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Wellington Central Library, 101 Wakefield Street, Wellington

Targeted Damage Evaluation Report following the November 2016 Kaikoura Earthquakes

Wellington City Council

15 February 2017
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Bringing ideas to life

Document control record

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Author signature		Approver signature	
Name	Adonia La Camera	Name	Duncan Fleming
Title	Structural Engineer	Title	Technical Director

Contents

Appendices

1 Executive Summary

This assessment has been carried out at the request of Aurecon's client, Wellington City Council for the Wellington Central Library at 101 Wakefield Street, Wellington.

The fundamental objective of a Targeted Damage Evaluation (TDE) requested by the Wellington City Council (WCC) is to identify and review the primary vertical and lateral load paths of specific buildings that fall under the Affected Building Profile and carry out an assessment of the damage to critical areas of the structure.

The document, *Engineering Guidelines for Targeted Damage Evaluation following the November 2016 Kaikoura Earthquakes, Version 1.1 – 25 January 2017* produced by the Society of Structural Engineers (SESOC), New Zealand Society for Earthquake Engineering (NZSEE) and WCC has been used as the basis of this investigation.

In this assessment, Aurecon structural engineers carried out intrusive investigations in specific locations to determine the extent of damage to the building. Cladding and lining materials were removed to expose the primary structure in various 'hot-spot' locations identified in a desktop study of the available documentation. The damage to the structure is discussed in Section 5.

From the 2016 Kaikoura earthquake the majority of the structure suffered only minor damage. Existing damage was observed in particular at the precast units of the ground floor level most of which have had support sections retrofitted in order to rectify any risk of failure in 2013.

The only area of concern identified in the inspections was a single precast floor unit at ground floor which was found to have a crack which could compromise its capacity (CDS A). This damage appears to be recent as no additional support has been installed to this unit, but it is typical when compared to previous damage to adjacent units which have had remedial works applied.

No evidence of plastic hinge formation was observed in seismic beams and columns, no beam elongation was observed and no loss of seating of the hollowcore floor units was seen. Several cracks were observed in the levelling compound floor topping in the proximity of the perimeter columns. Further investigations showed the cracks to be only superficial. The crack sizes were less than 0.5mm wide on the levelling compound.

Aside from the localised floor area mentioned above, it appears that the damage observed will not affect to the performance of the building or pose a risk in future earthquakes or aftershocks and it is therefore not necessary to change the current occupancy. The exterior cladding panels appear to be adequately fixed to the structure and do not pose a life safety hazard to occupants, passing pedestrians or neighbouring buildings. Furthermore, the internal egress paths including stairs do not appear to have any damage that would limit their performance or cause failure resulting in egress routes being blocked.

2 Description of Structure

As identified by the WCC, the Wellington City Library falls under the category of 'Affected Building Profile' due to a combination of its structural form, size and siting.

The building was designed and documented in 1989 in accordance with loading standards NZS4203:1984 and the concrete structures standard NZS3101:1982. The building is a six storey reinforced concrete frame structure constructed on flat ground. The building consists of a basement level, full height mezzanine level, three levels of library space and 2 levels for office use.

The structural system of the building consists of reinforced concrete moment resisting frames in the longitudinal and transverse directions with perimeter walls at basement level. The typical flooring system consists of precast pre-stressed hollowcore units with an in-situ topping spanning in the longitudinal direction of the building. Cladding to the structure includes precast concrete panels with window penetrations on three sides of the building, the remaining façade of the building has a glazed curtain wall system. The building foundations are made up of a series of bored reinforced concrete piles. Biaxial actions on "corner" columns has been limited by creating pin-end beam connections in one of the frame joining into these columns.

The concrete piles are generally belled at the base and are approximately 5-6m in length below the basement floor slab. The piles have been founded in dense gravels that underlie the site. The site is classified as 'Type C' subsoil in accordance with NZS 1170.5

Previous repair work to the building was observed at the basement level. Steel brackets have been installed to support hollowcore units due to transverse cracking. This repair work was designed by Holmes Consulting Group and installed in 2013/2014.

Figure 1 and 2 below show two views of the building, western elevation from Victoria Street and the eastern elevation from Civic Square. A typical floor plan of the building is shown in Figure 3.

Figure 1 - View of the Wellington City Library from Victoria Street

Figure 2 - View of the Wellington City Library from Civic Square

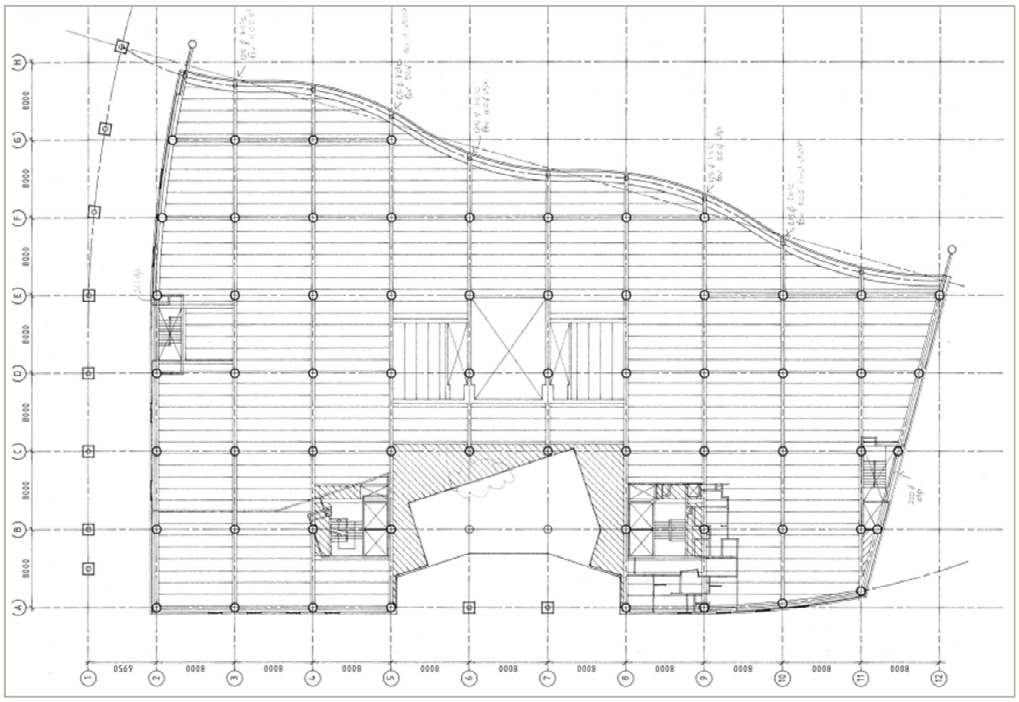

Figure 3 – First Floor Plan

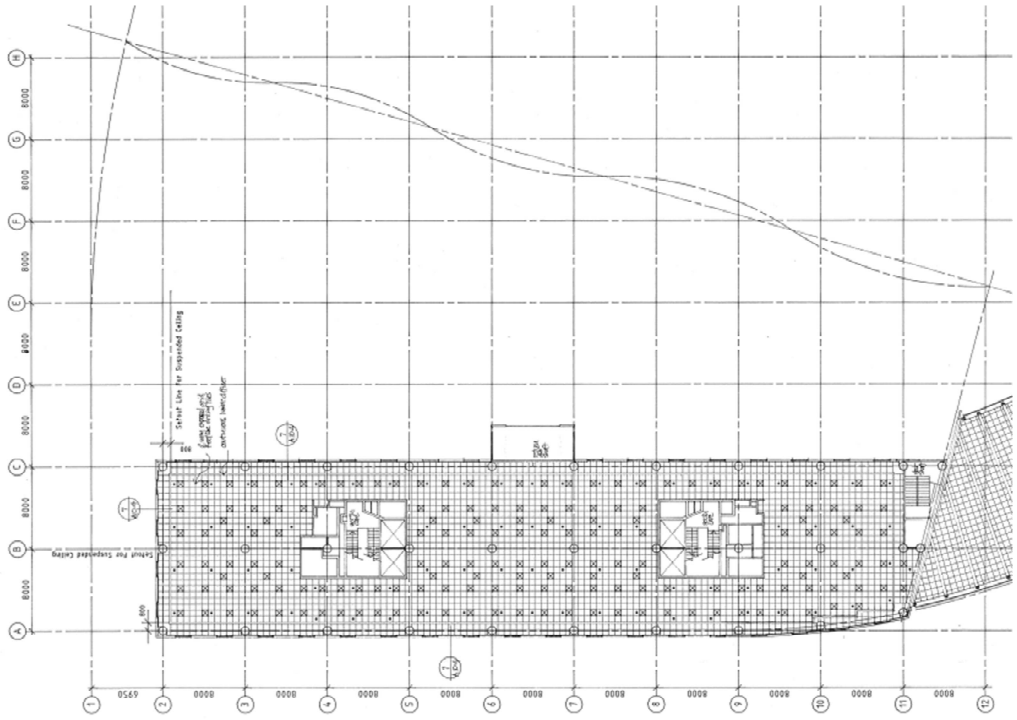

Figure 4 – Fourth Floor Plan

3 Inspections and Assessments Undertaken

3.1 Dates and Scope of Inspections and Assessments

Following the November 2016 earthquakes, Rapid Assessment investigations were carried out by Aurecon engineers Adonia La Camera and Mehrdad Seifi on 14 November 2016. The Rapid Assessment Form is attached in Appendix A.

The TDE inspections were carried out in accordance with the procedures documented in the SESOC guidelines. Structural engineers from Aurecon, Adonia La Camera and Jagnesh Makwana, carried out inspections in January and February 2017.

The scope of these inspections was to investigate the extent of damage to the building and in particular focus on damage to specific areas as follows:

- Cracking to hollowcore units for all levels
- Elongation of frames and seating damage leading to loss of support for precast flooring systems
- Disconnection of gravity load system for diaphragms, particularly in frames running parallel to the floor span
- Damage to beams and columns
- Identification of critical damage to stairs
- Identification of critical damage to support points of heavy cladding systems

3.2 Intrusive Investigations

As part of this evaluation the carpet was rolled back in several locations to reveal the top of the floor slab and ceiling tiles were lifted to expose the underside of the floor slab. In a few locations on each floor 10mm from the top of the concrete slab was removed to check if surface cracks were penetrating deeper into the slab.

Plaster surrounding a column that was cracked was removed to investigate the integrity of the column. 10mm of cover concrete was removed from a beam to investigate if cracking observed was superficial or structural. Furthermore, some of the beam column joint cover concrete was removed to check the integrity of the beam to column pin end connection.

Wall linings and concrete topping were removed to expose the bottom connection of the precast panels.

3.3 Building Inspections

The initial inspection was carried out on the 27th of January 2017. Subsequent inspections were carried out on the 3rd, 7th, 9th, and 10th of February 2017.

3.4 Pre-Earthquake Seismic Assessments

A seismic assessment was undertaken by Holmes Consulting Group in 2013 which determined the building to have a global seismic rating of 60% NBS (New Buildings Standard). However the stairs were rated between 35-45% NBS. The precast panel connection scored 40% NBS and the precast hollowcore unit seating was between 35-45% NBS.

4 Information Sources

4.1 Available Documentation

Full structural and architectural drawings were available provided by the WCC Archives and the original building designers, Holmes Consulting Group and Athfield Architects. Only partial mechanical and electrical service documentation was retrieved from the WCC Archives.

5 Damage Observed

5.1 Overview of Damage Observed

The damage noted to the primary structure consisting of reinforced concrete moment resisting frames were minor or insignificant.

Damaged observed during the intrusive investigation is summarised below. Reference should be made to Appendix C for photographs of damage to specific areas of the building with comments.

- No evidence of plastic hinge formation in the seismic beams and columns observed. Hairline cracks were noted in the potential plastic hinge zones of beams in several locations but no spalling or growth in the length of the beams was observed. Spalling of concrete cover was observed at the bottom of the pin-end beam/column connections which are expected and do not downgrade the system capacity. No damage was observed to columns. In Appendix C see photos 18, 22, 23, 26.
- No separation of the floor slab from the perimeter frames was observed where precast hollowcore units run parallel to the perimeter beams.
- No loss of seating to the hollowcore units was noted at support beam locations. There was minor spalling showing signs of movement in a few locations but no loss of seating was observed.

  Several cracks were noted in the levelling compound floor topping on several floor levels, in particular at the proximity of columns on the perimeter of the building. Several cracks propagate from the face of the columns are short and decrease in width. The width of the cracks were less than 0.5mm. In certain locations the floor levelling compound and 10mm of concrete topping was removed to check the vertical extension of the crack which was generally found to terminate within this 10mm depth. In one case the vertical crack penetrated through the entire slab depth. This was in the location where steel support brackets were provided following the earthquake in 2013.

  No signs or damage or cracking was observed to the underside of hollowcore units above the ground floor. Several cracks were observed at the ground floor level. The majority of these cracks were already identified by investigations done by Holmes Consulting Group in 2013 and additional support brackets installed.

  Only one crack is found on a single hollowcore precast unit to be of concern and classified as CDS A in accordance with the TDE Guidelines which will require repair work. This is a transverse crack across a hollowcore unit on ground level Grid 9/B-C. The dimension of the panel is 8m x 1.2m. Figure 5 shows the location.

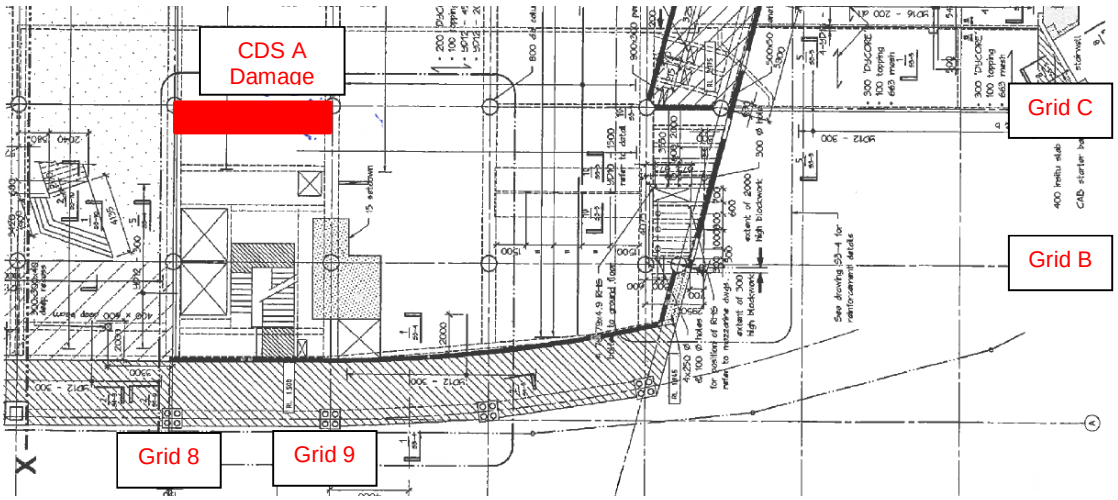

Figure 5 – Location of transverse crack to hollowcore ground floor unit

Figure 6 – Transverse crack to hollowcore ground floor unit. CDS A damage.

Refer Appendix C for photos (No. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15, 16, 27, 28, 29, 30, 31) related to floor cracking.

- No structural damage was observed to the steel structure supporting the central stairs. In particular the connection of the stair landing to concrete beam showed no signs of movement or cracking. The precast concrete emergency stairs suffered only minor damage at the landing joint connection which does not compromise the safety of the stairs. The external stairs running from Civic Square had damage to tiles due to an insufficient gap between the external stairs and the building. Damaged tiles were replaced soon after the earthquake. Refer Appendix C photos (No. 24, 25) related to stairs investigations.
- No signs of damage or inadequate movement was observed for the precast cladding panels and their connections. Refer Appendix C for photos (No. 12, 13, 19, 20, 21) related to cladding panels.

Other damage noted to the structure thought to be unrelated to the 2016 Kaikoura earthquake include:

- Small cracks to the blockwork walls noted in the basement of the building which are not a concern.
- Shrinkage cracks (~0.1-0.5mm wide) seen in the concrete topping of the carpark floors.

6 Assessment

Based on the extent and nature of the damage observed, we believe there is no need for the occupancy of the building to be changed. However, the area above and below the damaged hollowcore unit needs to be vacant until propping has been provided. Repair works are required to restore the integrity of the floor unit in one location.

7 Further Actions Proposed

No further investigations are required.

Appendix A
Rapid Assessment Forms

EARTHQUAKE RAPID ASSESSMENT FORM

Complex Residential and all Non-Residential Buildings
Level 2

ASSESSMENT

Fields with asterisks (*) are mandatory, others are optional.

1 Assessor Name*: MEHRDAD SEIFI ADONIA CAMERA
Assessor ID*: Authority*:

2 Assessment Date*: 14 / 11 / 16 (Day / Month / Year)
Assessment Time*: 10 15 (Hour / Minute *(to nearest half hour)*) A ◯ AM B ◯ PM

BUILDING IDENTIFICATION

3 Building Name: WELLINGTON CITY LIBRARY
Unit / Number*: /
Street*: VICTORIA ST.
City/Town*: WELLINGTON
GPS (Degree with 5 decimals after comma) South -, East ,
Other ID or access: Photo taken A ◯ No B ◯ Yes Photo ID.

4 Contact Name: PETER BREMAN
Type: A ◯ Owner B ◯ Tenant C ☑ Other Property Manager.
Phone (with area code): (0 2 1) 2 2 7 8 2 8 6

5 Existing Placard*: ☑ None ◯ W ◯ Y1 ◯ Y2 ◯ R1 ◯ R2 Date*: (Day / Month / Year) Team ID*:

BUILDING DESCRIPTION

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Dimensions	Constr. Age	Building Type	Structure Type	Cladding Type
Storeys above ground incl. ground floor: 05	A ◯ <1935	A ◯ Complex residential	A ◯ Timber frame	A ◯ Brick veneer
Storeys below ground: 01	B ◯ 1935-1976	B ◯ School	B ◯ Steel frame	B ☑ Concrete panels
Footprint (m²): 3509	C ◯ 1977-1984	C ☑ Commercial/Office	C ☑ Concrete frame	C ◯ Steel
	D ☑ 1985-2000	D ◯ Industrial	D ◯ Concrete shear wall	D ☑ Glass
	E ◯ >2000	E ◯ Critical facility	E ◯ Tilt-up concrete	E ◯ Lightweight
	F ◯ Unknown	F ◯ Public assembly	F ◯ Reinforced masonry	F ◯ Other:
		G ◯ Other:	G ◯ Unreinforced masonry	
			H ◯ Other:	

EXTERNAL RISKS

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Potential Cause*	A Yes	B No
1 Objects falling from adjacent buildings. Adjacent building ID or address: not Significant.	◯	☑
2 Land instability above	◯	☑
3 Land instability below	◯	☑
4 Other: Some superficial damage observed on External facade.	◯	◯

If required add sketch on separate page showing extent and nature of the external risk factors.

VERSION 01 – APRIL 2014

DAMAGE ASSESSMENT

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	Damage				
	N/A	Unknown	Minor or None	Moderate	Severe
Overall Hazard*	N/A	A	B	C	D
1 Collapse or partial collapse	✓	○	○	○	○
2 Building or storey leaning	✓	○	○	○	○
3 Other:	○	○	○	○	○
Structural Hazards*	N/A	A	B	C	D
4 Foundations	○	✓	○	○	○
5 Roofs, floors	○	○	✓	○	○
6 Gravity systems (columns, beams, etc)	○	○	○	✓	○
7 Lateral systems (walls, frames, braces)	○	○	✓	○	○
8 Diaphragms, horizontal bracing	○	○	✓	○	○
9 Precast connections	○	✓	○	○	○
10 Other:	○	○	○	○	○

	Damage				
	N/A	Unknown	Minor or None	Moderate	Severe
Non-structural Hazards*	N/A	A	B	C	D
11 Parapets, ornamentation, chimneys	○	○	○	○	○
12 Cladding, glazing	○	○	✓	○	○
13 Ceilings, light fixtures	○	○	○	✓	○
14 Interior walls, partitions	○	○	○	✓	○
15 Access/egress (elevators, stairs, exits)	○	○	○	✓	○
16 Significant fire saftey concerns	○	✓	○	○	○
17 Utilities (e.g. gas, electricity, waste water, plumbing)	○	✓	○	○	○
18 Other:	○	○	○	○	○

Comments: Stairs

9 Estimated Damage A ○ None B ✓ 0-10% C ✓ 11-30% D ○ 31-60% E ○ 61-100%

SUGGESTED FURTHER ACTIONS

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Recommended further Assessment*	Safety Cordon*	Barricades*	Urgency of suggested action*
A ○ None B ✓ Level 2 Rapid Assessment (tick below if particular expertise is required) B1 ✓ Structural Engineer B2 ○ Geotechnical Engineer B3 ○ Other: C ✓ Further evaluation to be arranged by building owner B-C Joints and Central Stairs Plus Stairs from Civic Square.	A ○ None required B ✓ Cordon required Describe extent (add diagram on separate sheet if required) Stairs from Civic Square must be Cordoned.	A ○ None required B ○ Barricades already in place C ○ Barricades required Describe extent (add diagram on separate sheet if required)	A ○ Standard B ○ Immediate action required

SUMMARY

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Observed Damage	Level 2 Rapid Assessment Outcome*
Light or no damage	W ○ **CAN BE USED** (From assessment no known dangers)
Moderate damage	Y1 ○ **RESTRICTED ACCESS TO PART(S) OF THE BUILDING ONLY**
	Y2 ○ **RESTRICTED ACCESS – SHORT TERM ENTRY ONLY with or without supervision** Access to be supervised A ○ Yes B ○ No
Heavy damage	R1 ○ **ENTRY PROHIBITED (At risk from external factors)**
	R2 ○ **ENTRY PROHIBITED (Severe damage to building)**

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Survey Extent*	
Exterior	A ○ Partial
	B ✓ Complete
Interior	C ○ Not accessed
	D ✓ Partial
	E ○ Complete

Assessor Signature* Sikandar

NOTES

13 Further Check is required by inspecting the Beam-Colum joints with chipping away the Concrete Cover. Internal Stair Connections requires further check. External stair from Civic Square Connection to be checked.

If required add a sketch on a separate sheet of paper showing building damage, access restrictions or cordoning areas. Identify the building on the sketch and staple the sheet to this assessment form.

Sketch included on separate page? ○ Yes ✓ No

Appendix B
Standardised Summary Table

Standardised Summary Table: Targeted Damage Evaluation Data

V1.23

All RED cells must be filled in prior to submission.
Submit drawings with form.

Location

Building Name:	Bldg D - Wellington Central Library				Assessing Engineer:	Adonia La Camera
	Unit	No:	Street		CPEng No:	
Building Address:	NA	101	Wakefield Street		Company:	Aurecon NZ Ltd
Legal Description:	Lot 1 DP 494594 CFR 724107				Company project number:	254449
					Company phone number:	04 472 9589
	Degrees	Min	Sec			
GPS south:					Date of submission:	
GPS east:					Inspection Date:	
					Revision:	
Building Unique Identifier (WCC BUFI number):	1000722				Is there a full report with this summary?	

Available documentation

Architectural	full	original designer name/date	Athfield Architects Ltd / 1990
Structural	full	original designer name/date	Holmes Consulting Group / 1990
Mechanical	partial	original designer name/date	Rankine & Hill Limited / 1990
Electrical	partial	original designer name/date	Rankine & Hill Limited / 1990
Geotech report	none	original designer name/date	NA

Site

Surrounding Site slope:	flat	Max retaining height (m):	3.5
Soil type:	Other fill	Soil Profile (if available):	Flat
Site Class (to NZS1170.5):	C		
In reclamation zone?	yes	If Ground improvement on site, describe:	No
Proximity to ocean (m, if <100m):		Approx site elevation (m):	4.00

Building

No. of storeys above ground (excl. mezzanine):	5	*single storey = 1*	Ground floor elevation (Absolute) (m):	4.00
Mezzanine?	yes			
Ground floor split?	no		Ground floor elevation above ground (m):	0.00
Storeys below ground	1			
Foundation type:	bored cast-insitu concrete piles		if Foundation type is other, describe:	
Building height (m):	23.00			
Floor footprint area (approx):	3360			
Year of construction:	1990		Year of design:	1990
Is the building consistent with the Structural drawings?	yes	*If no, describe variation in report*		
Seismic Strengthening/retrofit present?	no		If so, when (year)?	
			And what load level?	
Use/occupancy (ground floor):	Commercial/Public Building		Type of strengthening/retrofit:	
Use/occupancy (upper floors):	Commercial/Public Building		Securing of non-structural elements:	
Use/occupancy notes (if required):	Library and office use			
Importance level (to NZS1170.5):	IL2			
Plan irregularity:	significant		First storey height (m)	6.80
Vertical irregularity	severe		Typical storey height (m)	4.50
Other irregularity				

Gravity Structure

Gravity System:	frame system		
Roof system:	concrete	slab thickness (mm)	65
Beams:	precast concrete	overall depth (mm)	865
Columns:	cast-insitu concrete	typical dimensions (mm x mm)	900 diameter
Walls:	partially filled concrete masonry	thickness (mm)	190

Floor Diaphragm:

Type of floor system	precast concrete with topping	[describe using options below]	
Topping thickness (slab if CIP) (mm)	65		
Topping (slab if CIP) reinforcement	Mesh (cold drawn)		
Precast unit type	Hollowcore	describe if hollowcore units are spaced with timber infill	
Precast unit depth (mm)	200		
Precast unit seating detail	Hollow-core (no reinforcement into unit)		
Low friction bearing strip used	No		
Beam to slab continuity reinforcement	Mild steel reinforcement		
Link slab between precast units and frames	No	If yes, describe link slab (including width and thickness)	
# bays of frames spanning parallel to single precast unit	1		
Ties from columns into floor (for least restrained column)	Mild steel reinforcement	diagonal or straight column ties?	Straight column ties

Lateral load resisting structure (assumed for design)

Lateral system along:	ductile concrete moment frame	**Note: Define along and across in detailed report!**	note typical bay length (m)	8
Closest direction to "along":	NE-SW			
Design Ductility assumed, μ:	3.00			
Period along:	1.83		estimate or calculation?	calculated
Total deflection (ULS) (mm):	457		estimate or calculation?	calculated
maximum interstorey deflection (ULS) (mm):	130		estimate or calculation?	calculated
Lateral system across:	ductile concrete moment frame		note typical bay length (m)	8
Closest direction to "across":	NW-SE			
Design Ductility assumed, μ:	3.00			
Period across:	1.45		estimate or calculation?	calculated
Total deflection (ULS) (mm):	411		estimate or calculation?	calculated
maximum interstorey deflection (ULS) (mm):	120		estimate or calculation?	calculated

Separation from neighbouring structures:

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

Non-structural elements (fill in matrix)

		Damaged in EQ?	Threat to Life Safety?	Threat to Egress?
Stairs:	precast, full flight	no	no	no
Wall cladding:	precast panels	no	no	no
Roof Cladding:	Other (specify)	no	no	no
Glazing:	aluminium frames	no	no	no
Ceilings:	light tiles	no	no	no
Fire suppressant system:	Sprinkler system with localised manual call points, smoke detectors and sounders	unknown	unknown	unknown
Heating and Ventilation system:	VAV system to office floors generally, CV system to main public library area, with supplementary FCUs to perimeter glazing areas of office floors	unknown	unknown	unknown
Elevator:	yes	no	no	no
Other heavy or hazardous elements:	Machinery	no	no	no

Critical Damage States Evaluation for RC Buildings*

**reference Targeted Damage Evaluation Guidelines for description of each damage type*

Damage posing collapse risk (A and B)

Where multiple cases observed, fill in for worst case

Transverse crack at end of hollowcore (top of slab):

Max crack width:	< 0.5mm (including "hairline")	If cracked, how many units with damage:	10
Web cracking?:	none visible	Closest crack distance to beam support (mm):	0
Vertical offset at crack?:	no		

Transverse crack at end of hollowcore (bottom of unit):

Max crack width:	0.5-2mm	If cracked, how many units with damage:	1
Web cracking?:	none visible	Closest crack distance to beam support (mm):	150
Vertical offset at crack?:	no		

Transverse crack at end of ribs:

Max crack width:	Not Applicable	If cracked, how many units with damage:	
Inclination of crack:	not applicable	Closest crack distance to beam support (mm):	
Vertical offset at crack?:	not applicable		
Damage to support of precast unit:	insignificant	If damaged, how many units with damage:	
Remaining precast unit support:	25-75 mm	Estimated seating lost due to damage (mm):	0
Evidence of beam elongation:	no	Estimated seating lost due to beam elongation (mm):	0

Loss of column lateral support:	insignificant	*Note: Mesh does not count as ties*		How many columns affected?	
Shear cracks in columns:	none			How many columns affected?	

Damage posing lower risk (C)

Column Plastic Hinge damage - Criterion 1 met?	no damage	*Hinge damage criteria:*	Describe damage as per criterion 1	
Criterion 2 met?	no damage		Describe damage as per criterion 2	
Criterion 3 met?	no damage	1. *Total crack width in plastic hinge > 0.005d*	Describe damage as per criterion 3	
Criterion 4 met?	no damage		Describe damage as per criterion 4	
Location of critical column plastic hinge:	NA	2. *Sliding has occurred on a crack*		
Beam Plastic Hinge damage - Criterion 1 met?	no damage		Describe damage as per criterion 1	
Criterion 2 met?	no damage	3. *Wide (>0.5mm) diagonal cracks*	Describe damage as per criterion 2	
Criterion 3 met?	no damage		Describe damage as per criterion 3	
Criterion 4 met?	damage but criteria not met	4. *Concrete degradation, indicated by significant spalling (concrete cover can be removed by hand)*	Describe damage as per criterion 4	Occurred at the pinned beam locations
Location of critical beam plastic hinge:	NA			
Wall Plastic Hinge damage - Criterion 1 met?	no damage		Describe damage as per criterion 1	
Criterion 2 met?	no damage		Describe damage as per criterion 2	
Criterion 3 met?	no damage		Describe damage as per criterion 3	
Criterion 4 met?	no damage		Describe damage as per criterion 4	
Location of critical wall plastic hinge:	NA			
Web cracking of Hollowcore	none known		If cracked, how many units with damage:	
Longitudinal cracking of hollowcore	fully developed, with reinf in topping intact		If cracked, how many units with damage:	3
Mesh fracture	none observed			

Damage to other elements posing life-safety risk

Stairs	no significant damage	Describe damage:	Minor damage at the landing joints
Heavy cladding	no significant damage	Describe damage:	
Heavy overhead non-structural elements	not applicable	Describe damage:	

Building Closure

Was the building closed following the earthquake?	yes		
If yes, from when	14/11/2016	dd/mm/yyyy	
If yes, to when	17/11/2016	dd/mm/yyyy	
If yes, what was the reason(s)	Non-structural damage (including internal a	greatest priority	
(use all that apply, in priority order)	L1/L2 assessments		
(if "other", please specify in notes)			

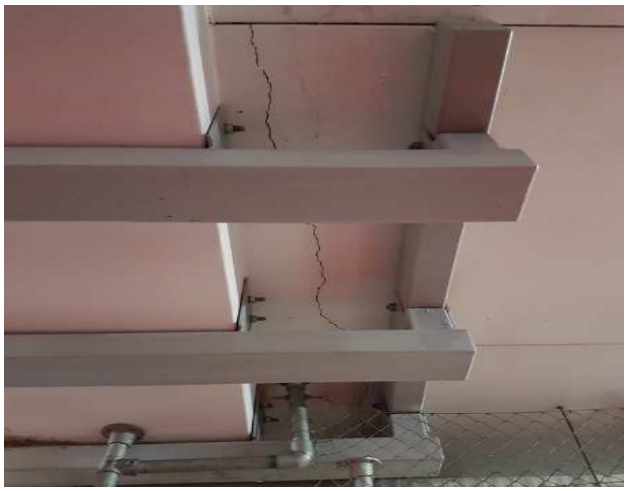
Recommendations

Repair/strengthening recommended:	significant structural	Describe:	Repair Hollow core panel at Ground Floor Level
Building Consent required:	unknown	Describe:	
Interim occupancy recommendations:	Continued normal occupancy	Describe:	Vacate the area above damaged Hollow core panel until propping is been provided
External barricading of public spaces recommended?	no	Describe:	

Official Use only:

Accepted By		Initial WCC review by:	
Date:		Further review by (or indicate Not Required):	

Appendix C
Photographs of Damage

ID.	Location & comments	Photographs
1.	Underside of Ground Floor Level Grid 3/B-C. Diagonal crack. This crack was existing as observed from a photo taken in 2013.	
2.	Underside of Ground Floor Level Grid 5/B-C. Longitudinal cracking in the direction of floor span. This crack was existing as observed from a photo taken in 2013.	
3.	Underside of Ground Floor Level Grid 6/C. Transverse cracking (perpendicular to the direction of floor span). Occurred following the earthquakes in 2013. Support brackets provided.	

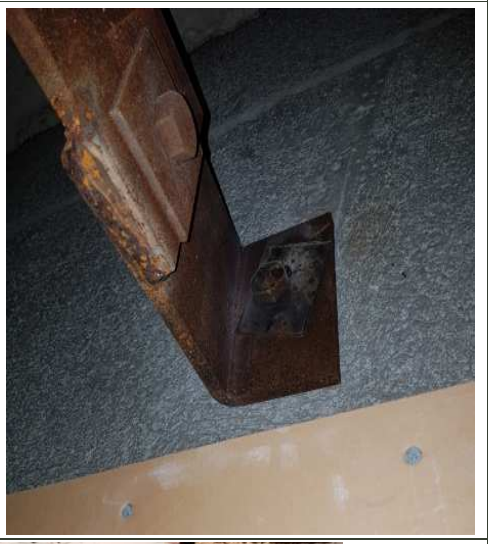
4.	Underside of Ground Floor Level Grid 9/B-C. Significant transverse cracking (perpendicular to the direction of floor span). Its width range between 1 and 2 mm. The panel needs to be repaired.	
5.	Underside of Ground Floor Level Grid 9/B-C. Significant transverse cracking (perpendicular to the direction of floor span). Its width range between 1 and 2 mm. The panel needs to be repaired.	
6.	Underside of Ground Floor Level Grid 9/B-C. Significant transverse cracking (perpendicular to the direction of floor span). Its width range between 1 and 2 mm. The panel needs to be repaired.	

7.	Underside of Ground Floor Level Grid 7/A-B. Transverse cracking (perpendicular to the direction of floor span). This crack was existing as observed from a photo taken in 2013.	
8.	Underside of Ground Floor Level Grid 8/F. Transverse cracking (perpendicular to the direction of floor span). This crack was existing as observed from a photo taken in 2013.	
9.	Underside of Ground Floor Level Grid 6/B. Diagonal cracking (perpendicular to the direction of floor span) adjacent to column. This crack was existing as observed from a photo taken in 2013.	

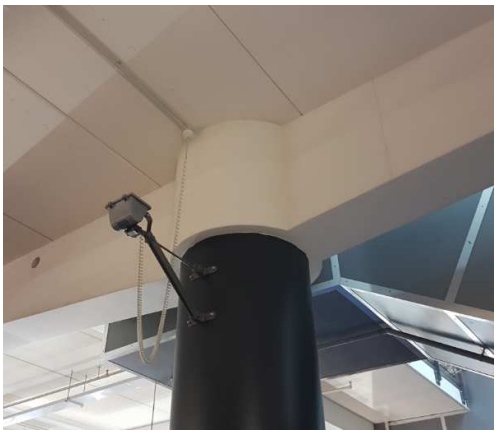
10.	Ground Floor cracking adjacent to column near Grid 11/A. Crack width on the levelling compound less than 0.5mm.	
11.	Second Floor cracking adjacent to column near Grid 11/A. Further investigations showed the crack to be only superficial.	
12.	First Floor cracking adjacent to column on Grid 12/E. Those cracks behind the beams are not structural. They define the area above the bottom precast cladding connections.	

13.	Ground Floor cracking adjacent to column on Grid 2/B.	
14.	No signs of cracking on Ground Floor adjacent to column on Grid 2/G	
15.	No signs of cracking on Ground Floor adjacent to column on Grid 4/E	

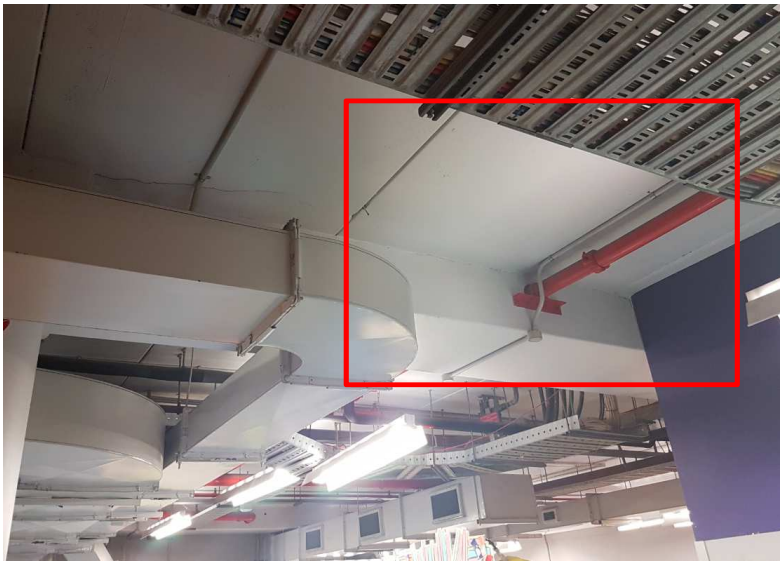
16.	Second floor cracking adjacent to column on Grid 10/D.	
17.	Fourth floor cracking on perimeter of building adjacent to precast panels Grid 2/C. Those cracks behind the beams are not structural. They define the area above the bottom precast cladding connections.	
18.	No signs of cracking to column on Grid 4/A on mezzanine level.	 

19.	No signs of earthquake damage to precast panels connections on fourth level Grid 2-3/C.	
20.	No signs of earthquake damage to precast panels connections on third level Grid 10-11/A.	 
21.	Extrusive investigation of third level slab at precast panel junction on Grid 11/A indicating no significant signs of earthquake damage.	

22.	Minor spalling to mezzanine level reinforced concrete beam on Grid 4/A.	
23.	No signs of recent earthquake damage to mezzanine level reinforced concrete beam on Grid 5/A.	
24.	No significant signs of earthquake damage to stair landing between third and fourth floor levels in south core stairwell.	 

25.	Gap opening of joint between stair units in Harris Street end stairwell.	
26.	No notable earthquake damage to ground floor columns and beams.	 
27.	Superficial crack to ground floor on Grid 4/E-F	

28.	Cracking to ground floor on Grid 6/F-G	
29.	Ground floor cracking near Grid 9/F. Crack width ~1.0mm. Steel bracket supports are provided below this crack following the 2013 earthquake.	
30.	Ground floor cracking on the top of the slab near Grid 9-10/B. Crack width ~0.6mm.	

31.	Ground floor panels near Grid 9-10/B. No crack observed in the area inside the red square.	

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