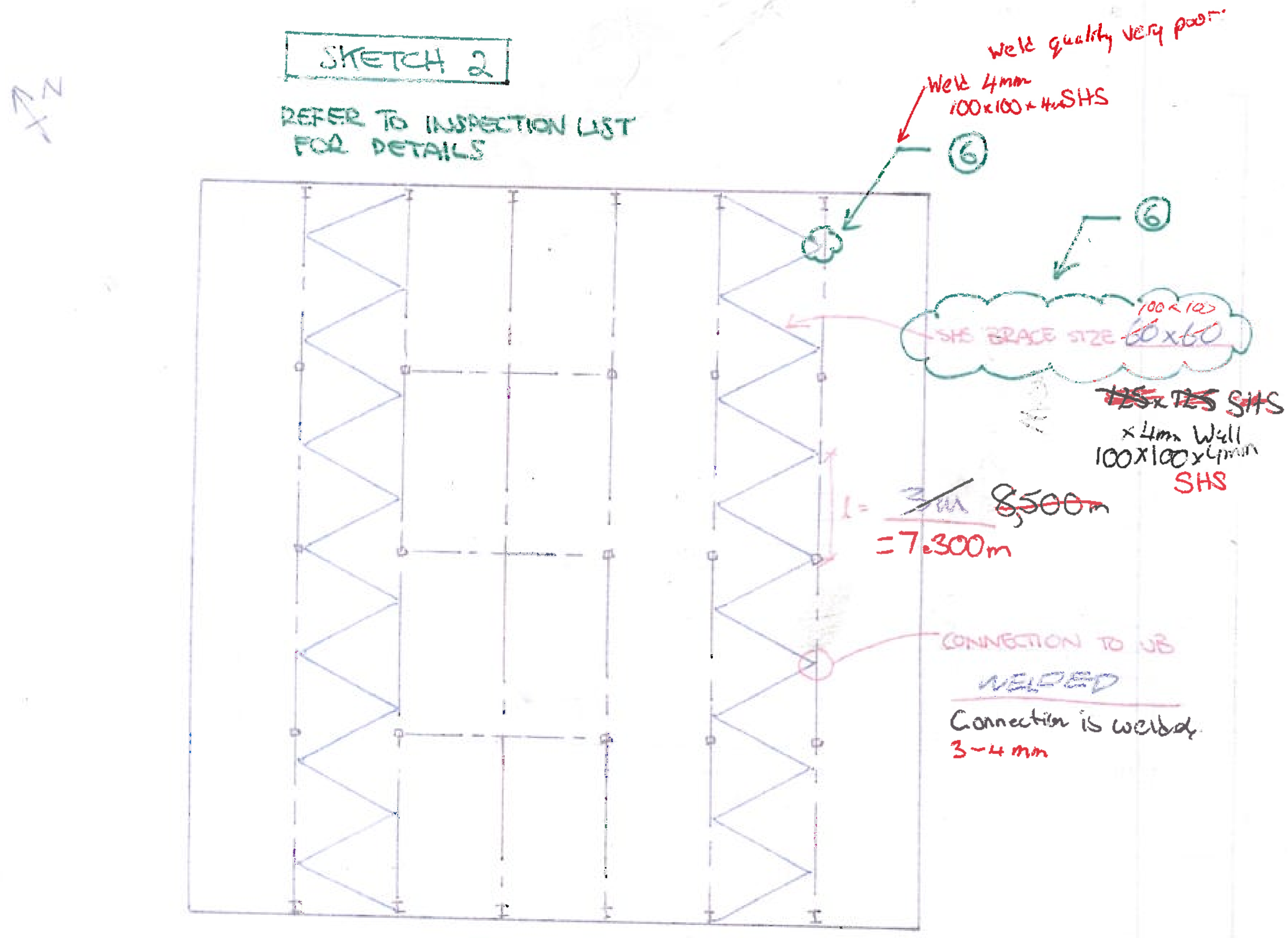
SUBJECT:

DESIGNER/DATE: CHECK DATE:

JOB NO:

PAGE NO: 2 OF: 5

SECTION: FILE:



SKETCH 2

REFER TO INSPECTION LIST FOR DETAILS

Weld quality very poor.

Weld 4mm
100x100x4mmSHS

SHS BRACE SIZE ~~60x60~~ 100x100

~~125x125~~ ~~SHS~~
x 4mm Wall
100x100x4mm
SHS

CONNECTION TO UB
WELDED

Connection is welded.
3-4 mm

ROOF PLAN

Ladder

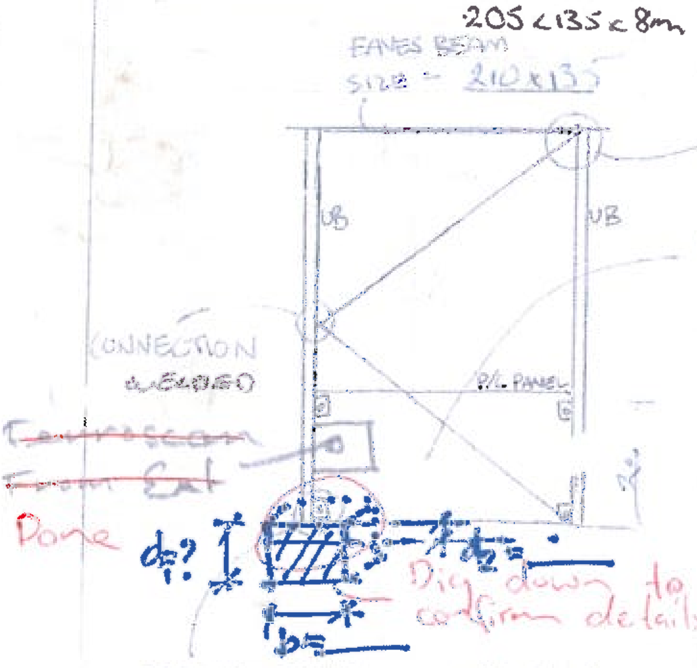
100x100
60x60
250x145X10 I

crane support bolts
20mm x 65mm
Grade M

6LP UB

crane beam 250mm x 10mm x 150mm
beam 200mm x 10mm x

JOB TITLE:
SUBJECT:
DESIGNER/DATE: CHECK DATE:
JOB NO:
PAGE NO: PA OF: 5
SECTION: FILE:



205x135x8mm
EAVES BEAM SIZE = 210x135

CONNECTION Welded

PANEL REINFORCEMENT = See Scan

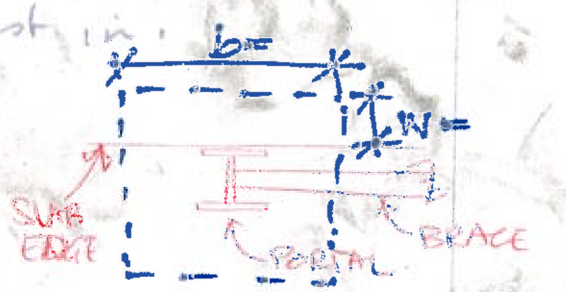
CONNECTION WELDED

Dig down to expose foundations, confirm details as per page 1.

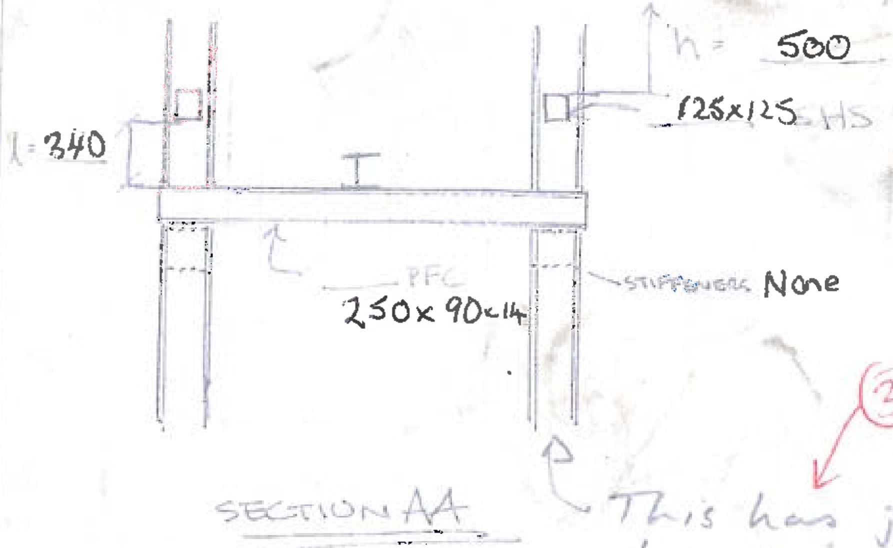
PRECAST PANEL CONNECTION:
BOLT SIZE = X16mm Dia. Cast in
GRADE = ?8.8

d_1 = footing/pad/pilecap depth
d_2 = ground beam depth

TYPICAL BRACED BAY



extent clear of slab (width, breadth and depth)



h = 500 TO BOTTOM FLANGE OF MAIN RAFTER

125x125 HS

PFC 250x90x14

STIFFENERS None

SECTION AA

③ is this independent of the mezzanines?

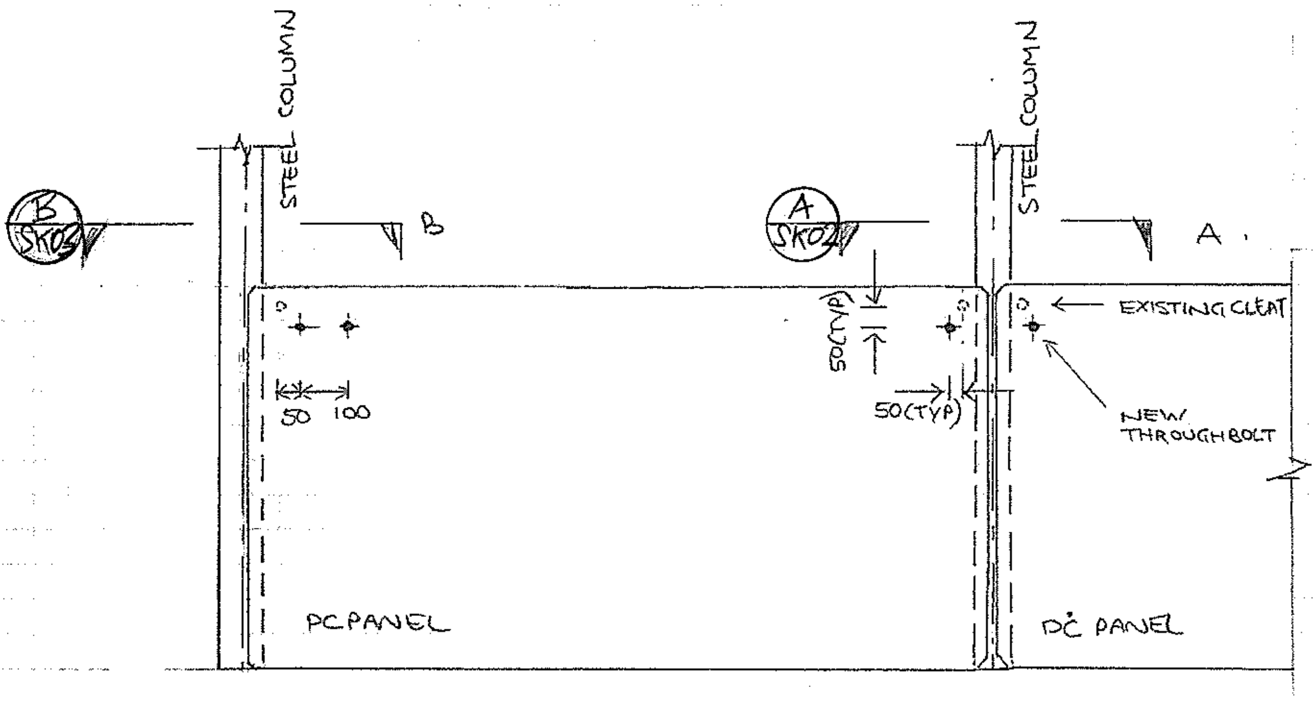
This has just been built for the pumps crane only

yes it is independent of the Mezzanine floor

Appendix C

Temporary Strengthening Scheme

Drawing Plotted:



1 — [illegible] ELEVATION (N.T.S)
PRECAST CLADDING TEMP FIXINGS

www.beca.com

No.	Revision	By	Chk	Appd	Date
1	FOR CONSTRUCTION	HP			10/1/13

Client: CHRISTCHURCH CITY COUNCIL

Project: CITY CARE PAGES RD BU 0879-018 EQ2

Design GAH 10/1/13
Drawn GAH
Dsg Verifier
Dwg Check

Beca

Title: PRECAST CLADDING PANEL TEMPORARY FIXING - ELEVATION

Approved for Construction *
Date:
* Refer to Revision 1 for Original Signatures

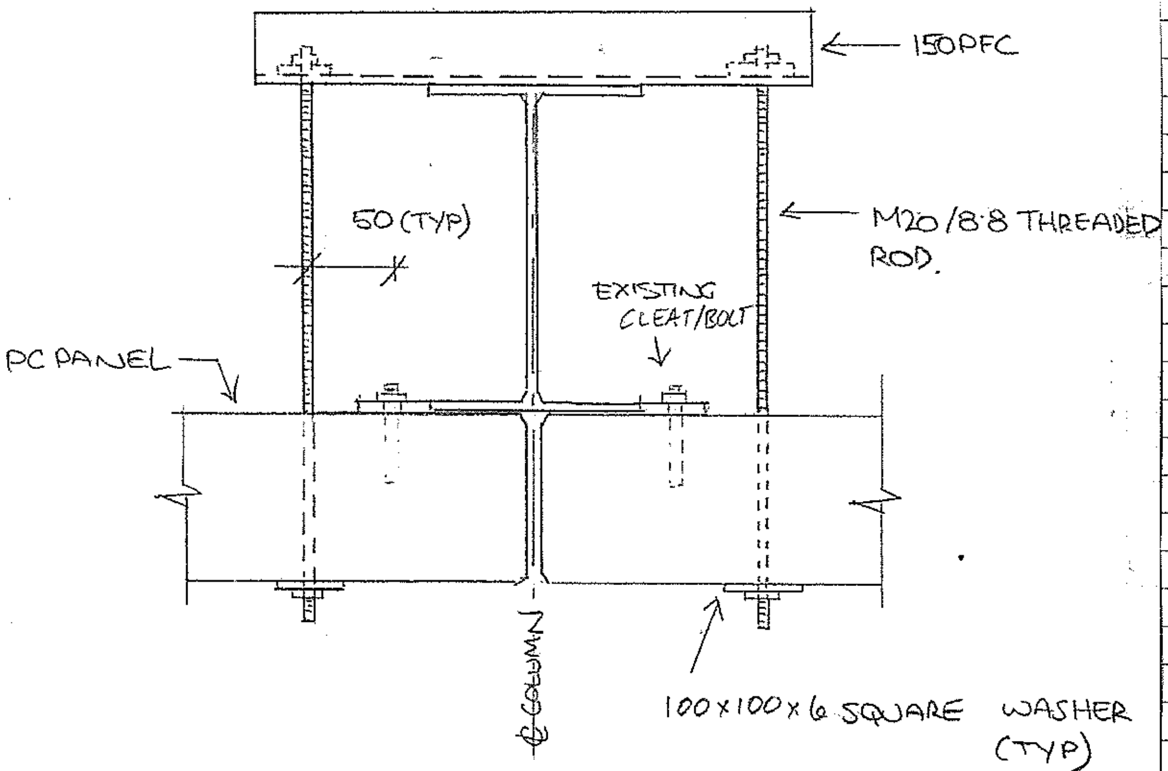
Scale as drawn (A4) NTS
Discipline STRUCTURAL
Drawing No. 5323355/142 - SK01
Rev. 1

Document No.

DO NOT SCALE

IF IN DOUBT ASK

Drawing Plotted:



A
SK01

SECTION (NTS)

TYPICAL PC PANEL CLAMP DETAIL.

www.beca.com

No.	Revision	By	Chk	Appd	Date
1	FOR CONSTRUCTION	EHF			

Client: CHRISTCHURCH CITY COUNCIL

Project: CITY CARE PAGES RD
64 0879 018 EQ2

Title: PRECAST CLADDING PANEL TEMPORARY FIXING DETAIL A

Approved for Construction *
Date:
* Refer to Revision 1 for Original Signatures

Design GAH 10/01/13
Drawn
Dsg Verifier
Dwg Check

Scale as drawn (A4) NTS
Discipline STRUCTURE
Drawing No. 5323355/142-SK02
Rev. 1

Document No.

DO NOT SCALE

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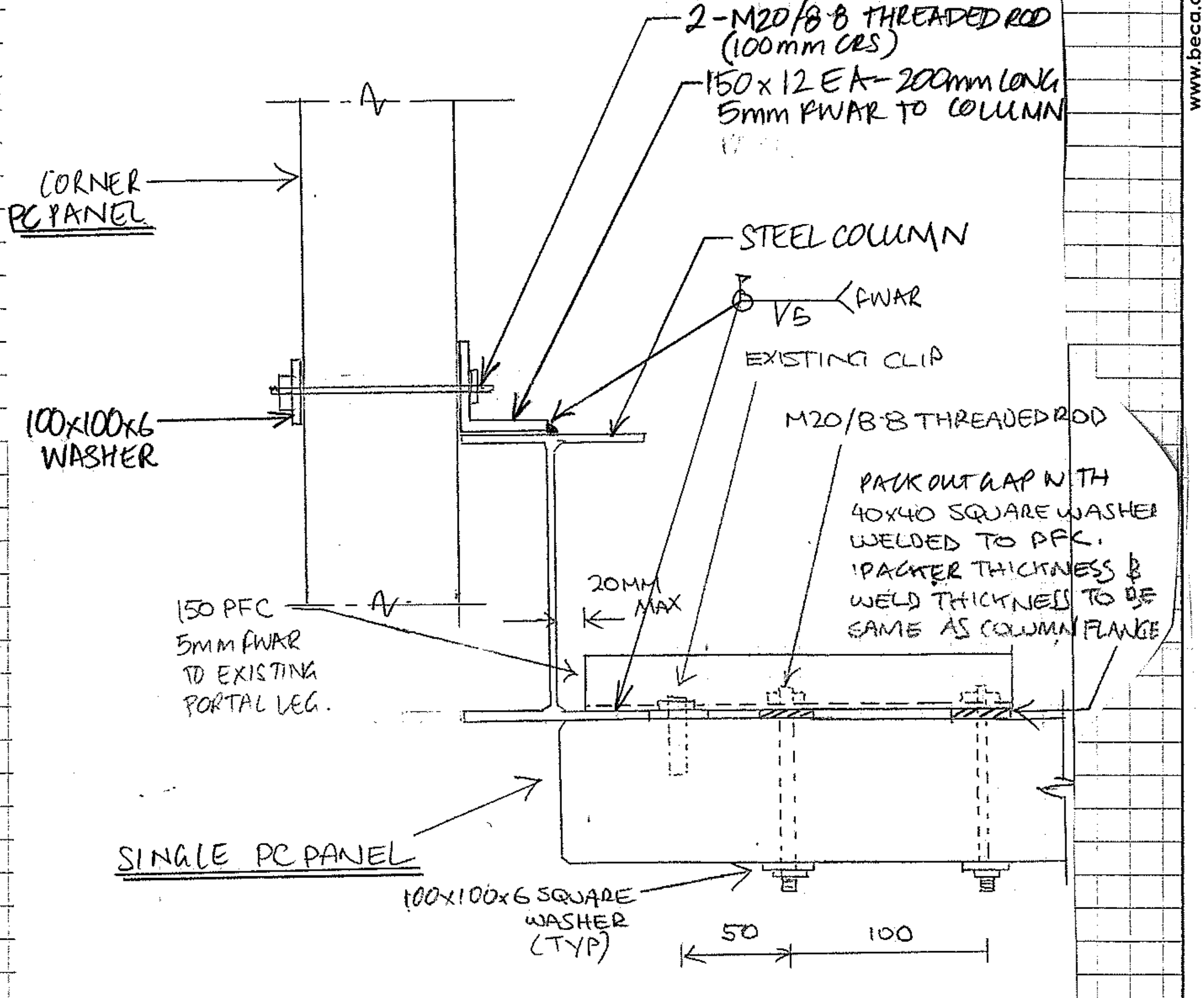
Drawing Plotted:



B
SK01

SECTION (NTS)

PC PANEL DETAIL FOR SINGLE OR CORNER

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No.	Revision	By	Chk	Appd	Date
1	FOR CONSTRUCTION	HO			

Client: CHRISTCHURCH CITY COUNCIL

Project: CITY CARE PAGES RD
BU 0879018 EQ2

Design	GAH	10/1/13
Drawn		
Dsg Verifier		
Dwg Check		

Beca

Title: PRECAST CLADDING PANEL TEMPORARY FIXING DETAIL B

Approved for Construction *

Date:

* Refer to Revision 1 for Original Signatures

Scale as drawn (A4) NTS

Discipline STRUCTURE

Drawing No. 5323355/142-SK03

Rev. 1

Document No.

DO NOT SCALE

IF IN DOUBT ASK

Appendix D

CERA DEE Summary Data

Detailed Engineering Evaluation Summary Data

V1.11

Location

Building Name: City Care Supershed

Unit No: Street

Building Address: Shuttle Drive | Shuttle Drive

Legal Description:

Degrees Min Sec

GPS south:

GPS east:

Building Unique Identifier (CCC): BU 0879-017 EQ2

Reviewer: David Whittaker

CPEng No: 123089

Company: Beca

Company project number: 5323355

Company phone number: 33663521

Date of submission: 27/08/2013

Inspection Date: 7/08/2012

Revision:

Is there a full report with this summary? yes

Site

Site slope: flat

Soil type:

Site Class (to NZS1170.5): D

Proximity to waterway (m, if <100m):

Proximity to clifftop (m, if < 100m):

Proximity to cliff base (m,if <100m):

Max retaining height (m):

Soil Profile (if available): unknown

If Ground improvement on site, describe:

Approx site elevation (m): 10.00

Building

No. of storeys above ground: 2 single storey = 1

Ground floor split? no

Storeys below ground: 0

Foundation type: other (describe)

Building height (m): 6.00

Floor footprint area (approx): 1225

Age of Building (years): 25

Ground floor elevation (Absolute) (m):

Ground floor elevation above ground (m): 0.00

if Foundation type is other, describe: unknown, shallow foundations presumed

height from ground to level of uppermost seismic mass (for IEP only) (m): 5.5

Date of design: 1976-1992

Strengthening present? no

Use (ground floor): commercial

Use (upper floors): commercial

Use notes (if required):

Importance level (to NZS1170.5): IL2

If so, when (year)?

And what load level (%g)?

Brief strengthening description:

Gravity Structure

Gravity System: frame system

Roof: steel framed

Floors: precast concrete with topping

Beams: steel non-composite

Columns: structural steel

Walls: non-load bearing

rafter type, purlin type and cladding: UB beams, Steel C Purlins, lightwight metal roofing and wall cladding, lower part precast

unit type and depth (mm), topping: unknown

beam and connector type: unknown

typical dimensions (mm x mm): unknown

0

Lateral load resisting structure

Lateral system along: other (note)

Ductility assumed, μ: 1.25

Period along: 0.40 0.00

Total deflection (ULS) (mm):

maximum interstorey deflection (ULS) (mm):

Note: Define along and across in detailed report!

describe system: Tension/compression braces

estimate or calculation? estimated

estimate or calculation?

estimate or calculation?

Lateral system across: welded and bolted steel moment frame

Ductility assumed, μ: 2.00

Period across: 0.40 0.00

Total deflection (ULS) (mm):

maximum interstorey deflection (ULS) (mm):

note typical bay length (m): 35

estimate or calculation? estimated

estimate or calculation?

estimate or calculation?

Separations:

north (mm):

east (mm):

south (mm):

west (mm):

leave blank if not relevant

Non-structural elements

Stairs: steel

Wall cladding: precast panels

Roof Cladding: Metal

Glazing:

Ceilings: light tiles

Services(list):

describe supports: fixed top and bottom

thickness and fixing type: 130mm thick, bolted connections

describe:

Available documentation

Architectural: none

Structural: none

Mechanical: none

Electrical: none

Geotech report: none

original designer name/date:

original designer name/date:

original designer name/date:

original designer name/date:

original designer name/date:

Damage

Site:

(refer DEE Table 4-2)

Site performance: slight

Describe damage:

Settlement: 0-25mm — notes (if applicable): estimated

Differential settlement: 0-1:350 — notes (if applicable): estimated

Liquefaction: 2-5 m²/100m³ — notes (if applicable): some did occur (from aerial photos)

Lateral Spread: none apparent — notes (if applicable):

Differential lateral spread: none apparent — notes (if applicable):

Ground cracks: 0-20mm/20m — notes (if applicable): estimated

Damage to area: none apparent — notes (if applicable):

Building:

Current Placard Status: green

Along — Damage ratio: 0%

Describe (summary):

Describe how damage ratio arrived at: damage not significant enough to reduce capacity

Across — Damage ratio: 0%

Describe (summary):

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

Diaphragms — Damage?: no — Describe:

CSWs: — Damage?: yes — Describe: liquefaction potential

Pounding: — Damage?: no — Describe:

Non-structural: — Damage?: yes — Describe: precast dado panels

Recommendations

Level of repair/strengthening required: minor structural — Describe: Precast panel fixings

Building Consent required: yes — Describe:

Interim occupancy recommendations: full occupancy — Describe:

Along — Assessed %NBS before: 15% ##### %NBS from IEP below

Assessed %NBS after: 15%

If IEP not used, please detail assessment methodology: Force based Quantitative Assessment

Across — Assessed %NBS before: 16% ##### %NBS from IEP below

Assessed %NBS after: 16%

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: 5.5m

Seismic Zone, if designed between 1965 and 1992: B

not required for this age of building

not required for this age of building

	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 =k_μ, if pre-1976, fromTable 3.3:		
Ductiity Scaling Factor, **Factor D**:	1.00	1.00

2.6 Structural Performance Scaling Factor:

	along	across
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 1.0

Height Difference effect D2, from Table to right 1.0

Therefore, Factor D: 1

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!**

Official Use only:

Accepted By:

Date:

Appendix E

Previous Reports and Assessments

②

Christchurch Eq RAPID Assessment Form - LEVEL 2

Inspector Initials: MW?
Territorial Authority: Christchurch City
Date: 22-6-11
Time: 12:30
Final Posting (e.g. UNSAFE): Inspected G1

Building Name: Red Sled Eco Stove
Short Name: North of City Care
Address: 210 Pages Road

GPS Co-ordinates: S° E°
Contact Name:
Contact Phone:
Storeys at and above ground level: 1
Below ground level: Mezz
Total gross floor area (m²):
Year built:
No of residential Units:
Photo Taken: Yes [✓ No]

Type of Construction
- ☐ Timber frame
- ☑ Steel frame
- ☐ Tilt-up concrete
- ☐ Concrete frame
- ☐ RC frame with masonry infill
- ☐ Concrete shear wall
- ☐ Unreinforced masonry
- ☐ Reinforced masonry
- ☐ Confined masonry
- ☐ Other:

Primary Occupancy
- ☐ Dwelling
- ☐ Other residential
- ☐ Public assembly
- ☐ School
- ☐ Religious
- ☐ Commercial/ Offices
- ☑ Industrial
- ☐ Government
- ☐ Heritage Listed
- ☐ Other

Investigate the building for the conditions listed on page 1 and 2, and check the appropriate column. A sketch may be added on page 3

Overall Hazards / Damage	~~Minor~~/None	Moderate	Severe	Comments
Collapse, partial collapse, off foundation	☑	☐	☐	
Building or storey leaning	☑	☐	☐	
Wall or other structural damage	☑	☐	☐	
Overhead falling hazard	☑	☐	☐	
Ground movement, settlement, slips	☑	☐	☐	
Neighbouring building hazard	☑	☐	☐	
Electrical, gas, sewerage, water, hazmats	☐	☐	☐	Not Known

Record any existing placard on this building:
Existing Placard Type (e.g. UNSAFE):

Choose a new posting based on the new evaluation and team judgement. Severe conditions affecting the whole building are grounds for an UNSAFE posting. Localised Severe and overall Moderate conditions may require a RESTRICTED USE. Place INSPECTED placard at main entrance. Post all other placards at every significant entrance. Transfer the chosen posting to the top of this page.

INSPECTED GREEN: G1 | G2
RESTRICTED USE YELLOW: Y1 | Y2
UNSAFE RED: R1 | R2 | R3

Record any restriction on use or entry:

Further Action Recommended:

Tick the boxes below only if further actions are recommended
- ☐ Barricades are needed (state location):
- ☐ Detailed engineering evaluation recommended
  - ☐ Structural
  - ☐ Geotechnical
  - ☐ Other:
- ☐ Other recommendations:

Estimated Overall Building Damage (Exclude Contents)

None	☐		
0-1 %	☐	31-60 %	☐
2-10 %	☑	61-99 %	☐
11-30 %	☐	100 %	☐

Sign here on completion: M Frost
Date & Time: 22/6/11 12:30
ID: Murray Frost
PRUP1: 021 403 180

Inspection ID: ________ *(Office Use Only)*

Structural Hazards/ Damage	Minor/None	Moderate	Severe	Comments
Foundations	☐	☐	☐	
Roofs, floors (vertical load)	☐	☐	☐	
Columns, pilasters, corbels	☐	☐	☐	
Diaphragms, horizontal bracing	☐	☐	☐	
Pre-cast connections	☐	☐	☐	
Beam	☐	☐	☐	
Non-structural Hazards / Damage				
Parapets, ornamentation	☐	☐	☐	
Cladding, glazing	☐	☐	☐	
Ceilings, light fixtures	☐	☐	☐	
Interior walls, partitions	☐	☐	☐	
Elevators	☐	☐	☐	
Stairs/ Exits	☐	☐	☐	
Utilities (eg. gas, electricity, water)	☐	☐	☐	
Other	☐	☐	☐	
Geotechnical Hazards / Damage				
Slope failure, debris	☐	☐	☐	
Ground movement, fissures	☐	☐	☐	
Soil bulging, liquefaction	☐	☐	☐	

General Comment Three areas.
① Super sled just north of city care bldg N-S Portal frame
② Open Yard
③ Eco Bldg to north with E-W portal frame.
Some minor repairs - ring Tim Driver

Usability Category

Damage Intensity	Posting	Usability Category	Remarks
Light damage *Low risk*	Inspected (Green)	G1. Occupiable, no immediate further investigation required ✓	
		G2. Occupiable, repairs required	
Medium damage *Medium risk*	Restricted Use (Yellow)	Y1. Short term entry	
		Y2. No entry to parts until repaired or demolished	
Heavy damage *High risk*	Unsafe (Red)	R1. Significant damage: repairs, strengthening possible	
		R2. Severe damage: demolition likely	
		R3. At risk from adjacent premises or from ground failure	

Sketch (optional)
Provide a sketch of the entire building or damage points. Indicate damage points.

Recommendations for Repair and Reconstruction or Demolition (Optional)

- Approx dozen ceiling panels falling in upstairs cafe
- Light fittings falling down in office upstairs
- RHS props at midspan & quarter span have slight bow. Could be pre earthquakes.
- Super shed garage doors damaged. Possibly pre earthquake.
- Dishwasher tipped over in yard out back
- Fire extinguishers & hose reels need attention. Fallen over & cabinets open
- Brick work facing on south side of super shed - east side 2/3mm crack. Will need to be removed.

CityCare Pages Road – Super Shed
Detailed Engineering Evaluation
BU 0879-017 EQ2
Qualitative Report

Prepared for Christchurch City Council (CCC)

By Beca Carter Hollings & Ferner Ltd (Beca)

31 January 2014

Revision History

Revision Nº	Prepared By	Description	Date
A	Stefan Reuther	Draft for CCC review	9 October 2012
B	Stefan Reuther	Updated Building Identifier (BU) Number	31 January 2014

Document Acceptance

Action	Name	Signed	Date
Prepared by	Stefan Reuther	Reuther	31 January 2014
Reviewed by	Nicholas Charman		31 January 2014
Approved by	David Whittaker		31 January 2014
on behalf of	Beca Carter Hollings & Ferner Ltd		

CityCare Pages Road – Super Shed
BU 0897-017 EQ2

Detailed Engineering Evaluation
Qualitative Report – SUMMARY
Version 1

Address
Shuttle Drive
Bromley
Christchurch

Background

This is a summary of the Qualitative 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.

The Super Shed building is located at CityCare Pages Road, Shuttle Drive, Bromley, Christchurch. The building consists of steel portal frames in one direction and is braced in the other direction with a combination of precast concrete and profile metal wall cladding. It was originally built between 1982 and 1990 according to aerial photographs available. The approximate floor area is 1200m^2 internally. No architectural or structural drawings were available and no calculations were carried out.

Key Damage Observed

Visual inspections on 7 August 2012 indicate the building has suffered moderate structural damage. The key damage observed includes:

- Cracking to the north eastern concrete wall panels at the panel joints.
- Vertical cracking to the north eastern wall panels at the middle of the panel.
- Significant cracking and spalling at concrete wall panel connections to the superstructure.
- Shear failure of bolts at the top concrete wall panel connection at the north and south corner of the building (it is likely that other connections have also failed that were not able to be inspected).
- Local buckling to steel column at brace connection at south corner of the building.
- Cracking to concrete floor slab around columns.
- Cracking to asphalt pavement at columns.

Critical Structural Weaknesses (CSW)

The following potential Critical Structural Weaknesses have been identified:

- Site characteristics, significant liquefaction potential due to widespread liquefaction observed in the surrounding area.

- Inadequate precast wall panel connections/supports for in-plane and out-of-plane load effects.

Indicative Building Strength (from Initial Evaluation Procedure and CSW assessment)

The building has been assessed to have a seismic capacity of 37% NBS using the NZSEE Initial Evaluation Procedure (IEP) and is therefore classified as potentially Earthquake Risk and Seismic Grade C.

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 potentially 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.

Temporary make-safe works have been advised to Christchurch City Council on 8 August 2012 for stabilising of precast wall panels where damaged connections were observed. These panels pose a threat to the public and people working nearby and Christchurch City Council has been advised to place barricades around the precast panels.

It is recommended that:

- Further efforts are made to obtain structural drawings.
- A verticality and level survey could be carried out to determine the extent of settlement of the building for insurance purposes.
- A quantitative %NBS analysis of the building should be completed.
- Repair damage to concrete wall panels and movement joints.
- Investigate precast wall panel to portal frame connections where damaged, and repair where necessary.
- Investigate all precast panel connections as part of the quantitative assessment and strengthen if required.
- Intrusive investigations to confirm seating of precast floor units in mezzanine floor area.
- Repairs that would bring the building back to an "as new" condition are typically entitled under typical replacement insurance policies. We suggest you consult with your insurance advisor as to how you wish to proceed.

Table of Contents

Appendices

1 Background

Beca Carter Hollings & Ferner Ltd (Beca) has been engaged by Christchurch City Council (CCC) to undertake a qualitative Detailed Engineering Evaluation (DEE) of the Super Shed building located at CityCare Pages Road at Shuttle Drive, Bromley, Christchurch.

This report is a Qualitative 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 qualitative assessment involves 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 the assessment is to determine the likely building performance and damage patterns, to identify any potential Critical Structural Weaknesses or collapse hazards, and to make an initial assessment of the likely building strength in terms of percentage of New Building Standard (%NBS).

At the time of this report, no intrusive site investigation, detailed analysis, or modelling of the building structure has been carried out. The building description below is based only on our visual inspection as drawings were not available.

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:

- The importance level and occupancy of the building
- The placard status that was assigned during the state of emergency following the 22 February 2011 earthquake
- 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.

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 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.

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:

- 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.

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.

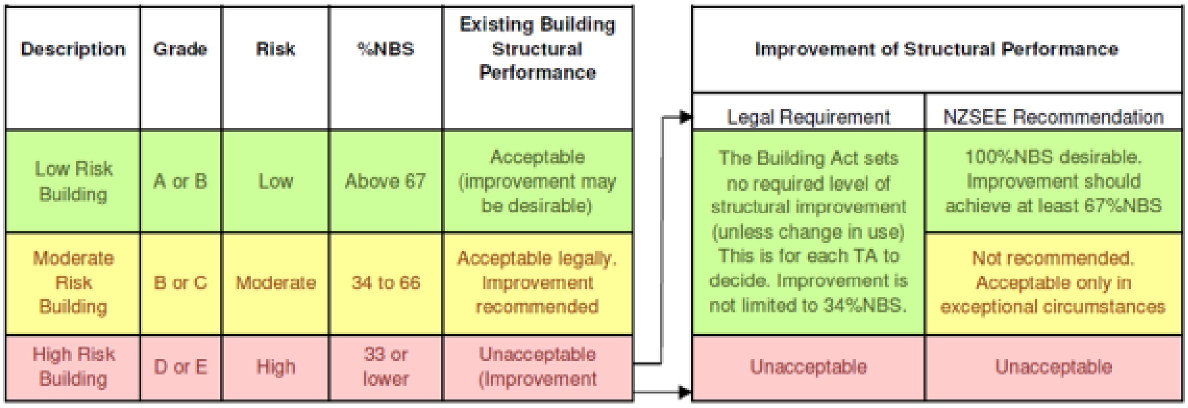
3 Earthquake Resistance Standards

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. No drawings of the structure were available, therefore the building information is assumed from our visual inspection only.

Table 4.1: Building Summary Information

Item	Details	Comment
Building name	City Care Pages Road – Super Shed	
Street Address	Shuttle Drive Bromley Christchurch	
Age	1982 - 1990	No drawings available, the construction date is assumed based on aerial photographs.
Description	Warehouse with offices	
Building Footprint / Floor Area	Approx. 35m x 35m/1200m^2	
No. of storeys / basements	Mostly one storey / no basement	Mezzanine floor in corner of warehouse.
Occupancy / use	Warehouse and offices	Importance Level 2
Construction	Steel portal frames with metal wall cladding and precast concrete wall panels on the bottom 3m. Mezzanine floor consists of precast concrete flat slab units with insitu topping supported on beams and columns and load bearing walls.	Based on visual inspection. No drawings available. Beams/columns are likely to be steel but could not be inspected due to linings in place
Gravity load resisting system	Metal roof on steel purlins which are supported by steel portal frames. Concrete mezzanine floor is supported on steel beams and columns.	No drawings available

Item	Details	Comment
Seismic load resisting system	Steel portal frames transversely, steel SHS tension/compression bracing in roof and walls in the longitudinal direction. Mezzanine floor is braced with flat bracing within the walls. No bracing was observed to the north eastern wall.	No drawings available
Foundation system	Unknown but assumed to be shallow foundations with a concrete slab on grade in the northern part of the building and asphalt pavement in the southern part of the building	No drawings available.
Stair system	Steel stairs to upstairs office	Supported by cantilever steel beams
Other notable features	None	
External works	Asphalt pavement	
Construction information	Visual inspection	No drawings available.
Likely design standard	NZS4203:1976 or NZS4203:1984	Inferred from age of building
Heritage status	No heritage status	
Other		

4.2 Structural 'Hot-spots'

- Precast concrete panel fixings to steel portal frames.
- Connections of tension and compression bracing due to large eccentricities.
- Inadequate seating of precast floor units in mezzanine structure.

5 Site Investigations

5.1 Previous Assessments

The building had a level 2 rapid assessment undertaken following the February 2011 and June 2011 earthquake events (refer to Appendix C).

5.2 Level 4 Damage Inspection

Visual inspections as part of the level 4 damage assessment were undertaken on 7 August 2012.

6 Damage Assessment

6.1 Damage Summary

The table below provides a summary of damage observed during our inspection. Refer to Appendix A for photographs of the observed damage.

Table 6.1: Damage Summary

Damage type	Unknown	Minor	Moderate	Major	Comment
settlement of foundations	✓				None observed during the visual inspection. Level survey may be required
tilt of building	✓				None observed during visual inspection. Vertical survey may be required to confirm.
liquefaction	✓				None observed during visual inspection. The aerial reconnaissance on 24 February 2012 indicates widespread liquefaction in surrounding areas. Volume is unknown.
settlement of external ground	✓				None observed during visual inspection.
lateral spread / ground cracks		✓			Cracks in asphalt pavement observed.
frame		✓			Local buckling to steel column at brace connection at south corner of the building.
concrete walls			✓		Cracking adjacent to joints of precast panels. Minor vertical cracks to the north eastern wall. Significant cracking and spalling at panel connections to superstructure. Broken/missing bolts at top panel connections in north and south corner of building. Connections have failed in pull out/shear.
cracking to concrete floors		✓			Cracking to concrete floor slab around columns
bracing		✓			Local buckling to steel column at brace connection at south corner of the building.
precast flooring seating	✓				Not inspected due to linings in place.
stairs					No damage observed during visual inspection.
cladding /envelope					No damage observed during visual inspection. Refer above for precast wall panels.

Damage type	Unknown	Minor	Moderate	Major	Comment
internal fit out					No damage observed during visual inspection.
building services	✓				No inspection of services was carried out.
other					

6.2 Surrounding Buildings

There are no adjacent buildings that are close enough to affect this building during an earthquake.

6.3 Residual Displacements and General Observations

No evidence of permanent settlement or displacements were 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

The primary structure has suffered minor visible structural damage and therefore we believe its structural capacity has not been materially affected.

7 Generic Issues

The following generic issues referred to in Appendix A of the EAG guideline document have been identified as applicable to the Super Shed building:

Single level tilt panel

- Brittle panel connections and cracked panels at the connections.
- Steel bracing connections inadequate.
- Hard-draw wire mesh reinforcement or inadequate reinforcement contents making panels prone to non-ductile face loading failure.

Precast concrete floor systems

- Inadequate support of precast units.
- Inadequate connection of floor diaphragm to the vertical structure.

Steel concentric braced frames

- Connections inadequate for capacity of braces

8 Critical Structural Weaknesses

The following potential Critical Structural Weaknesses have been identified:

8.1 Site Characteristics

Liquefaction occurred on the Pages Road site, and was considered significant. Therefore a site characteristic factor of 0.7 is used to assess the %NBS in the IEP of the building.

8.2 'Other factors', factor F

- Many connectors between the precast panels (likely to be secondary structure - cladding and 'parts' for design purposes) and the primary structure failed. Connections have little or no allowance to accommodate interstorey drift of the structure.
- Connections of tension and compression braces have large eccentricities.

Therefore a factor F of 0.9 was used to assess the %NBS in the IEP of the building.

9 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.

10 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. We recommend that level and verticality surveys are undertaken to confirm settlement of the building not able to be seen during our visual inspections as building settlement may be a significant insurance entitlement.

11 Initial Capacity Assessment

11.1 %NBS Assessment

The building has had its seismic capacity assessed using the Initial Evaluation Procedure based on the information available. The building's capacity is expressed as a percentage of New Building Standard (%NBS) and is in the order of that shown below in Table 11.1. A factor of 0.9 has been selected for the F factor. These capacities are subject to confirmation by a quantitative analysis which is more detailed. The post-damage capacity is considered to be the same as the original capacity.

Table 11.1: Indicative Building Capacities

System	Direction	Seismic Performance in *%NBS*	Notes
Steel SHS tension/compression bracing	Longitudinal	37%	NZSEE Initial Evaluation Procedure. IL 2, Z=0.3.
Steel moment frames	Transverse	48%	NZSEE Initial Evaluation Procedure. IL 2, Z=0.3.

11.2 Seismic Parameters

The seismic design parameters based on current design requirements from NZS1170:2004 and the NZBC clause B1 for this building are:

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

11.3 Expected Structural Ductility Factor

The lateral load resisting system in the transverse direction is steel portal frames which have been assumed to have a ductility factor of 2.0 in the IEP. The tension/compression braces in the longitudinal direction have been assumed to have a ductility factor of 1.25 for the IEP.

11.4 Discussion of results

Based on the IEP results, the Super Shed is considered potentially Earthquake Risk and seismic grade C as the IEP result is greater than 33%NBS and less than 67%NBS. This assessment is qualitative and based on the NZSEE IEP only.

12 Initial Conclusions

- The building has been assessed to have a seismic capacity of 37% NBS and is therefore potentially Earthquake Risk.
- Critical Structural Weaknesses have been identified.

13 Recommendations

13.1 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 potentially 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.

Temporary make-safe works have been advised to Christchurch City Council on 8 August 2012 for stabilising of precast wall panels where damaged connections were observed. These panels pose a threat to the public and people working nearby and Christchurch City Council has been advised to place barricades around the precast panels.

13.2 Further Investigations, Survey or Geotechnical Work

It is recommended that:

- Further efforts are made to obtain structural drawings.
- A verticality and level survey could be carried out to determine the extent of settlement of the building for insurance purposes.
- A quantitative %NBS analysis of the building should be completed.
- Repair damage to concrete wall panels and movement joints.
- Investigate precast wall panel to portal frame connections where damaged, and repair where necessary.
- Investigate all precast panel connections as part of the quantitative assessment and strengthen if required.
- Intrusive investigations to confirm seating of precast floor units in mezzanine floor area.

13.3 Damage Reinstatement

Repairs that would bring the building back to an “as new” condition are typically entitled under typical replacement insurance policies. We suggest you consult with your insurance advisor as to how you wish to proceed.

14 Design Features Report

Repairs will be required to reinstate the existing structural system and no additional load paths are expected as a result of the suggested remedial work.

15 Limitations

The following limitations apply to this engagement:

- 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.
- 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.
- The inspections are limited to building structural components only.
- Inspection of building services, pipework, pavement, and fire safety systems is excluded from the scope of this report.

- 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.
- The preliminary 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.
- 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 A: Aerial Photograph of site showing various buildings (Source: Google Maps)

Photo 1: Exterior view of North West elevation

Photo 2: Exterior view of North East elevation

Photo 3: Exterior view of South East elevation

Photo 4: Exterior view of South West elevation

Photo 5: Interior view warehouse

Photo 6: Interior view warehouse and mezzanine floor

Photo 7: Interior view office

Photo 8: Typical cracking to concrete wall panel

Damage Description: Cracking to concrete wall panel adjacent to joint

Photo 9: Tension/Compression brace with large connection eccentricities at each end

Photo 9: Panel connection with missing bolt at north corner of building

Damage Description: Possible shear failure of bolt.

Photo 10: Panel connection with concrete spalling

Damage Description: Possible shear/pull out failure of bolt/concrete panel

Photo 11: Panel connection with missing bolt at southern corner of building

Damage Description: Possible shear failure of bolt

Photo 12: Panel connection with concrete spalling at southern corner of building

Damage Description: Possible shear failure of bolt/panel

Photo 13: Panel connection with concrete cracking at southern corner of building

Damage Description: Possible shear failure of bolt/concrete panel

Photo 14: Tension/compression brace connection at southern corner of building

Damage Description: Local buckling of web and flange

Photo 15: Typical cracking to concrete slab

Damage Description: Cracking to concrete slab at column locations

Photo 15: Cracking to asphalt pavement

Damage Description: Cracking to asphalt pavement at column location.

Appendix B

CERA DEE Summary Data

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name: City Care Supershed
Unit No: Street
Building Address: Shuttle Drive | Shuttle Drive
Legal Description:
Degrees Min Sec
GPS south:
GPS east:
Building Unique Identifier (CCC): BU 0879-017 EQ2

Reviewer: David Whittaker
CPEng No: 123089
Company: Beca
Company project number: 5323355
Company phone number: 33663521
Date of submission: 27/08/2013
Inspection Date: 7/08/2012
Revision:
Is there a full report with this summary? yes

Site

Site slope: flat
Soil type:
Site Class (to NZS1170.5): D
Proximity to waterway (m, if <100m):
Proximity to clifftop (m, if < 100m):
Proximity to cliff base (m,if <100m):

Max retaining height (m):
Soil Profile (if available): unknown
If Ground improvement on site, describe:
Approx site elevation (m): 10.00

Building

No. of storeys above ground: 2 single storey = 1
Ground floor split? no
Storeys below ground: 0
Foundation type: other (describe)
Building height (m): 6.00
Floor footprint area (approx): 1225
Age of Building (years): 25

Ground floor elevation (Absolute) (m):
Ground floor elevation above ground (m): 0.00
if Foundation type is other, describe: unknown, shallow foundations presumed
height from ground to level of uppermost seismic mass (for IEP only) (m): 5.5
Date of design: 1976-1992

Strengthening present? no
If so, when (year)?
And what load level (%g)?
Brief strengthening description:

Use (ground floor): commercial
Use (upper floors): commercial
Use notes (if required):
Importance level (to NZS1170.5): IL2

Gravity Structure

Gravity System: frame system
Roof: steel framed — rafter type, purlin type and claddin: UB beams, Steel C Purlins, lightwight metal roofing and wall cladding, lower part precast
Floors: precast concrete with topping — unit type and depth (mm), toppin: unknown
Beams: steel non-composite — beam and connector typ: unknown
Columns: structural steel — typical dimensions (mm x mm): unknown
Walls: non-load bearing — 0

Lateral load resisting structure

Lateral system along: other (note) — describe system: Tension/compression braces
Note: Define along and across in detailed report!
Ductility assumed, μ: 1.25
Period along: 0.40 0.00 — estimate or calculation? estimated
Total deflection (ULS) (mm): — estimate or calculation?
maximum interstorey deflection (ULS) (mm): — estimate or calculation?

Lateral system across: welded and bolted steel moment frame — note typical bay length (m): 35
Ductility assumed, μ: 2.00
Period across: 0.40 0.00 — 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: steel — describe supports: fixed top and bottom
Wall cladding: precast panels — thickness and fixing type: 130mm thick, bolted connections
Roof Cladding: Metal — describe:
Glazing:
Ceilings: light tiles
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: slight — Describe damage:
Settlement: 0-25mm — notes (if applicable): estimated
Differential settlement: 0-1:350 — notes (if applicable): estimated
Liquefaction: 2-5 m²/100m³ — notes (if applicable): some did occur (from aerial photos)
Lateral Spread: none apparent — notes (if applicable):
Differential lateral spread: none apparent — notes (if applicable):
Ground cracks: 0-20mm/20m — notes (if applicable): estimated
Damage to area: none apparent — notes (if applicable):

Building:
Current Placard Status: green

Along — Damage ratio: 0% — Describe how damage ratio arrived at: damage not significant enough to reduce capacity
Describe (summary):

Across — Damage ratio: 0%
Describe (summary):

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

Diaphragms — Damage?: no — Describe:
CSWs: — Damage?: yes — Describe: liquefaction potential
Pounding: — Damage?: no — Describe:
Non-structural: — Damage?: yes — Describe: precast dado panels

Recommendations

Level of repair/strengthening required: minor structural — Describe: Precast panel fixings
Building Consent required: yes — Describe:
Interim occupancy recommendations: full occupancy — Describe:

Along — Assessed %NBS before: 15% ##### %NBS from IEP below — If IEP not used, please detail assessment methodology: Force based Quantitative Assessment
Assessed %NBS after: 15%

Across — Assessed %NBS before: 16% ##### %NBS from IEP below
Assessed %NBS after: 16%

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: 5.5m

Seismic Zone, if designed between 1965 and 1992: B

not required for this age of building

not required for this age of building

	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 =k_μ, 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 1.0

Height Difference effect D2, from Table to right 1.0

Therefore, Factor D: 1

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!**

Official Use only:

Accepted By:

Date:

Appendix C

Previous Reports and Assessments

②

Christchurch Eq RAPID Assessment Form - LEVEL 2

Inspector Initials: MWF
Territorial Authority: Christchurch City
Date: 22-6-11
Time: 12:30
Final Posting (e.g. UNSAFE): Inspected G1

Building Name: Red Sled Eco stove
Short Name: North of City Cave
Address: 210 Pages Road

GPS Co-ordinates: S° E°
Contact Name:
Contact Phone:

Storeys at and above ground level: 1
Below ground level: Mezz
Total gross floor area (m²):
Year built:
No of residential Units:

Photo Taken: Yes [✓ No]

Type of Construction

☐ Timber frame
☑ Steel frame
☐ Tilt-up concrete
☐ Concrete frame
☐ RC frame with masonry Infill
☐ Concrete shear wall
☐ Unreinforced masonry
☐ Reinforced masonry
☐ Confined masonry
☐ Other:

Primary Occupancy

☐ Dwelling
☐ Other residential
☐ Public assembly
☐ School
☐ Religious
☐ Commercial/ Offices
☑ Industrial
☐ Government
☐ Heritage Listed
☐ Other

Investigate the building for the conditions listed on page 1 and 2, and check the appropriate column. A sketch may be added on page 3

Overall Hazards / Damage	~~Minor~~/None	Moderate	Severe	Comments
Collapse, partial collapse, off foundation	☑	☐	☐	
Building or storey leaning	☑	☐	☐	
Wall or other structural damage	☑	☐	☐	
Overhead falling hazard	☑	☐	☐	
Ground movement, settlement, slips	☑	☐	☐	
Neighbouring building hazard	☑	☐	☐	
Electrical, gas, sewerage, water, hazmats	☐	☐	☐	Not Known

Record any existing placard on this building:

Existing Placard Type (e.g. UNSAFE):

Choose a new posting based on the new evaluation and team judgement. Severe conditions affecting the whole building are grounds for an UNSAFE posting. Localised Severe and overall Moderate conditions may require a RESTRICTED USE. Place INSPECTED placard at main entrance. Post all other placards at every significant entrance. Transfer the chosen posting to the top of this page.

INSPECTED GREEN: G1 | G2

RESTRICTED USE YELLOW: Y1 | Y2

UNSAFE RED: R1 | R2 | R3

Record any restriction on use or entry:

Further Action Recommended:

Tick the boxes below only if further actions are recommended

☐ Barricades are needed (state location):
☐ Detailed engineering evaluation recommended
  ☐ Structural ☐ Geotechnical ☐ Other:
☐ Other recommendations:

Estimated Overall Building Damage (Exclude Contents)

None	☐		
0-1 %	☐	31-60 %	☐
2-10 %	☑	61-99 %	☐
11-30 %	☐	100 %	☐

Sign here on completion: M Frost
Date & Time: 22/6/11 12:30
ID: Murray Frost
PRUP1: 021 403 180

Inspection ID: __________ *(Office Use Only)*

Structural Hazards/ Damage	Minor/None	Moderate	Severe	Comments
Foundations	☐	☐	☐	
Roofs, floors (vertical load)	☐	☐	☐	
Columns, pilasters, corbels	☐	☐	☐	
Diaphragms, horizontal bracing	☐	☐	☐	
Pre-cast connections	☐	☐	☐	
Beam	☐	☐	☐	
Non-structural Hazards / Damage				
Parapets, ornamentation	☐	☐	☐	
Cladding, glazing	☐	☐	☐	
Ceilings, light fixtures	☐	☐	☐	
Interior walls, partitions	☐	☐	☐	
Elevators	☐	☐	☐	
Stairs/ Exits	☐	☐	☐	
Utilities (eg. gas, electricity, water)	☐	☐	☐	
Other	☐	☐	☐	
Geotechnical Hazards / Damage				
Slope failure, debris	☐	☐	☐	
Ground movement, fissures	☐	☐	☐	
Soil bulging, liquefaction	☐	☐	☐	

General Comment Three areas.
① Super shed just north of city care bldg N-S Portal frame
② Open Yard
③ Eco Bldg to north with E-W portal frame.
Some minor repairs - ring Tim Driver

Usability Category

Damage Intensity	Posting	Usability Category	Remarks
Light damage *Low risk*	Inspected (Green)	[✓ G1. Occupiable, no immediate further investigation required]	
		G2. Occupiable, repairs required	
Medium damage *Medium risk*	Restricted Use (Yellow)	Y1. Short term entry	
		Y2. No entry to parts until repaired or demolished	
Heavy damage *High risk*	Unsafe (Red)	R1. Significant damage: repairs, strengthening possible	
		R2. Severe damage: demolition likely	
		R3. At risk from adjacent premises or from ground failure	

Inspection ID: ________ *(Office Use Only)*

Sketch (optional)
Provide a sketch of the entire building or damage points. Indicate damage points.

Recommendations for Repair and Reconstruction or Demolition (Optional)

- Approx dozen ceiling panels falling in upstairs cafe
- Light fittings falling down in office upstairs
- RHS props at midspan & quarter span have slight bow. Could be pre earthquakes.
- Super shed garage doors damaged. Possibly pre earthquake.
- Dishwasher tipped over in yard at back
- Fire extinguishers & hose reels need attention. Fallen over & cabinets open
- Brick work facing on south side of super shed - east side 2/3mm crack. Will need to be removed.