INDEPENDENT ASSESSMENT ON EARTHQUAKE PERFORMANCE
OF
32 Cathedral Square
The Press

FOR

Royal Commission of Inquiry into building failure caused by the Canterbury Earthquakes

Report prepared by Peter C Smith and Jonathan W Devine of

Spencer Holmes Ltd

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Introduction

This report has been commissioned by the Royal Commission of Inquiry into building failure caused by the Canterbury Earthquakes to review the performance of the Press Building at 32 Cathedral Square, Christchurch during the Canterbury earthquake sequence.

The report is based on documentation provided by the Royal Commission of Inquiry into building failure caused by the Canterbury Earthquakes. No inspection of the building was possible prior to the building being demolished.

Location of Building

The location of the building in the Christchurch CBD is shown on the aerial photograph of Christchurch and the direction of the epicentre of the 4th September, 2010 and 22nd February, 2011 earthquakes are shown on an aerial photo of the site included in Appendix 1.

Description of Building

The Press Building was constructed circa 1909. The building was a large rectangular building with four storeys and a basement. The basement partially extended above ground level. The west and south elevations faced the street and east and north sides abutted adjoining properties. A light well was constructed approximately midway along the eastern wall of the building.

The basement was constructed as a paper store. The printing operations were located in the northern portion of each floor with office and editorial departments located in the southern portion of each floor. Refer original plans included in Appendix 2. A full height internal un-reinforced masonry shear wall with openings, separated the two areas on all floors. The internal wall was located off centre; the office area being approximately half the size of the printing operational area on each floor.

The building was constructed with a steel skeleton consisting of cast iron columns supported on concrete foundation pads. These columns support steel girders and in-situ concrete floors. The buildings exterior walls were un-reinforced masonry with Oamaru stone applications to windows and other areas of its facade. The building was founded on strip footing foundations.

Gravity System

The gravity loads were carried by the steel skeleton frames and the perimeter unreinforced masonry walls. The floor construction consisted of 200mm thick mesh reinforced insitu concrete supported on concrete arch beams spaced at 1800 to 2400 mm crs in turn supported on steel beams. These beams were orientated in the transverse direction (east-west). Details are provided in Holmes Consulting Groups plans 105849 S1-01 to 06 recording heritage features of the building.

The basement walls were constructed of 800mm thick reinforced concrete. The thickness of the walls above ground floor level were typically:

Location	No of Wythes
Ground floor to first floor	6
First floor to second floor	5
Second floor to third floor	4
Third floor to roof	3

Actual thicknesses are recorded on the Holmes Consulting Group's plans in Appendix 3.

Seismic System

The building relied on the un-reinforced perimeter and internal unreinforced masonry walls for seismic resistance. The steel framing provided negligible seismic resistance. Due to the open street facades, the primary seismic resisting elements were the north, east and internal walls.

The in-situ reinforced concrete floors and roof provided stiff but brittle rigid diaphragms at each level of the building.

History of Alterations

The following is a brief history of the alterations and adjustments, that we are aware of, that have been made to the building during its life:

- In the late 1960's parapets and finials were removed as part of earthquake safety works. Some small areas were retained to the north-east portion of the building.
- In 1974 a building permit was approved for the installation of parapet supports. Support was provided with diagonal steel braces fixed into the concrete roof with dynabolts. These braces were connected to an RHS that was fixed to the back face of the parapet. Bolts to the RHS were drilled through the parapet and connected to a steel angle on the external face of the parapet.
- Various other works had been undertaken through the buildings history. These works were largely adjustments to office fit-outs, internal partitioning, fire safety upgrades and similar minor works.

There were no records of structural or seismic upgrades having been carried out through the life of the building.

Documentation was provided that established that the buildings owner, Ganellen, had engaged Holmes Consulting Group to investigate the building strength and to develop proposals for strengthening of the building in June, 2010. This work was incomplete at the date of the 22nd February, 2011 earthquake.

Compliance

The building was constructed for The Press in 1907. In 1976 the basement was converted from use as a paper store into a car park. All other alterations appear to relate to internal fitout.

A review of the Christchurch City Council records indicates that the building complied with the requirements of the Building Act 1991 due to the building pre-existing the Building Act and no alterations or change of use occurring since the introduction of the Building Act

Christchurch City Council Policy on Earthquake Prone Buildings

We understand that the Christchurch City Council applied for and was granted powers under section 301A of the Municipal Corporation Act and the Christchurch City Council adopted a generally passive approach to the upgrading of earthquake risk buildings.

There are no records of any Seismic Risk Building -Survey or Hazardous Appendage Survey having been undertaken by the Christchurch City Council.

The Christchurch City Council's first policy in respect to earthquake prone buildings was introduced in 2006.

This policy was reviewed in 2010.

Events subsequent to 4th September, 2010 Earthquake

The building suffered damage as a result of the 4th September, 2010 Darfield earthquake.

A Rapid Assessment-Level 1 was undertaken on behalf of the Christchurch City Council on 5th September, 2010. This recorded signs of cracking on west wall arches and south wall columns.

Another Rapid Assessment-Level 1 was undertaken on the same day that recorded that the building was "generally fine, no issue, superficial cracking of window broken". Both rapid assessments assigned green placards. Both assessments estimated that the overall building damage was less than 1%. A Rapid Assessment-Level 2 was undertaken the following day on the turret. This recorded that one masonry wall was cracked and that the turret balustrade was loose off fixings. This assessment recommended a detailed structural engineering evaluation.

Representatives of Lewis Bradford inspected the building on the 9th September, 2010 identifying a number of areas of superficial damage along with minor cracking to structural elements. Due to a lack of access to view some critical structural elements and time constraints, the building was deemed not fit to occupy.

Representatives of Lewis Bradford visited the site again on the 14th September, 2010 after some opening up had been undertaken. Lewis Bradford required some securing of the stone parapet above the main entry prior to occupation of the building. The assessment also recommended inspection of all existing stone to perimeter frames and a new concrete shear wall in the north-west corner of the building. It was noted that the second and third floors in this area would need to be cordoned off until this work was completed. The securing works to the stone parapet over the entry area was completed and the building was deemed fit to occupy by Lewis Bradford on the 20th September, 2010.

A structural integrity assessment was undertaken of the building by Harrison Grierson on 15th September, 2010. This assessment identified that the north end of of the east wall to the upper level had diagonal cracks present and some loose bricks. The west end of the north level 3 (top storey) wall also had large cracks in the wall. The report refers to emergency strengthening having been applied to the wall and that the wall had been sufficiently stabilised until permanent

remedial works were designed and constructed. The report recommended that this corner of the building to the top two floors was not occupied and access should be limited to essential personnel.

Other damage noted was localised aesthetic damage such as minor stress cracks in walls, external stonework and window surrounds. The report concluded that the building was structurally sound and safe to occupy.

Lewis Bradford provided a report titled "Structural Evaluation and Hazard Assessment Report Following 4/9/10 Earthquake." The report identified the main areas of damage as the north-west brick wall at level 3, the north-east brick wall at level 3 and the stonework and minor brick areas to the south and west perimeter frames.

Lewis Bradford recommended that the two areas of damaged brickwork should be structurally strengthened to replace the lost strength, but also enhance the overall structural strength up to recommended levels. Lewis Bradford anticipated new structural walls of reinforced concrete to be constructed on the interior face of the existing brickwork.

Christchurch City Council record that at a meeting on the 16th September, 2010 attended by John Higgins, Neil Carrie, Kate Agnew and Michael Doig to review internal damage to heritage building, Kate Agnew and Neil Carrie were satisfied that replacement of broken glass, repair and painting of internal cracking, providing no structural elements involved, could be undertaken without the need for a resource consent. The applicant was to provide a report to confirm that cracking was only superficial.

Lewis Bradford advise that their engagement ended on the 1st November 2010. It appears that no progress on the installation of the reinforced concrete shear walls had been made prior to the termination of Lewis Bradford's engagement.

The building suffered some further damage during the 26th December 2010 earthquake.

A Rapid Assessment-Level 1 was undertaken on behalf of the Christchurch City Council on 26th December, 2010. This assessment identified moderate and severe hazards within the building, particularly cracking of brick work, including south façade, and a risk of failure of neighbouring parapet on the east side.

The Christchurch City Council wrote to the building owners on 29th December, 2010 advising that the building had been identified as having been damaged in the Boxing Day earthquake and was considered dangerous. The Christchurch City Council issued a Section 124 (1) (c) notice under the Building Act 2002 on 29 December, 2010.

Holmes Consulting Group undertook an inspection of the building on 12th January, 2011.

The assessment identified the following damage following the 26th December 2010 earthquake:

South Wall
Several piers were severely damaged

West Wall
Extensive cracking evident on façade. Some evidence of settlement towards the centre of the wall adjacent to the dividing wall between the two portions of the building.

North Wall
Third floor, north-west columns severely damaged in 4th September, 2010 quake. The two piers in the north-east corner were significantly damaged in the Boxing Day quake. The need for strengthening and added stiffness to be provided to the 3rd floor was identified.

East Wall
Significant damage to piers of the north section of the wall at the third floor and adjacent returns of the light well.

Central East West Wall (Including Central Stairwell)
Walls had suffered extensive damage from Boxing Day event resulting in lateral movement at and above third floor.

Roof Level
Damage to the tower in the south west corner. Damage to parapets mostly along the north and east facades. Need for upgrading of the parapet restraint and strengthening of the tower was identified.

In a letter to the Christchurch City Council of 12th January, 2011 Holmes Consulting Group advised "that where the structural integrity of the building had been materially affected, interim securing measures had been taken to restore the structural integrity of the performance of the building to at least a condition that existed prior to the earthquake of 26th December, 2010. Also, that all potentially dangerous features adjacent to or near by buildings had been identified".

In Holmes Consulting Group's memorandum of the 3rd March, 2011, Holmes Consulting Group advised that a full assessment of the building in its pre-4th September, 2010 earthquake condition was approximately 40 to 45% of full code in the east-west direction and 50% of full code in the north- south direction. In the same memorandum, Holmes Consulting Group advised that the building's residual strength following the 4th September, 2010 and 26th December, 2010 earthquakes was less than 33% FCL. In the memorandum Holmes Consulting Group set out proposed repair and reinstatement work.

A very detailed record of cracking present in the building was prepared by Baker Cavanagh Architects in January, 2011.

The building was severely damaged during the severe shaking that occurred during the 22nd February, 2011 earthquake. A Rapid Assessment-Level 1 was undertaken on the building on 28th February, 2011. This Level 1 assessment identified the collapse of the upper storey, the need for urgent removal of parapets and the need for barricading to protect pedestrians. The building was given a red placard.

Holmes Consulting Group advised in their report of 3rd March, 2011 that in their opinion the building was irretrievably damaged. Refer photos in Appendix 3.

Structural Failure

The earthquake of 22nd February, 2011 tragically resulted in significant collapse of the roof and structure above level 3. The Police Operation Earthquake photos indicate that failure of the roof diaphragm over the internal wall allowed the northern portion of the roof to translated in a north-

easterly direction, rotating about the junction of the internal un-reinforced masonry wall and the east wall. As the northern portion of the roof translated, the northern portion of the roof failed at several of the supporting beam lines. Refer photos in Appendix 4. The internal un-reinforced masonry wall appears to have failed in a northerly out of plane direction. The southern portion of the roof translated in a south-easterly direction. The majority of the roof slab came to rest on the level 3 slab. Portions of the external walls above level 3 and of the roof slab that was left projecting beyond the level 3 slab fell to the ground. The turret was severely damaged.

The code lateral load coefficient for the roof for an elastic responding four storey structure in Christchurch at the time of the earthquake sequence was 1.48g. Based on GNS Science records of measurements of accelerations in the Christchurch CBD during the 22nd February, 2011 earthquake, the building was likely to have been subjected to a ground acceleration of 0.9g. This level of ground acceleration equates to an acceleration of 2.0g at roof level. On the basis of Holmes Consulting Group's strength assessment of the building in the pre 4th September, 2010 earthquake the building had a lateral load capacity approaching 0.7g. The above figures demonstrate that the roof could not have survived the 22nd February 2011 earthquake had the walls been in an undamaged condition.

It is also possible that the earthquake shaking may have been accentuated by pounding with the adjacent building to the east and by the effects of vertical acceleration. Photos of the adjoining building along the east wall included in Appendix 4 indicate that pounding may have occurred.

We are of the opinion that even if the walls had not been damaged under the 4th September, 2010 and 26th December, 2010 earthquakes, the collapse would have occurred under the severity of shaking that occurred during the 22nd February, 2011 earthquake.

Issues Arising from Review

Occupancy of earthquake damaged buildings

In their letter to the building owner 16th September, 2010, Lewis Bradford assessed the building as safe to occupy once the temporary securing works to the stone parapet above the main entry had been undertaken. In their letter to the building owner, Lewis Bradford had identified damage to existing stone to perimeter frames and recommended inspection and review as soon as possible to ensure that there were no loose stones affecting long term public safety. Lewis Bradford also identified that a new shear wall was required in the north-west corner of the building commenting that " This area is to be cordoned off to the second and third floors locally using hoardings to allow walls to be constructed) in the next two-three weeks."

Lewis Bradford confirmed that the building was fit for occupation on the 20th September, 2010.

Harrison Grierson inspected the building on the 15th September, 2010 and concluded "the building is structurally sound and safe to occupy. (Other than the north end of level 3.)"

The building suffered further damage as a result of the 26th December, 2010 earthquake. On the 12th January, 2011, Holmes Consulting Group advised that interim securing measures had been taken to restore the structural integrity to at least a condition that existed prior to the earthquake of 26th December, 2010. On the basis of the above assessments, the Christchurch City Council allowed access into the building and removing the cordons.

In Holmes Consulting Group's memorandum of the 3rd March, 2011, Holmes Consulting Group advised that a full assessment of the building in its pre-4th September, 2010 earthquake condition

was approximately 40 to 45% of full code in the east-west direction and 50% of full code in the north-south direction. In the same memorandum, Holmes Consulting Group advised that the building's residual strength, following the 4th September, 2010 and 26th December, 2010 earthquakes, was less than 33% FCL. In the memorandum Holmes Consulting Group set out proposed repair and reinstatement work.

It is evident that a number of engineers inspected the building after the 4th September, 2010 earthquake and considered that the building had sufficient reserve strength to withstand any expected aftershock. The building did withstand the 26th December aftershock without other than further minor damage.

Clearly there was a level of earthquake that would exceed the buildings strength, assessed by Holmes Consulting Group as less than 33% FCL following the 26th December, 2010 earthquake. The intensity of shaking experienced in the 22nd February, 2011 earthquake significantly exceeded this level of resistance. We are satisfied that the upper floor of the building would not have withstood the intensity of shaking experienced on the 22nd February, 2011 if the building had not been damaged by the previous earthquakes.

Earthquakes are infrequent events and engineers receive no training in the assessment of earthquake damaged un-reinforced masonry buildings. Further, the rapid assessment process is primarily focussed on addressing damage to buildings. It is suggested that after a significant earthquake, the controlling authority should establish minimum strength criteria and require an engineering assessment establishing that the building achieves the minimum strength requirement prior to occupancy of an un-reinforced masonry building or public access within the fall zone of the building. It is also suggested that engineers receive professional CPD training on the assessment of earthquake damaged buildings.

Delay in installation of level 3 shear wall

Following the 4th September, 2010, Lewis Bradford deemed the building fit to occupy on the basis that a new shear wall would be constructed in the north-west corner of the building within the next 2 to 3 weeks.

Holmes Consulting Group coordinated securing work after the 26th December, 2010 earthquake and reported that interim securing work had been completed by the 12th January, 2011, restoring the structural integrity to at least that existing prior to 26th December, 2010. In Holmes Consulting Groups memorandum of 3rd Feoruary, 2011 Holmes Consulting group commented under north wall that "A 150mm concrete skin is propose, as the south wall"

There are no records that indicate why the construction of the shear wall recommended by Lewis Bradford, and subsequently re-affirmed by Holmes Consulting Group was not constructed in the almost 6 month period between the 4th September, 2010 earthquake and the 22nd February, 2011 earthquake.

Upgrading of un-reinforced masonry buildings

The damage that occurred to the building in the 22nd February, 2011 earthquake demonstrates the risk that un-reinforced masonry buildings pose to the occupiers of the building and people in the vicinity of the building at the time of such an event. Tragically the earthquake series has highlighted the danger to the public of these unreinforced masonry buildings.

The Building Act provides two opportunities for the structural upgrading of buildings. These opportunities are:

- upon a change of use
- implementation and enforcement of an earthquake prone building policy

Improved public safety in a significant earthquake relies on territorial authorities adopting and implementing a meaningful programme for strengthening and upgrading of un-reinforced masonry buildings and enforcing the provisions for structural upgrading when a building is subject to a change of use.

The delay in the Christchurch City Council implementing a policy on earthquake prone buildings may or may not have contributed to the damage which occurred as a result of the severe 22nd February, 2011 earthquake. However, for a special use building which is unlikely to have a change of use, the earthquake prone policy of the territorial authority is one of a few catalysts to initiate upgrading of an un-reinforced masonry building in the interests of public safety.

Undoubtedly the Christchurch City Council's attitude to earthquake risk buildings was influenced by the widely held perception that Christchurch was a low seismic hazard zone.

New Zealand is a seismically active country with many un-reinforced masonry and other low seismic strength buildings in cities and rural communities. It is suggested that these communities address the risk that un-reinforced masonry buildings pose in the event of a moderate to severe earthquake if the tragic loss of life that occurred in Christchurch is not to occur in a future event.

Structural Form

The less than desirable structural form of the building is noted.

While reasonably robust structural elements are provided in each of the longitudinal and transverse directions, the building has low resistances to torsional effects. The damage that occurred to the walls at the northern end of the building in the 4th September, 2010 and 26th December, 2010 earthquakes would appear to have compromised the strength of these elements.

It is suggested that increased redundancy should be a requirement for strengthening of un-reinforced masonry buildings, particularly in the upper levels where the effects of vertical acceleration may be significant.

Vertical Acceleration Effects

It is suggested that consideration be given to requiring vertical acceleration effects to be considered in the upper levels of un-reinforced masonry buildings.

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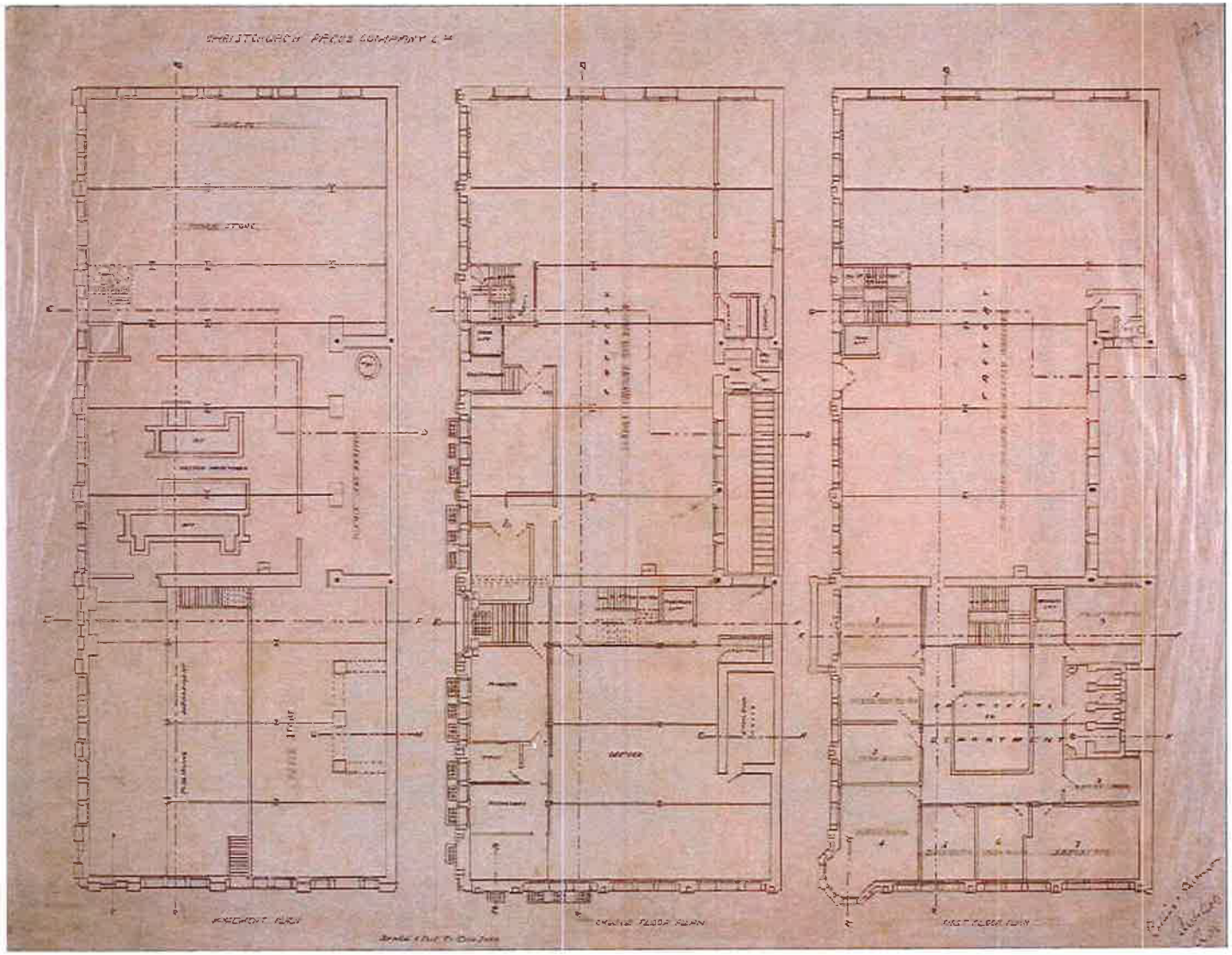
APPENDIX 1:
Site Plans

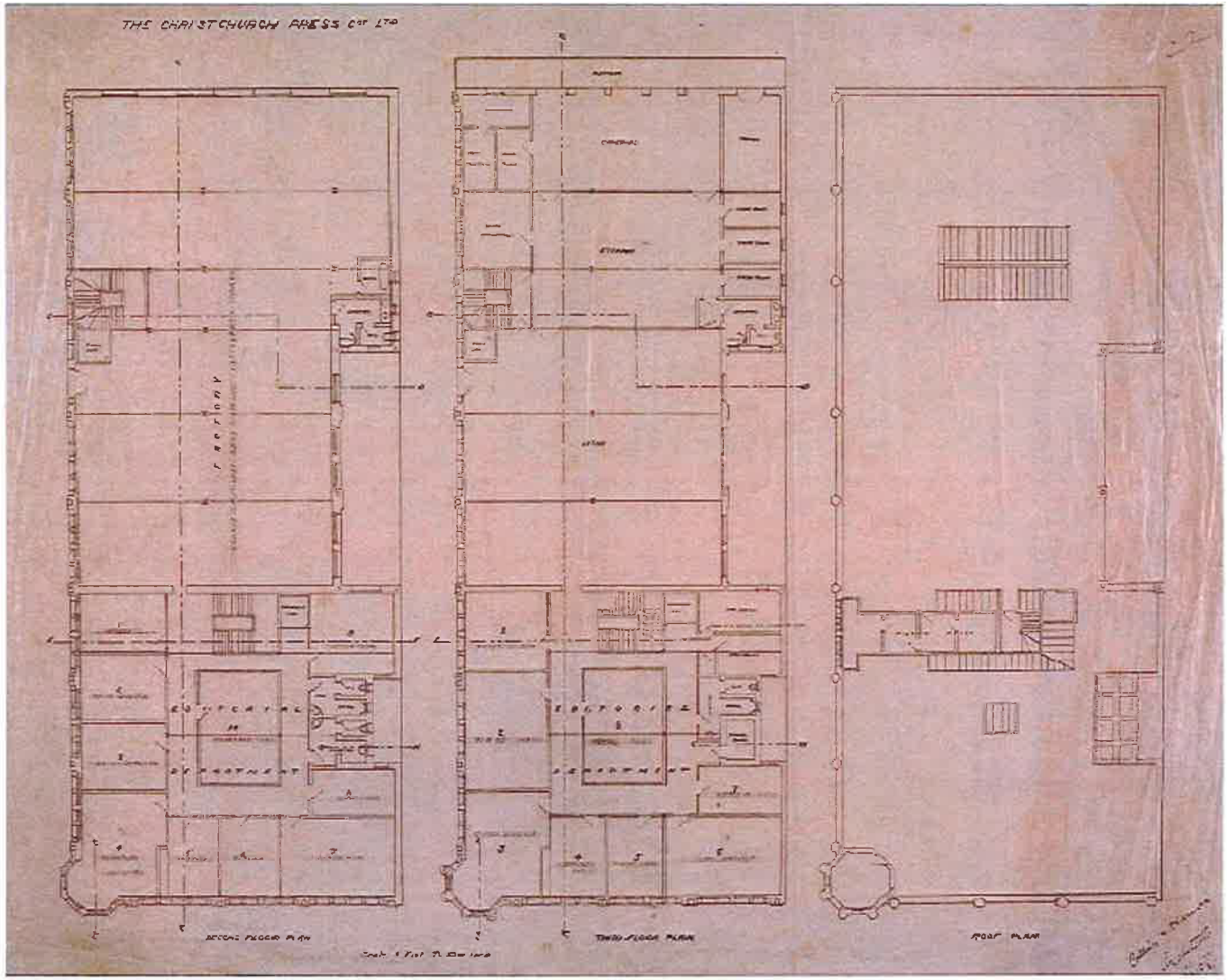

Gloucester St
NORTH
Colombo Ln
Manchester St
Worcester St
Cbb Ln
Tramway Ln
Westpac Ln
Cathedral Square

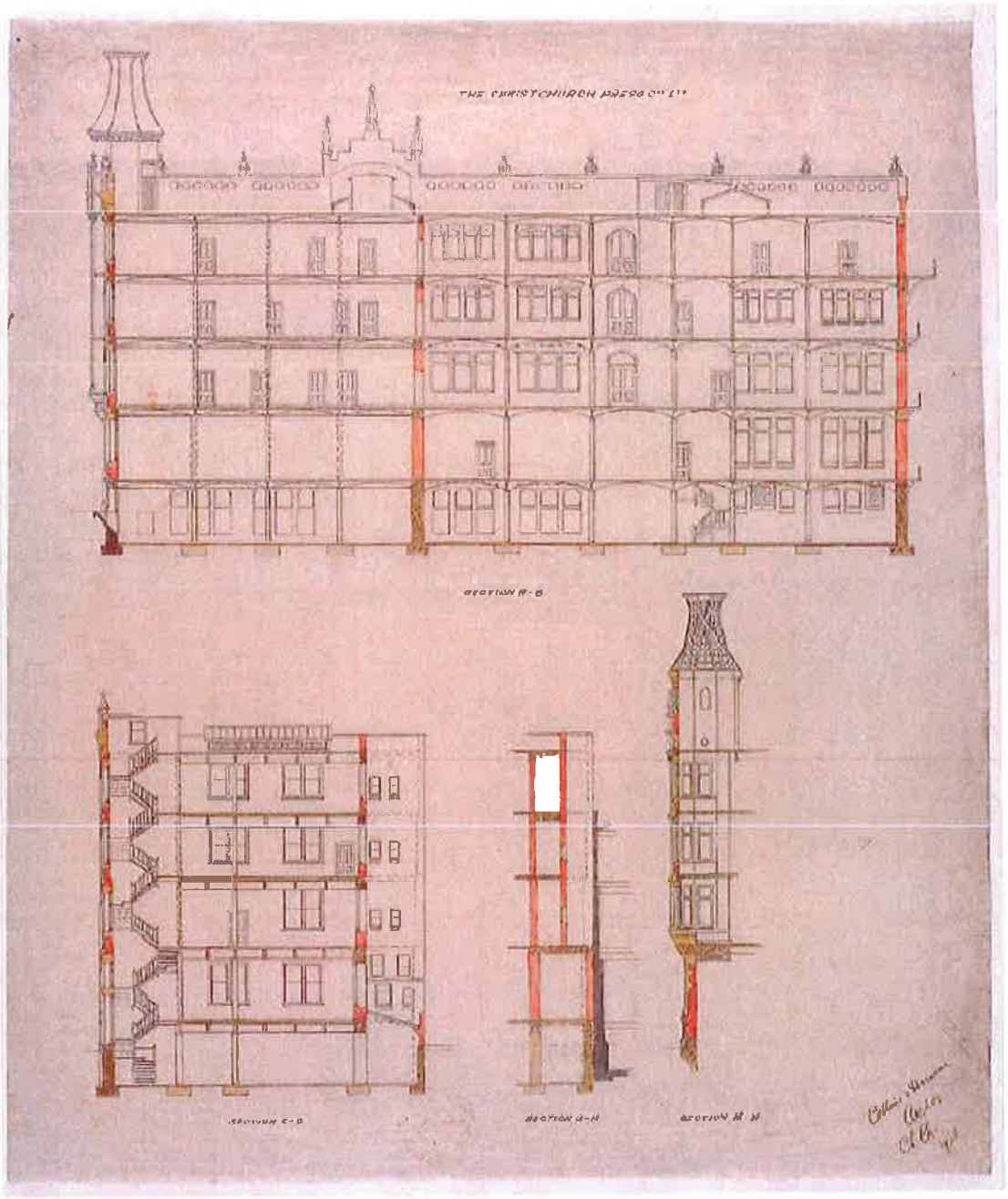

Armagh St
Gloucester St
Worcester St
Cathedral Square
Hereford St
Manchester St
Oxford Tce
Colombo St
Liverpool St
Google

APPENDIX 2:

Plans and sections of Press Building-at 32 Cathedral Square

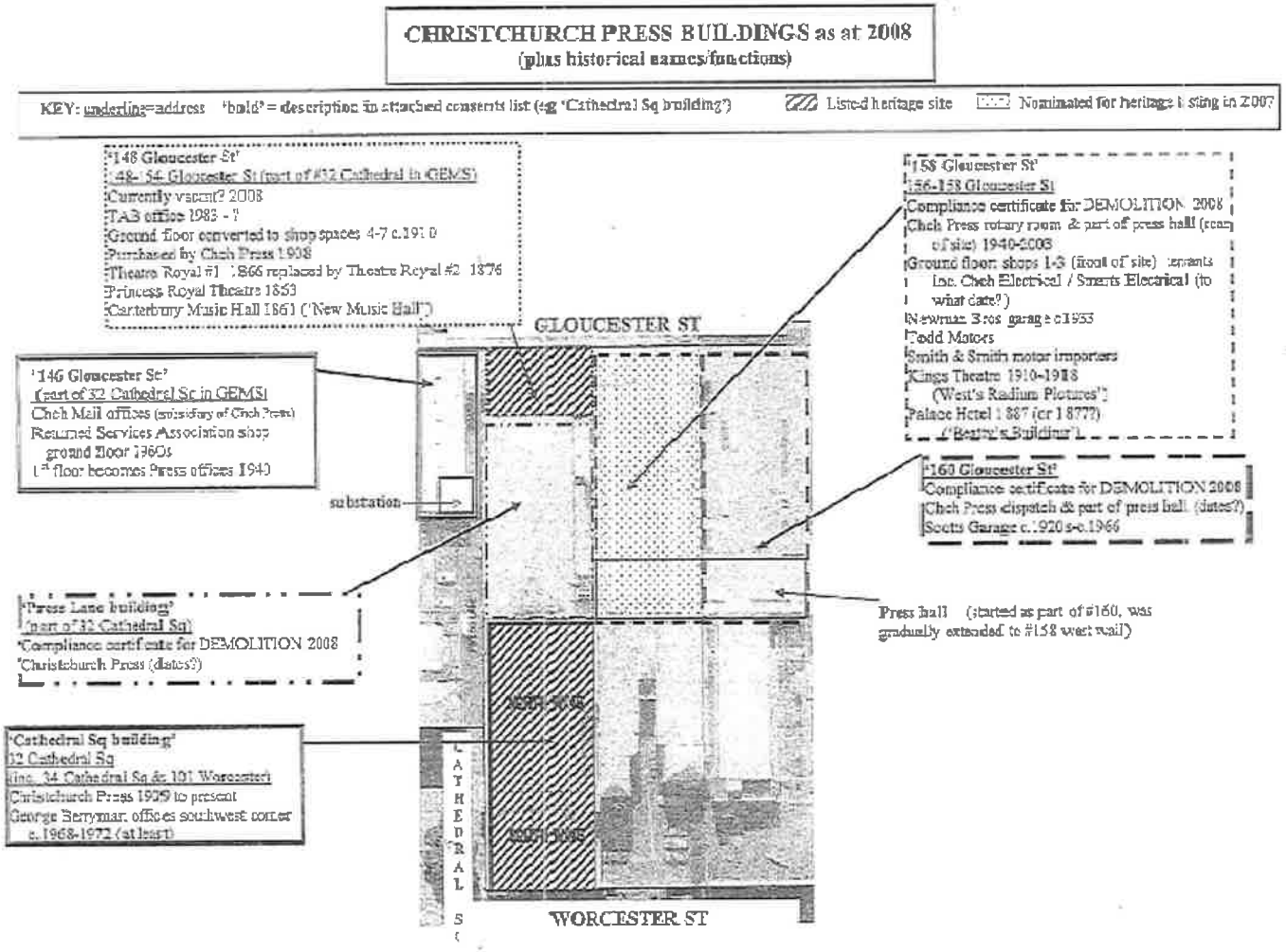






APPENDIX 3:

Holmes Consulting Group
- Plans recording original construction


CHRISTCHURCH PRESS BUILDINGS as at 2008
(plus historical names/functions)
KEY: underling=address 'bold' = description in attached consents list (eg 'Cathedral Sq building') Listed heritage site Nominated for heritage listing in 2007
'146 Gloucester St'
148-154 Gloucester St (part of #32 Cathedral in GEMS)
Currently vacant? 2008
TAB office 1983 - ?
Ground floor converted to shop spaces 4-7 c.1910
Purchased by Chch Press 1908
Theatre Royal #1 1866 replaced by Theatre Royal #2 1876
Princess Royal Theatre 1853
Canterbury Music Hall 1861 ('New Music Hall')
'158 Gloucester St'
156-158 Gloucester St
Compliance certificate for DEMOLITION 2008
Chch Press rotary room & part off press hall (rear of site) 1940-2008
Ground floor shops 1-3 (front of site) tenants Inc. Chch Electrical / Smarts Electrical (to what date?)
Newman Bros garage c1933
Todd Motors
Smith & Smith motor importers
Kings Theatre 1910-1918
('West's Radium Pictures')
Palace Hotel 1887 (cr 1877)
('Beattie's Building')
GLOUCESTER ST
'146 Gloucester St'
(part of 32 Cathedral Sq in GEMS)
Chch Mail offices (subsidiary of Chch Press)
Returned Services Association shop ground floor 1960s
1st floor becomes Press offices 1940
substation
'160 Gloucester St'
Compliance certificate for DEMOLITION 2008
Chch Press dispatch & part of press hall (dates?)
Scotts Garage c.1920 s-c.1966
'Press Lane building'
(part of 32 Cathedral Sq)
'Compliance certificate for DEMOLITION 2008
'Christchurch Press (dates?)
Press hall (started as part of #160, was gradually extended to #158 west wall)
'Cathedral Sq building'
32 Cathedral Sq
(inc. 34 Cathedral Sq & 101 Worcester)
Christchurch Press 1909 to present
George Berryman offices southwest corner c.1968-1972 (at least)
CATHEDRAL S
WORCESTER ST

CHRISTCHURCH PRESS CO. BUILDINGS
(32 CATHEDRAL SQ & RELATED ADJACENT SITES)

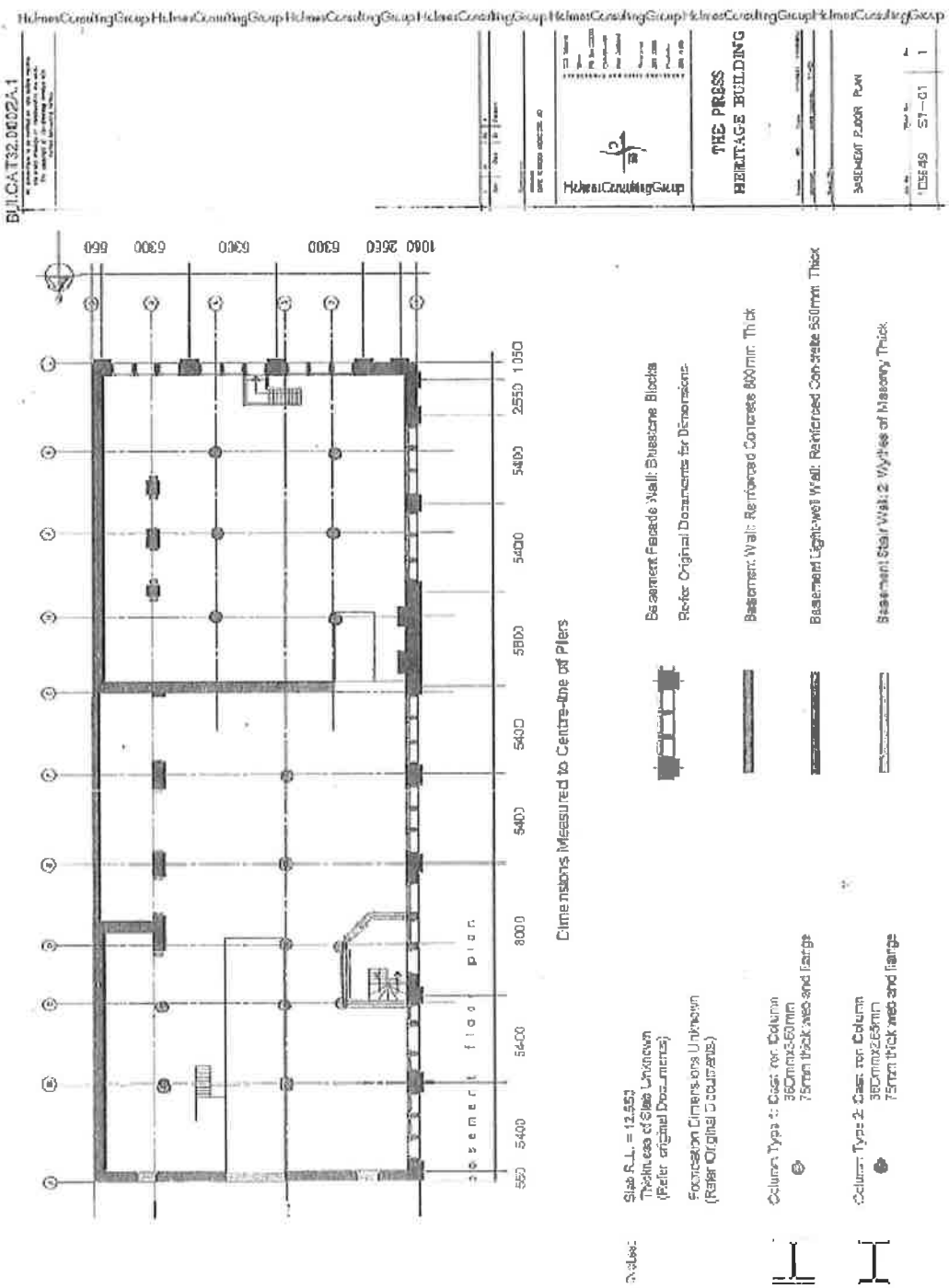
Rough site history to 2008
(with ground plans)
AND
List of building/resource consents issued 1940 to 2008
(attached)

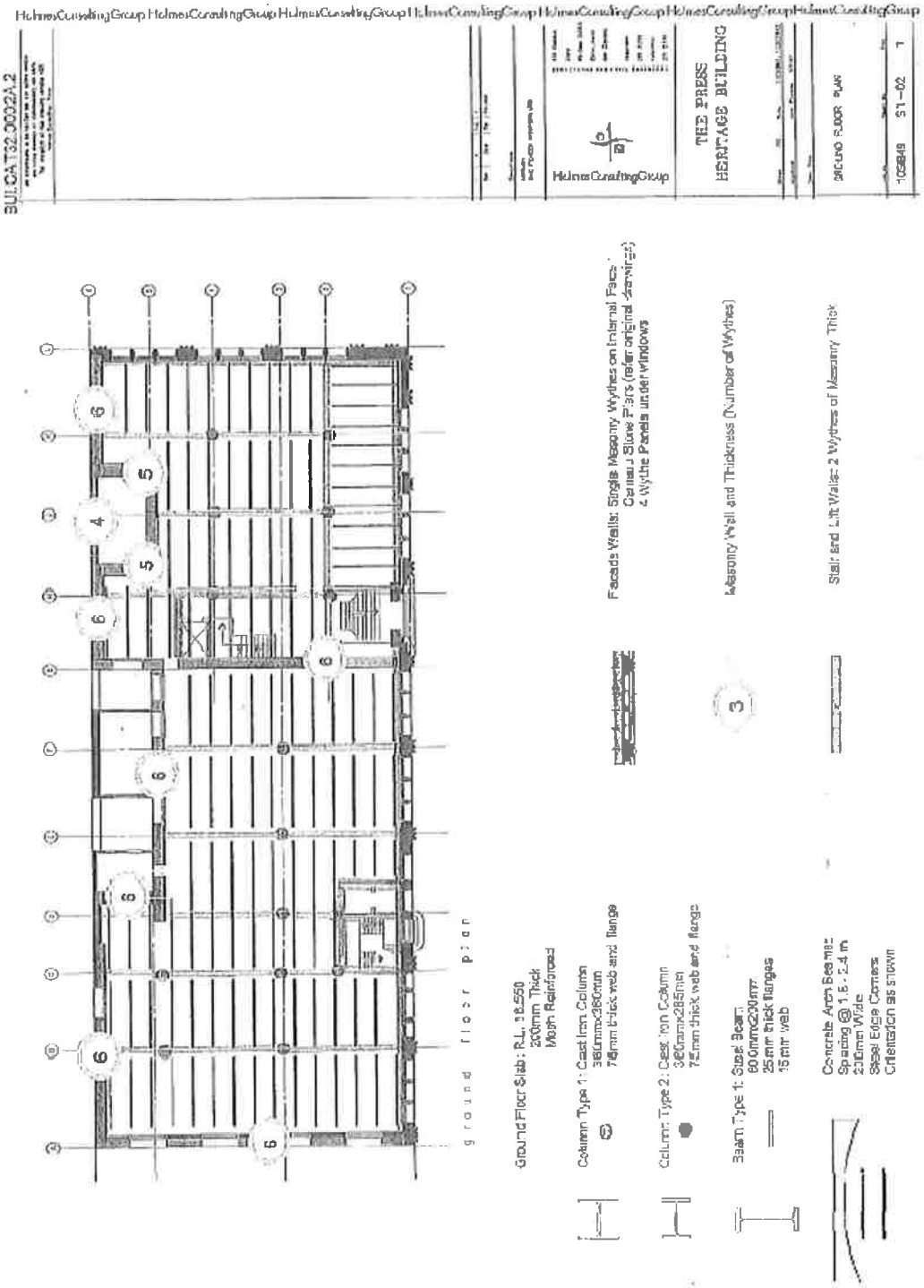
Alternate addresses amalgamated into 32 Cathedral St:
34 Cathedral Square / 101 Worcester St / 146 Gloucester St
148-154 Gloucester St (old Theatre Royal)
Related addresses stored separately (were other Chch Press buildings):
156-158 Gloucester St (old Palace Hotel/Kings Theatre)
160 Gloucester St (old Scotts Garage)

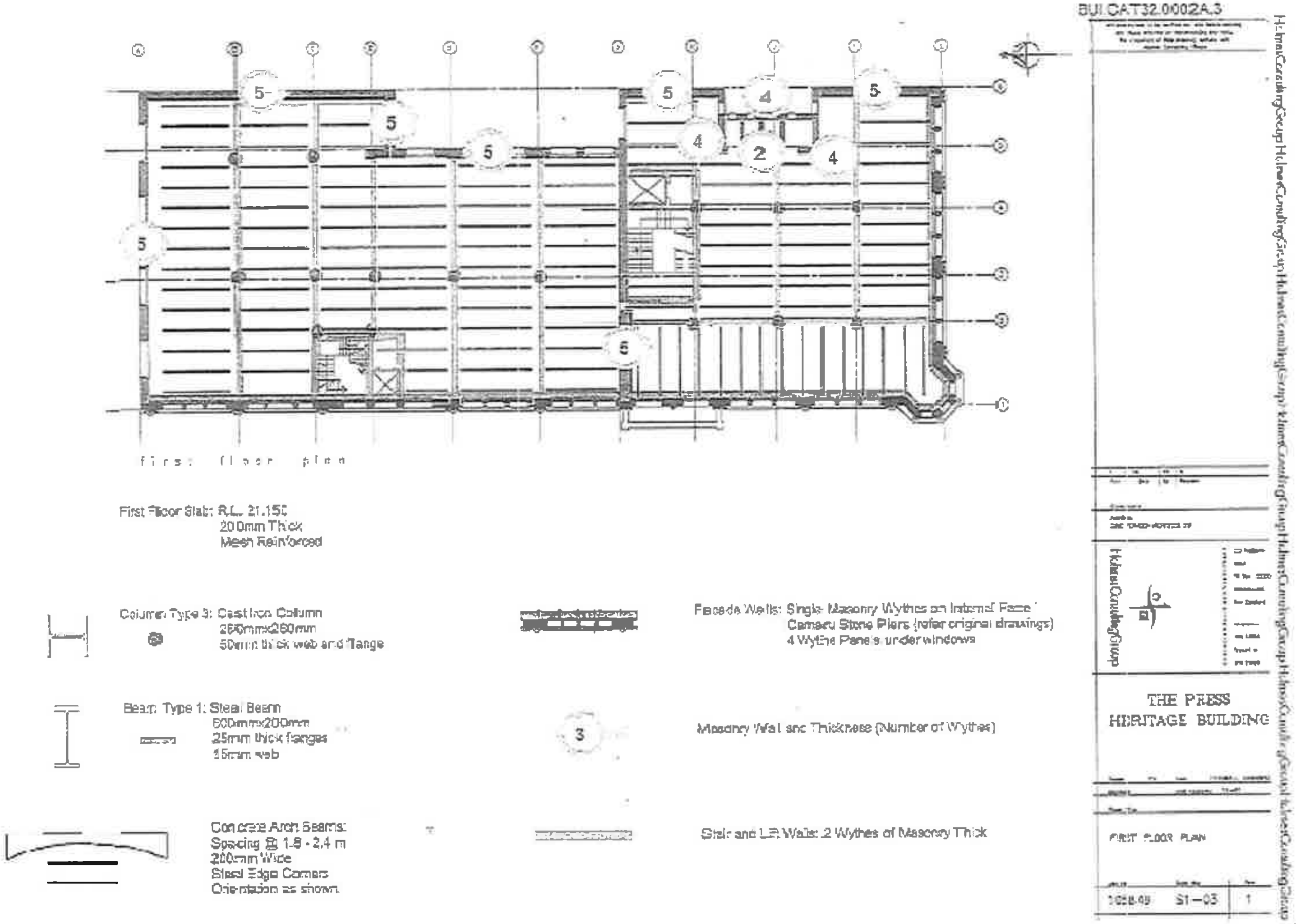
Old addresses:
The outsides of several Chch Press Building plans have been labelled "22 Cathedral Sq", "50 Cathedral Sq" etc at some time in the past but these addresses don't correspond at *all* to current Cathedral Sq numbering & appear to be either errors, or related to a (superseded) past system of addresses around the Square.

As at Mar 2008 the Press buildings are listed in GEMS as follows:
158 Gloucester (old heritage Kings Theatre/Palace Hotel) & 160 Gloucester (old Scotts Garage) both exist as separate addresses.
Consents for 146 Gloucester (old RSA), 148-154 Gloucester (old Theatre Royal heritage building) & 30-34 Cathedral (the heritage Press Building on Cathedral Sq and the non-heritage Press Lane building) are *all* grouped in GEMS under "32 Cathedral Sq". I have included more precise building locations in the full consents list.

A compliance certificate has been issued Jan 08 for demolition of the Press Lane building and 146, 158 & 160 Gloucester St.
32 Cathedral Sq (the Press Building) and 148 Gloucester St (old Theatre Royal) are to remain.
Currently unknown which address/es will be assigned to the cleared site/s.



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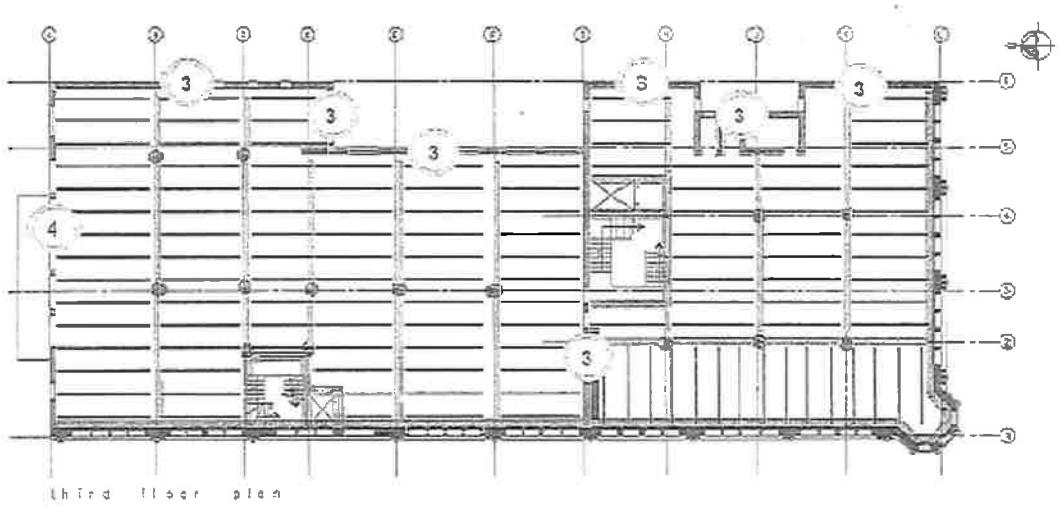
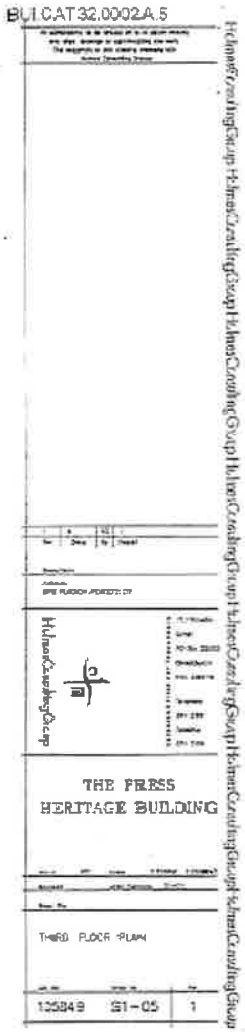
5
4
2
6
first floor plan
First Floor Slab: R.L. 21.150
200mm Thick
Mesh Reinforced
Column Type 3: Cast Iron Column
250mmx250mm
50mm thick web and flange
Beam Type 1: Steel Beam
600mmx200mm
25mm thick flanges
15mm web
Concrete Arch Beams:
Spacing @ 1.8 - 2.4 m
200mm Wide
Steel Edge Corners
Orientation as shown
Facade Walls: Single Masonry Wythes on Internal Face
Cameru Stone Piers (refer original drawings)
4 Wythe Panels under windows
3
Masonry Wall and Thickness (Number of Wythes)
Stair and LR Walls: 2 Wythes of Masonry Thick
THE PRESS
HERITAGE BUILDING
FIRST FLOOR PLAN
S1-03
1


third floor plan
Third Floor Slab: R.L. 29.400
200mm Thick
Mesh Reinforced
Column Type 4: Cast Iron Column
765 mm x 155mm
35mm thick web and flange
Beam Type 1: Steel Beam
300mm x 200mm
25mm thick flanges
15mm web
Concrete Arch Beams:
Spacing @ 1.8 - 2.4 m
200mm Wide
Steel Edge Corners
Orientation as shown
Facade Walls: Single Masonry Wythes on Internal Face
Cement Stone Piers (refer original drawings)
3 Wythe Panels under windows
3
Masonry Wall and Thickness (Number of Wythes)
Stair and Lift Walls: 2 Wythes of Masonry Thick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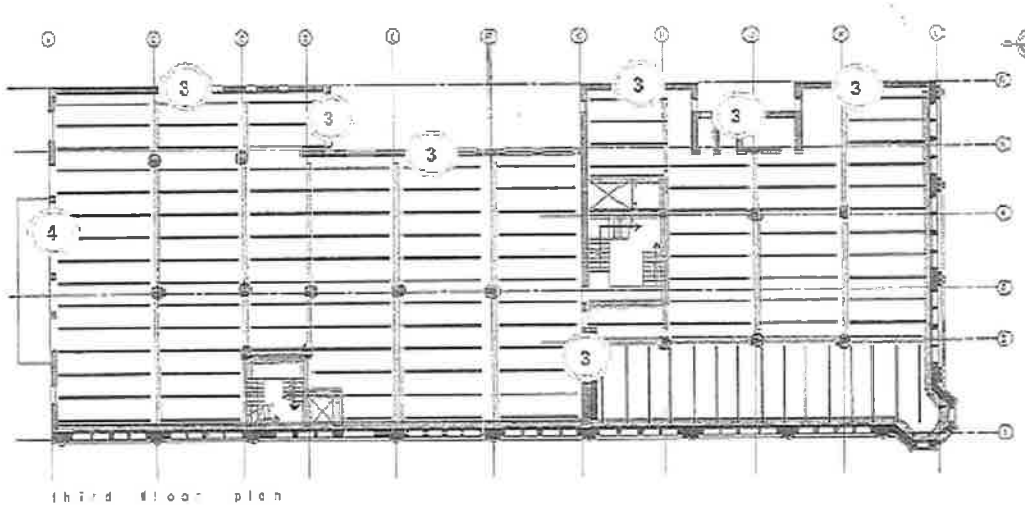
THE PRESS
HERITAGE BUILDING
THIRD FLOOR PLAN
135849
S1-05
1



Third Floor Slab: R _ 29 400
200mm Thick
Mesh Reinforced

Column Type 4: Cast Iron Column
185mmx185mm
35mm thick web and flange

Beam Type 1: Steel Beam
600mmx230mm
25mm thick flanges
15mm web

Concrete Arch Beams:
Spacing @ 1.8 - 2.4 m
200mm Wide
Steel Edge Corners
Orientation as shown

Facade Walls: Single Masonry Wythes on Interna Faces
Oamaru Stone Piers (refer original drawings)
3 Wythe Panels under windows

3 Masonry Wall and Thickness (Number of Wythes)

Stair and Lift Walls: 2 Wythes of Masonry Thick

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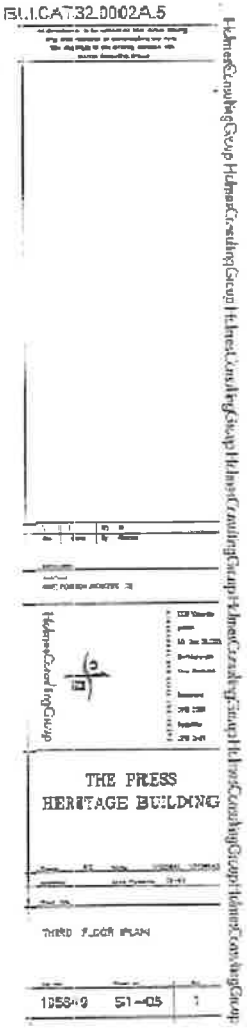

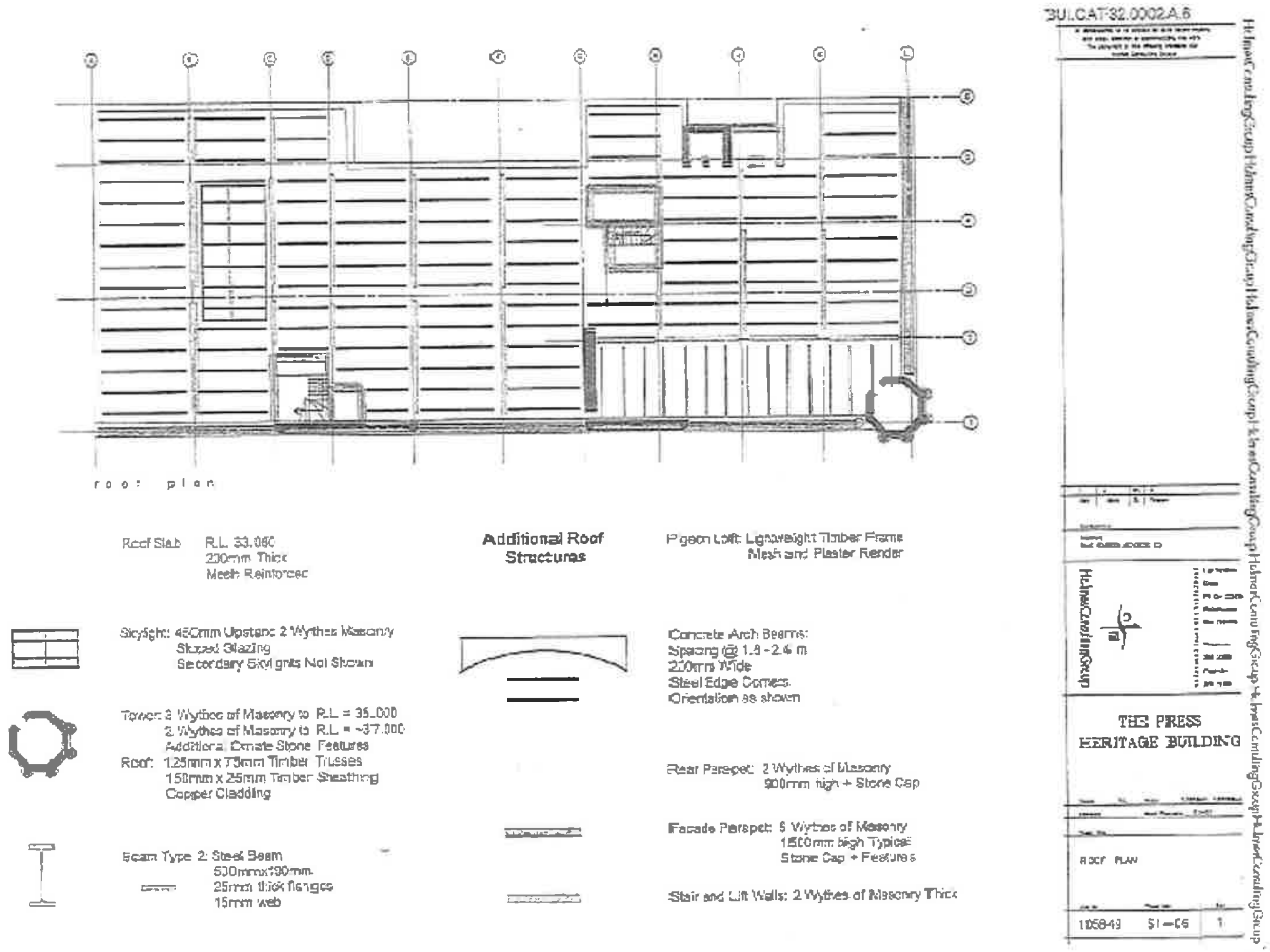
roof plan
Roof Slab R.L. 33.060
200mm Thick
Mesh Reinforced
Additional Roof Structures
Pigeon Loft: Lightweight Timber Frame
Mesh and Plaster Render
Skylight: 450mm Upstand 2 Wythes Masonry
Sloped Glazing
Secondary Skylights Not Shown
Concrete Arch Beams:
Spacing @ 1.8 - 2.6 m
200mm Wide
Steel Edge Corners
Orientation as shown
Tower: 3 Wythes of Masonry to R.L. = 35.000
2 Wythes of Masonry to R.L. = 37.000
Additional Ornate Stone Features
Roof: 125mm x 75mm Timber Trusses
150mm x 25mm Timber Sheathing
Copper Cladding
Rear Parapet: 2 Wythes of Masonry
900mm high + Stone Cap
Facade Parapet: 5 Wythes of Masonry
1500mm high Typical
Stone Cap + Features
Beam Type 2: Steel Beam
500mm x 190mm
25mm thick flanges
15mm web
Stair and Lift Walls: 2 Wythes of Masonry Thick
BUI.CAT32.0002A.6
THE PRESS
HERITAGE BUILDING
ROOF PLAN
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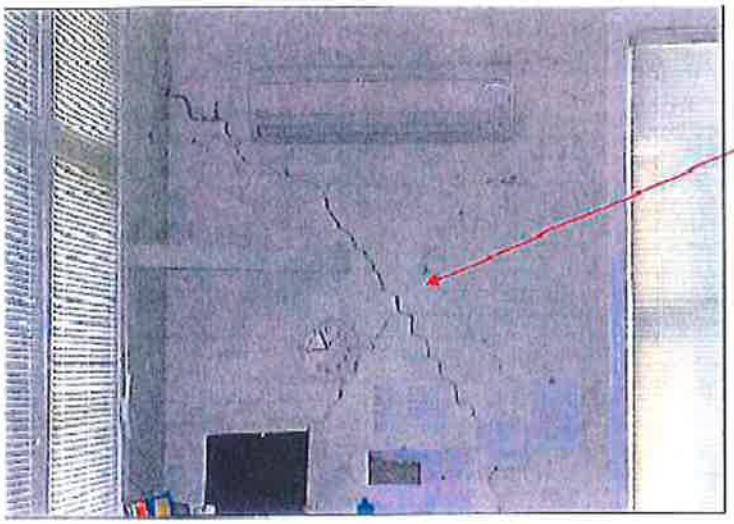
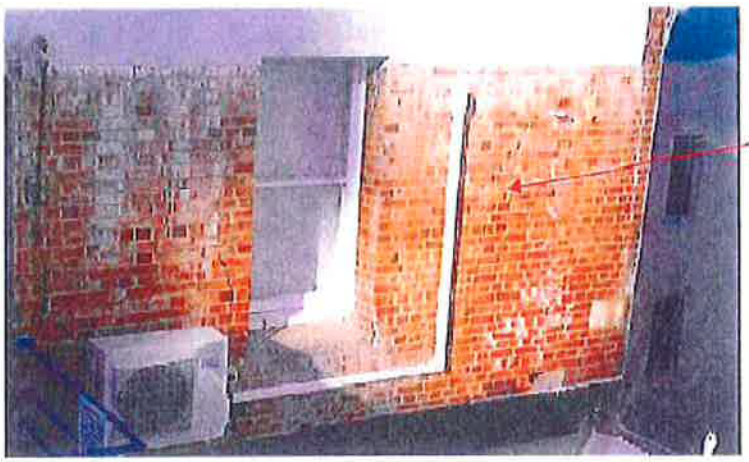
APPENDIX 4:

Photos of building after 4th September, 2010 earthquake



Damage:

Diagonal shear cracking to the internal exposed brickwork.



Damage:

Diagonal shear cracking to the external exposed brickwork.

Remedial works:

Threaded rods where secured by chemset on the North-western corner.

Remedial works:

Clamping of wall with threaded rods and steel angles.

APPENDIX 4:

Photograph records of damage following 22nd February, 2011 earthquake