aurecon

Templeton Pool Buildings

Quantitative Engineering Evaluation

Functional Location ID: PRO 1662 B002

Address: 62 Kirk Road, Templeton, Christchurch

Reference: 235011

Prepared for:

Christchurch City Council

Revision: 2

Date: 14 October 2013

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Author Signature		Approver Signature	
Name	Tim McKee	Name	Luis Castello
Title	Structural Engineer	Title	Senior Structural Engineer

Contents

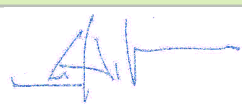
Appendices

Executive Summary – Female Changing

This is a summary of the Quantitative Engineering Evaluation for the Templeton Pool Buildings buildings and is based on the Detailed Engineering Evaluation Procedure document issued by the Engineering Advisory Group on 19 July 2011, visual inspections, available structural documentation and summary calculations as appropriate.

Building Details	**Name**	Templeton Pool Buildings – Female changing rooms			
Building Location ID	PRO 1662 B002			**Multiple Building Site**	Y
Building Address	62 Kirk Road, Templeton, Christchurch			**No. of residential units**	N/A
Soil Technical Category	N/A (TC1)	**Importance Level**	2	**Approximate Year Built**	1982
Foot Print (m²)	30	**Storeys above ground**	1	**Storeys below ground**	0
Type of Construction	Reinforced concrete frame and infill construction. The columns are 190mm square blockwork singly reinforced and the infill is 90mm thick unreinforced concrete blockwork.				

Quantitative L5 Report Results Summary		
Building Occupied	Y	The Templeton Pool Buildings - is currently in use.
Suitable for Continued Occupancy	Y	The Templeton Pool Buildings – the infill walls should be strengthened though.
Key Damage Summary	Y	Refer to summary of building damage Section 3.1 of the report body.
Critical Structural Weaknesses (CSW)	N	No critical structural weaknesses were identified.
Levels Survey Results	Y	Survey shows floor levels are within DBH guideline limits.
Building %NBS From Analysis	24%	Based on demand/capacity calculations. See Table 2 on Section 5.3

Approval			
Author Signature		Approver Signature	
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Title	Structural Engineer	Title	Senior Structural Engineer

Executive Summary – Male Changing

Building Details	**Name**	Templeton Pool Buildings – Male changing rooms			
Building Location ID	PRO 1662 B002			**Multiple Building Site**	Y
Building Address	62 Kirk Road, Templeton, Christchurch			**No. of residential units**	N/A
Soil Technical Category	N/A (TC1)	**Importance Level**	2	**Approximate Year Built**	1982
Foot Print (m²)	30	**Storeys above ground**	1	**Storeys below ground**	0
Type of Construction	Reinforced concrete frame and infill construction. The columns are 190mm square blockwork singly reinforced and the infill is 90mm thick unreinforced concrete blockwork.				

Quantitative L5 Report Results Summary

Building Occupied	Y	The Templeton Pool Buildings - is currently in use.
Suitable for Continued Occupancy	Y	The Templeton Pool Buildings – the infill walls should be strengthend.
Key Damage Summary	Y	Refer to summary of building damage Section 3.1 of the report body.
Critical Structural Weaknesses (CSW)	N	No critical structural weaknesses were identified.
Levels Survey Results	Y	Survey shows floor levels are within DBH guideline limits.
Building %NBS From Analysis	24%	Based on demand/capacity calculations. See Table 2 on Section 5.3

Approval

Author Signature		Approver Signature	
Name	Tim McKee	Name	Luis Castillo
Title	Structural Engineer	Title	Senior Structural Engineer

Executive Summary – Office

Building Details	**Name**	Templeton Pool Buildings – Office			
Building Location ID	PRO 1662 B002			**Multiple Building Site**	Y
Building Address	62 Kirk Road, Templeton, Christchurch			**No. of residential units**	NA
Soil Technical Category	N/A (TC1)	**Importance Level**	2	**Approximate Year Built**	1982
Foot Print (m²)	15	**Storeys above ground**	1	**Storeys below ground**	0
Type of Construction	Reinforced concrete frame and infill construction. The columns are 190mm square blockwork singly reinforced and the infill is 90mm thick unreinforced concrete blockwork.				

Quantitative L5 Report Results Summary

Building Occupied	Y	The Templeton Pool Buildings - is currently in use.
Suitable for Continued Occupancy	Y	The Templeton Pool Buildings – the infill walls should be strengthened
Key Damage Summary	Y	Refer to summary of building damage Section 3.1 of the report body.
Critical Structural Weaknesses (CSW)	N	No critical structural weaknesses were identified.
Levels Survey Results	Y	Survey shows floor levels are within DBH guideline limits.
Building %NBS From Analysis	24%	Based on demand/capacity calculations. See Table 2 on Section 5.3

Approval

Author Signature		Approver Signature	
Name	Tim McKee	Name	Luis Castello
Title	Structural Engineer	Title	Structural Engineer

1 Introduction

1.1 General

On the 8th March 2013 an Aurecon engineer visited the Templeton Pool Buildings to undertake a quantitative building damage assessment on three separate buildings on behalf of Christchurch City Council. Detailed visual inspections were carried out to assess the damage caused by the earthquakes on 4 September 2010, 22 February 2011, 13 June 2011, 23 December 2011 and related aftershocks.

The scope of work included:

- Assessment of the nature and extent of the building damage.
- Visual assessment of the building strength particularly with respect to safety of occupants if the building is currently occupied.
- Assessment of requirements for detailed engineering evaluation including any areas where linings and floor coverings need removal to expose connection details.

This report outlines the results of our Quantitative Assessment of damage to the Templeton Pool Buildings and is based on the Detailed Engineering Evaluation Procedure document issued by the Structural Advisory Group on 19 July 2011, visual inspections, available structural documentation and summary calculations as appropriate.

2 Description of the Building

2.1 Building Age and Configuration

The Templeton Pool Buildings area has three separate buildings that have been assessed in this report which are estimated to have been built in the 1980's. These include the male and female changing rooms and the office/shop shown in the site plan below. The plan areas of each building are 30, 30 and 15m^2 respectively. All of the buildings are constructed from concrete blockwork with 190mm square columns with central reinforcing and 90mm thick infill walls. All buildings have a lightweight metal roof on timber purlins spanning transversely onto the blockwork walls. The foundation system consists of a concrete slab on grade with edge thickenings assumed. The main pool plant and woman changing room are in the same building.

Figure 1. Site plan provided with the scope of works

2.2 Building Structural Systems Vertical and Horizontal

All buildings are similar. The roof gravity loads are supported by the timber purlins spanning transversely on to the blockwork walls sitting on a concrete slab on grade with edge thickenings assumed. The lateral loads are resisted by the unreinforced concrete blockwork walls in both directions.

2.3 Reference Building Type

A general overview of the reference building type, construction era and likely earthquake risk is presented in the figure below. The buildings assessed have been constructed in 1982 and according to the figure below, may be seismic prone.

Figure 2: Timeline showing the building types, approximate time of construction and likely earthquake risk. (From the Draft Guidance on DEEs of non-residential buildings by the Engineering Advisory Group)

2.4 Building Foundation System and Soil Conditions

Soil in this area is categorised as N/A – Rural and Unmapped however it is likely to be similar to the TC1 category in the surrounding areas. The foundation system is a concrete slab on grade for all buildings. According to CERA, TC1 land is unlikely to suffer future land damage from liquefaction.

2.5 Available Structural Documentation and Inspection Priorities

Two site plans were available.

Electronic copies of the following drawings were provided by CCC:

- Templeton Pool – Alterations (Paparua County Council), sheet 1 of 1, dated May 1982
- Templeton Pool – Site Plan (Paparua County Council), sheet 1, unknown date

No structural calcuations or drawings were available for review. The inspection priorities included inspection of the blockwork infill walls for cracking damage.

2.6 Available Survey Information

A floor level survey was undertaken to establish the level of unevenness across the floors. The results of the survey are presented in Appendix A.

The Ministry of Building, Innovation and Employment (MBIE) published the guidance "Repairing and Rebuilding Houses Affected by the Canterbury Earthquake Sequence" in December 2012, which recommends some form of re-levelling or rebuilding of the floor:

1. If the slope is greater than 0.5% for any two points more than 2m apart, or
2. If the variation in level over the floor plan is greater than 50mm, or
3. If there is significant cracking of the floor.

It is important to note that these figures are recommendations and are only intended to be applied to residential buildings. However, they provide useful guidance in determining acceptable floor level variations.

The floor levels for the Templeton Pool Buildings are considered to be acceptable.

3 Structural Investigation

3.1 Summary of Building Damage

The Templeton Pool Buildings were in use at the time the assessment was carried out. The following damage and observations were made and reviewed during the inspections of the quantitative assessment (refer to Appendix A for specific examples);

- Slight cracking in the concrete blockwork walls in various locations.
- Cracking in the concrete footpath around the buildings.
- Cracking in the concrete floor slab in the female changing rooms.
- Exposed reinforcing in the foundation wall of the office building.
- Cracking in the concrete blockwork wall alongside the footpath.

3.2 Record of Intrusive Investigation

There are no internal linings therefore no intrusive investigations were required to observe damage to the structure.

3.3 Damage Discussion

Only minor damages were noted in the damage assessment.

The stepped cracking in the blockwork walls and vertical cracking at intersections with the columns is considered to be minor. This minor cracking is not likely to have reduced the capacity of the buildings. It is recommended that the infill walls are strengthened out of plane. Cracking in the floor slab of the female changing rooms and along the footpaths is considered to be minor.

4 Building Review Summary

4.1 Building Review Statement

As no calculations and few drawings or documentations were available , assumptions had to be made in order to complete calculations using current NZ standards (Refre to Appendix B).

4.2 Critical Structural Weaknesses

No specific critical structural weaknesses were identified as part of the building assessment.

5 Building Strength (Refer to Appendix C for background information)

5.1 General

Generally, the three buildings seem to have performed well during the Canterbury earthquakes. However, the infill walls are unreinforced which reduces the strength of the buildings out of plane.

5.2 Initial %NBS Assessment

5.2.1 Parameters used in the seismic assessment

Table 1: Parameters used in the Seismic Assessment

Seismic Parameter	Quantity	Comment/Reference
Site Soil Class	D	NZS 1170.5:2004, Clause 3.1.3, Deep or Soft Soil
Site Hazard Factor, Z	0.30	DBH Info Sheet on Seismicity Changes (Effective 19 May 2011)
Return period Factor, R_u	1	NZS 1170.5:2004, Table 3.5
Ductility Factor for the concrete blockwork wall in both directions, μ	1.25	Concrete blockwork wall – limited ductility.

5.2.2 Lateral load resistance systems

The two changing rooms have a similar layout of column spacing and unreinforced blockwork infill. Lateral resistance is provided by the blockwork walls in the longitudinal direction and by a combination of blockwork walls and cantilver columns in the transverse direction. The roof diaphragm is considered to be flexible.

The office building is smaller in plan and has more openings than the changing rooms. Lateral resistance is considered to be provided predominantly from the cantilever columns in both directions. The roof diaphragm is considered to be flexible.

5.3 Assesment Results

The building strength assessment was carried out using detailed demand and capacity analysis. The following table presents the result form this assessment:

Table 2: Summary of results fromSeismic Assessment

Blocks	Direction	%NBS	Comments
Female Changing	North-south (along)	100%	In plane strength of unreinforced infill is adequate.
	East-west (across)	100%	In plane strength of unreinforced infill is adequate.
Male Changing	North-south (along)	100%	In plane strength of unreinforced infill is adequate.
	East-west (across)	100%	In plane strength of unreinforced infill is adequate.
Office	North-south (along)	73%	Limited by the capacity of the cantilever columns
	East-west (across)	86%	Limited by the capacity of the cantilever columns
Out of Plane	-	24%	Limited by the out of plane capacity of the unreinforced blockwork infill
Diaphragm	-	100%	Considered to be adequate due to the small distance between bracing lines
Foundation	-	100%	Considered to be adequate due to slab on grade with single storey and limited damage observed

5.4 Results Discussion

Detailed calculations highlighted lower percentages in regards to out-of-plane strength of the infill walls in all buildings of 24% NBS. The in plane strength of the male and female changing rooms is provided by the infill walls giving a capacity of 100% NBS. The in plane strength of the office building is provided predominantly from the cantilever blockwork columns giving a capacity of 73% NBS.

Due to the relatively small spans between columns and the well-defined load paths the diaphragm system is considered adequate for these buildings. Due to the construction type, lack of differential settlement and damage to the foundations, the foundation system is considered adequate for these buildings.

In summary, detailed calculations give a percentage new building standard (%NBS) of 24% for all of the buildings.

6 Conclusions and Recommendations

Given the good performance of the Templeton Pool Buildings in the Canterbury earthquake sequence and the lack of foundation damage, **a geotechnical investigation is currently not considered necessary**.

It is recommended that the infill walls are strengthened out of plane. This can be achieved by adding timber framing with plywood sheeting to the inside face of the infill walls between the blockwork columns and installing screws/fixings to the blockwork infill and top timber chord.

The Templeton Pool Buildings are currently in use and the buildings have suffered only minor damage. Because of this and the current use of the buildings, in our opinion the Templeton Pool Buildings are **suitable for continued occupation**.

7 Explanatory Statement

The inspections of the building discussed in this report have been undertaken to assess structural earthquake damage. No analysis has been undertaken to assess the strength of the building or to determine whether or not it complies with the relevant building codes, except to the extent that Aurecon expressly indicates otherwise in the report. Aurecon has not made any assessment of structural stability or building safety in connection with future aftershocks or earthquakes – which have the potential to damage the building and to jeopardise the safety of those either inside or adjacent to the building, except to the extent that Aurecon expressly indicates otherwise in the report.

This report is necessarily limited by the restricted ability to carry out inspections due to potential structural instabilities/safety considerations, and the time available to carry out such inspections. The report does not address defects that are not reasonably discoverable on visual inspection, including defects in inaccessible places and latent defects. Where site inspections were made, they were restricted to external inspections and, where practicable, limited internal visual inspections.

To carry out the structural review, existing building drawings were obtained (where available) from the Christchurch City Council records. We have assumed that the building has been constructed in accordance with the drawings.

While this report may assist the client in assessing whether the building should be repaired, strengthened, or replaced that decision is the sole responsibility of the client.

This review has been prepared by Aurecon at the request of its client and is exclusively for the client's use. It is not possible to make a proper assessment of this review without a clear understanding of the terms of engagement under which it has been prepared, including the scope of the instructions and directions given to and the assumptions made by Aurecon. The report will not address issues which would need to be considered for another party if that party's particular circumstances, requirements and experience were known and, further, may make assumptions about matters of which a third party is not aware. No responsibility or liability to any third party is accepted for any loss or damage whatsoever arising out of the use of or reliance on this report by any third party.

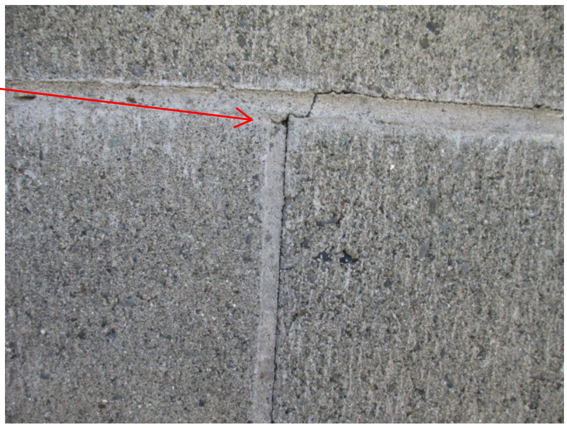
Without limiting any of the above, Aurecon's liability, whether under the law of contract, tort, statute, equity or otherwise, is limited as set out in the terms of the engagement with the client.

Appendices

Appendix A
Site Map, Photos, Levels surveys

4 December 2012 – Templeton Pool Buildings Site Photographs

Site map (supplied by the council in the scope of works)

Ref	Description	Photograph
1	General photo showing all three buildings assessed (in the top right section).	
2	General photo showing the north side of the pools.	
3	View of the south corner of the female changing rooms.	
4	Some minor cracking to the blockwork walls.	

5	View of the female changing rooms and store room from the east.	
6	View of the west corner of the female changing rooms.	
7	Interior view of the female changing rooms from the north.	
8	Interior view of the female changing rooms from the south.	

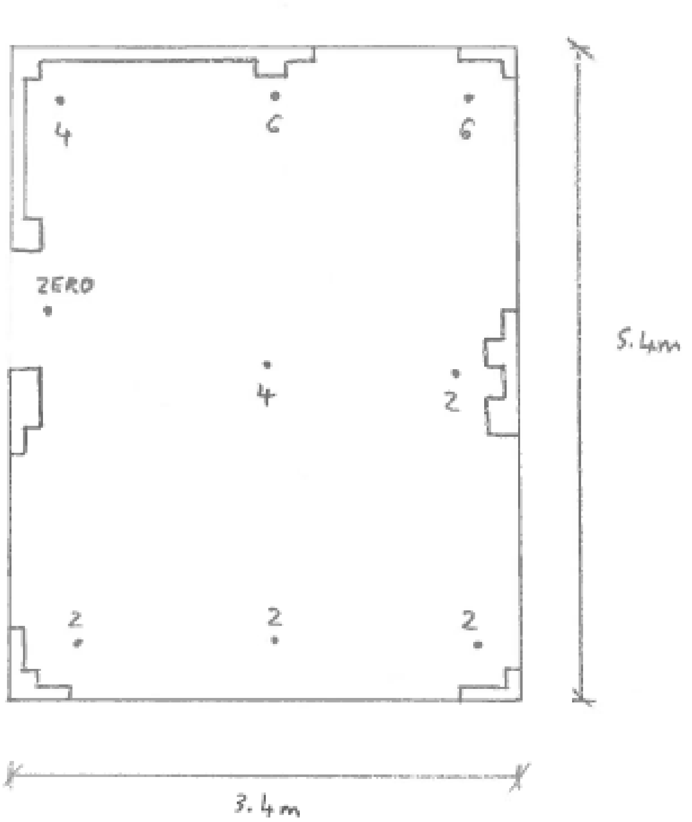
9	Deterioration of mortar between blocks in one section of the wall.	
10	Example of vertical cracking between a column and the wall.	
11	Interior view of the main plant room.	
12	Interior view of the main plant room showing the separating wall to the female changing room.	

13	External view of the office shop building from the south.	
14	External view of the office shop building from the north.	
15	Example of minor hairline cracking in the blockwork walls.	
16	Exposed reinforcing in the concrete foundation wall on the north side of the office shop building.	

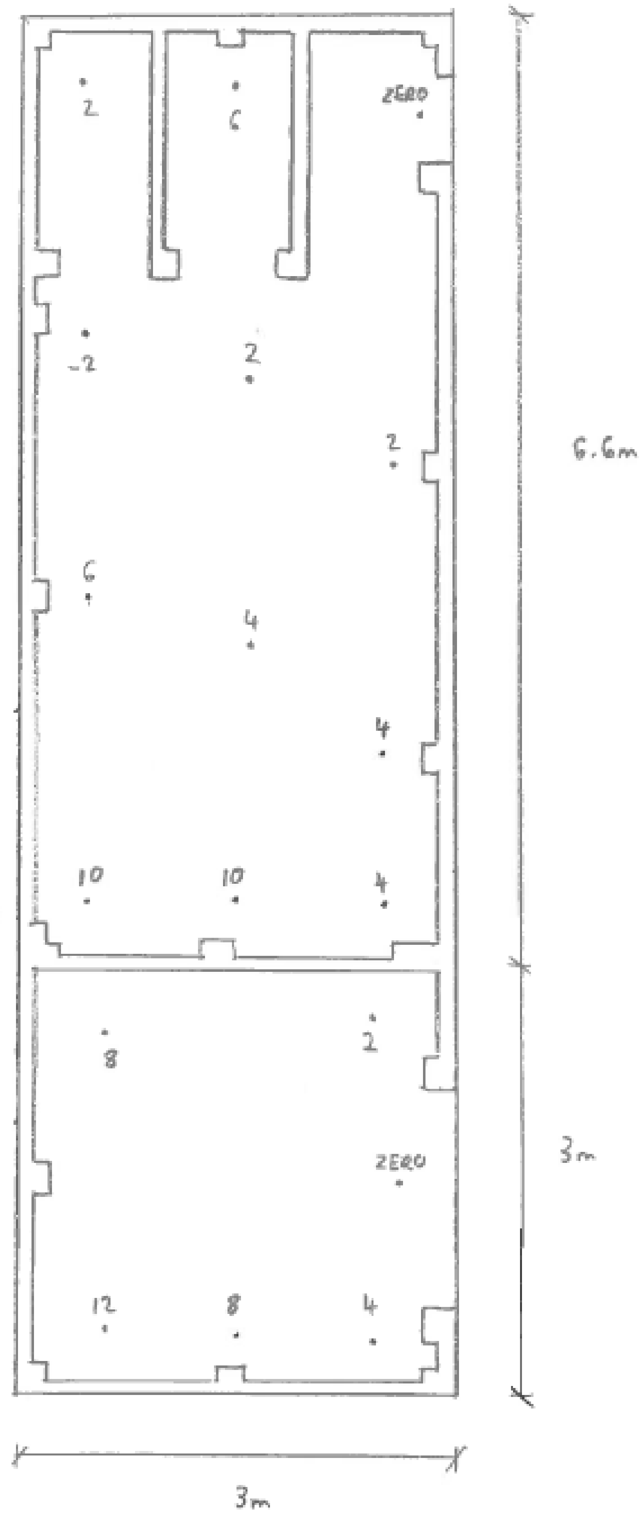
17	Interior view of the office shop showing the south corner	
18	Interior view of the office shop showing the east corner.	
19	Interior view of the office shop showing the north corner.	
20	Interior view of the office shop showing the west corner.	

21	External view of the male changing rooms from the south corner.	
22	External view of the male changing rooms from the north corner.	
23	Internal view of the male changing rooms from the north.	
24	Internal view of the male changing rooms from the south.	

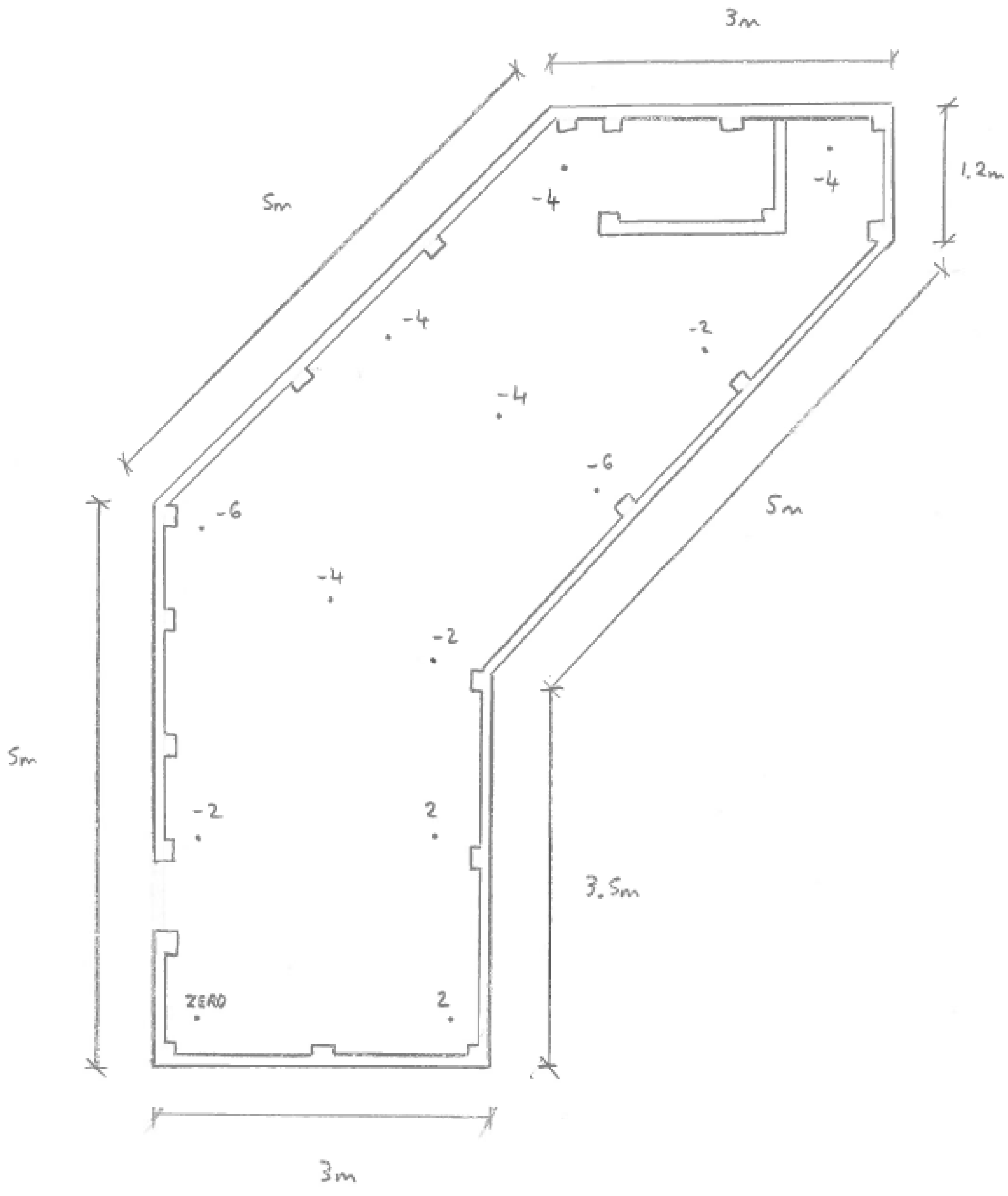
25	Example of the column bars bent over the timber top plates – assumed method for diaphragm connection.	



Floor Level Survey for the Office Building



Floor Level Survey for the Female Changing Rooms and Main Pool Plant



Floor Level Survey for the Male Changing Room

Appendix B

References, Limitation and Assumptions

1. Ministry of Business, Innovation, and Employment (MBIE) guidance, “Repairing and Rebuilding Houses Affected by the Canterbury Earthquakes”, January 2013

2. New Zealand Society for Earthquake Engineering (NZSEE), “Assessment and Improvement of the Structural Performance of Buildings in Earthquakes”, April 2012

3. Standards New Zealand, “AS/NZS 1170 Part 0, Structural Design Actions: General Principles”, 2002

4. Standards New Zealand, “AS/NZS 1170 Part 1, Structural Design Actions: Permanent, imposed and other actions”, 2002

5. Standards New Zealand, “NZS 1170 Part 5, Structural Design Actions: Earthquake Actions – New Zealand”, 2004

6. Standards New Zealand, “NZS 4230, Design of Reinforced Concrete Masonry Structures”, 2004

Limitation and Assumptions

The following table resume the limitation and assumptions made in order to complete calculations.

Table 1: Assumptions made

Assumptions	Description of the assumptions	Values
Dead load contributing in seismic calculations.	Lightweight metal roof on timber framing. 90 series blocks fully grouted. 190 series blocks fully grouted.	0.3 kPa 2.1 kPa 4.5 kPa
fy of all reinforcing bars.	Assumed to be made of grade 300 steel.	300 Mpa
Size of reinforcing bars.	Assumed to be similar to measured steel in photo 25.	12mm
Ductility Factor concrete blockwork walls/columns.	Assumed to be of limited ductility.	1.25

Appendix C
Strength Assessment Explanation

New building standard (NBS)

New building standard (NBS) is the term used with reference to the earthquake standard that would apply to a new building of similar type and use if the building was designed to meet the latest design Codes of Practice. If the strength of a building is less than this level, then its strength is expressed as a percentage of NBS.

Earthquake Prone Buildings

A building can be considered to be earthquake prone if its strength is less than one third of the strength to which an equivalent new building would be designed, that is, less than 33%NBS (as defined by the New Zealand Building Act). If the building strength exceeds 33%NBS but is less than 67%NBS the building is considered at risk.

Christchurch City Council Earthquake Prone Building Policy 2010

The Christchurch City Council (CCC) already had in place an Earthquake Prone Building Policy (EPB Policy) requiring all earthquake-prone buildings to be strengthened within a timeframe varying from 15 to 30 years. The level to which the buildings were required to be strengthened was 33%NBS.

As a result of the 4 September 2010 Canterbury earthquake the CCC raised the level that a building was required to be strengthened to from 33% to 67% NBS but qualified this as a target level and noted that the actual strengthening level for each building will be determined in conjunction with the owners on a building-by-building basis. Factors that will be taken into account by the Council in determining the strengthening level include the cost of strengthening, the use to which the building is put, the level of danger posed by the building, and the extent of damage and repair involved.

Irrespective of strengthening level, the threshold level that triggers a requirement to strengthen is 33%NBS.

As part of any building consent application fire and disabled access provisions will need to be assessed.

Christchurch Seismicity

The level of seismicity within the current New Zealand loading code (AS/NZS 1170) is related to the seismic zone factor. The zone factor varies depending on the location of the building within NZ. Prior to the 22nd February 2011 earthquake the zone factor for Christchurch was 0.22. Following the earthquake the seismic zone factor (level of seismicity) in the Christchurch and surrounding areas has been increased to 0.3. This is a 36% increase.

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

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

The New Zealand Society for Earthquake Engineering has proposed a way for classifying earthquake risk for existing buildings in terms of %NBS and this is shown in Figure C1 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 C1: NZSEE Risk Classifications Extracted from table 2.2 of the NZSEE 2006 AISPBE Guidelines

Table C1 below compares the percentage NBS to the relative risk of the building failing in a seismic event with a 10% probability of exceedance in 50 years (i.e. 0.2% in the next year). It is noted that the current seismic risk in Christchurch results in a 6% probability of exceedance in the next year.

Table C1: Relative Risk of Building Failure In A

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

Appendix D

Background and Legal Framework

Background

Aurecon has been engaged by the Christchurch City Council (CCC) to undertake a detailed engineering evaluation of the building

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

A qualitative assessment involves inspections of the building and a desktop review of existing structural and geotechnical information, including existing drawings and calculations, if available.

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).

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.

Canterbury Earthquake Recovery Authority (CERA)

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

Section 38 – Works

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

Section 51 – Requiring Structural Survey

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

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

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

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

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

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.

Christchurch City Council Policy

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

The 2010 amendment includes the following:

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

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

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

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

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

Building Code

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

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

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

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

Appendix E

Standard Reporting Spread Sheet

Detailed Engineering Evaluation Summary Data V1.14

Location

Building Name:	Templeton Pool Buildings	Reviewer:	Lee Howard
	Unit / No: / Street	CPEng No:	1008889
Building Address:	62 Kirk Road	Company:	Aurecon NZ Ltd
Legal Description:		Company project number:	235011
		Company phone number:	03 366 0821
	Degrees / Min / Sec		
GPS south:	43 / 32 / 59.00	Date of submission:	14/10/2013
GPS east:	172 / 28 / 16.00	Inspection Date:	8/03/2013
		Revision:	2
Building Unique Identifier (CCC):	PRO 1662 B002	Is there a full report with this summary?	yes

Site

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

Building

No. of storeys above ground:	1	single storey = 1 / Ground floor elevation (Absolute) (m):	
Ground floor split?	no	Ground floor elevation above ground (m):	
Storeys below ground	0		
Foundation type:	strip footings	if Foundation type is other, describe:	
Building height (m):	2.40	height from ground to level of uppermost seismic mass (for IEP only) (m):	
Floor footprint area (approx):			
Age of Building (years):	30	Date of design:	1976-1992
Strengthening present?	no	If so, when (year)?	
		And what load level (%g)?	
Use (ground floor):	public	Brief strengthening description:	
Use (upper floors):			
Use notes (if required):			
Importance level (to NZS1170.5):	IL2		

Gravity Structure

Gravity System:	load bearing walls		
Roof:	timber framed	rafter type, purlin type and cladding	
Floors:	concrete flat slab	slab thickness (mm)	
Beams:	timber	type	
Columns:	load bearing walls	typical dimensions (mm x mm)	
Walls:	load bearing concrete	#N/A	

Lateral load resisting structure

Lateral system along:	concrete frame with infill	Note: Define along and across in detailed report!	note total length of wall at ground (m):	
Ductility assumed, μ:	1.25			
Period along:	0.40	##### enter height above at H31	estimate or calculation?	
Total deflection (ULS) (mm):			estimate or calculation?	
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	
Lateral system across:	concrete frame with infill		note total length of wall at ground (m):	
Ductility assumed, μ:	1.25			
Period across:	0.40	##### enter height above at H31	estimate or calculation?	
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:			
Wall cladding:	exposed structure	describe	
Roof Cladding:	Metal	describe	
Glazing:			
Ceilings:			
Services(list):			

Available documentation

Architectural		original designer name/date	
Structural		original designer name/date	
Mechanical		original designer name/date	
Electrical		original designer name/date	
Geotech report		original designer name/date	

Damage

Site: (refer DEE Table 4-2)

Site performance:	Good	Describe damage:	
Settlement:		notes (if applicable):	
Differential settlement:		notes (if applicable):	
Liquefaction:		notes (if applicable):	
Lateral Spread:		notes (if applicable):	
Differential lateral spread:		notes (if applicable):	
Ground cracks:		notes (if applicable):	
Damage to area:		notes (if applicable):	

Building:

	Current Placard Status:	green		
Along	Damage ratio:	0%	Describe how damage ratio arrived at:	
	Describe (summary):			
Across	Damage ratio:	0%		
	Describe (summary):			
Diaphragms	Damage?:	no	Describe:	
CSWs:	Damage?:	no	Describe:	
Pounding:	Damage?:	no	Describe:	
Non-structural:	Damage?:	no	Describe:	

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

Recommendations

	Level of repair/strengthening required:	significant structural	Describe:	
	Building Consent required:	yes	Describe:	
	Interim occupancy recommendations:	full occupancy	Describe:	
Along	Assessed %NBS before e'quakes:	24% ##### %NBS from IEP below	If IEP not used, please detail assessment methodology:	Quantitative
	Assessed %NBS after e'quakes:	24%		
Across	Assessed %NBS before e'quakes:	24% ##### %NBS from IEP below		
	Assessed %NBS after e'quakes:	24%		

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: m

Seismic Zone, if designed between 1965 and 1992:

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	1.00	
Note 2: for RC buildings designed between 1976-1984, use 1.2	1.0	
Note 3: for buildngs designed prior to 1935 use 0.8, except in Wellington (1.0)	1.0	

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

		Along	Across
2.2 Near Fault Scaling Factor	Near Fault scaling factor, from NZS1170.5, cl 3.1.6:		1.00
	Near Fault scaling factor (1/N(T,D), **Factor A**:	1	1
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):		2
	Return Period Scaling factor from Table 3.1, **Factor C**:		
2.5 Ductility Scaling Factor	Assessed ductility (less than max in Table 3.2)	1.00	1.00
	Ductility scaling factor: =1 from 1976 onwards; or =kμ, if pre-1976, fromTable 3.3:		
	Ductiity Scaling Factor, **Factor D**:	1.00	1.00
2.6 Structural Performance Scaling Factor:	Sp:	1.000	1.000
	Structural Performance Scaling Factor **Factor E**:	1	1
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

		Along	Across
3.6. Other factors, Factor F	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

		Along	Across
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!**

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