INDEPENDENT ASSESSMENT ON EARTHQUAKE PERFORMANCE
OF
603 Colombo Street
Te@Net Internet Cafe

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

November 2011

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 building at 603 Colombo Street, 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 demolition

Location of Building

The building was located on the north-west corner of the intersection of Colombo Street and Mollett Street. The location of the site in the Christchurch CBD is identified in the site plan in Appendix 1.

Description of Building

The building at 603 Colombo Street was a two storey un-reinforced masonry building constructed with timber roof framing and timber first floor. The Christchurch City Council record the building as having been constructed in 1906.

The building had a reasonably open façade to Colombo Street and the upper storey facade of the Mollett Street frontage was also heavily penetrated.

The building had reasonably prominent parapets to the Mollett Street and to the Colombo Street frontages.

Compliance

The Christchurch City Council records identify that the Christchurch City Council accepted that structural upgrading was not a requirement of the building consent for the Te@ Net Internet Café fit out. A review of 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.

Christchurch City Council policy on Earthquake Prone Buildings

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

There was a Seismic Risk Building-Survey of the property undertaken by the Christchurch City Council on 2nd December, 1991. The building was assessed under the Seismic Risk Building-Survey with a numerical rating of 16 providing the building with a Building Classification A. (High risk). The results of the Seismic Risk Building-Survey do not appear to have been communicated to the owner.

There is a Hazard Appendage-Survey form on the Council records noting a cracked parapet, cornice and wall along the Colombo Street frontage on the 3rd November, 1992. There is also a record of cracking to the brickwork at the rear of the property.

The Christchurch City Council's first policy in respect of earthquake-prone, dangerous and insanitary buildings policy was introduced in 2006.

This policy was reviewed in early 2010.

Events Subsequent to 4th September 2010 Earthquake

The building suffered damage in the 4th September, 2010 earthquake. A Rapid Assessment-Level-1 undertaken on the 5th September, 2010 identified "cracks and displaced shop front glazing, Mollett Street parapet cracked, slight lean on Mollett Street wall – could be old settlements, structural review of parapet required, risk of neighbouring building collapse".

The building was assigned a yellow placard and the overall damage was assessed between 2 and 10%. The yellow placard was confirmed on the 11th September, 2010 after a Rapid Assessment Level-2 which identified that the south wall was at risk of collapse with significant cracking. The assessment noted that the barricades needed extension to cover the front of the Colombo Street entry to Mollett Street. The further Rapid Assessment-Level 2 on 12th October, 2010 referred to an engineers report required and a requirement for temporary propping of the south wall. The Christchurch City Council Enforcement Team Notices Coversheet of 12th October, 2010 identified "administration to update records as required Fencing to Colombo Street to remain in place." and "Provide temporary support to the south wall to prevent collapse of building materials falling onto the road and footpath."

Photos taken on 20th October, 2010 show barricades extending to footpath kerb level along Colombo Street and extending across Mollett Street. (Refer photos Appendix 2)

On 21st October, 2010 a Section 124 (1) (c) Building Act 2004 notice was issued to the owners.

Following the 26th December, 2010 earthquake a Rapid Assessment-Level 1 was undertaken on the building. The assessment assigned a red placard On 28th December, 2010 the Christchurch City Council wrote to the building owners advising that the Council considered the building to be a dangerous building and recommended the owner seek structural engineering advice from a qualified structural engineer on how to remove the dangers. A further Building Act notice was enclosed with the letter.

The building was significantly damaged in the 22nd February, 2011 earthquake. Both the Mollett Street and Colombo Street facades collapsed into the respective streets.

It is possible that part of the Colombo Street façade fell on Bus 228. The roof of the building was relatively unaffected, being supported by timber framing from which the facades have separated.

From the photos taken after the earthquake, it is evident that the failure of the Colombo Street façade at the junction with the north wall of the building is almost vertical indicating that the masonry was of low strength.

Structural Failure

The first floor façade to Mollett and Colombo Street failed by an outward rotation of the façade about the first floor support in the severe shaking during the 22nd February, 2011 earthquake.

The code lateral load coefficient for a façade to an elastic responding structure in Christchurch at the time of the earthquake sequence was 0.86g. The analysis of un-reinforced masonry construction is not covered in the NZ Building Code. The industry uses the New Zealand Society for Earthquake Engineering guidelines "Assessment and Improvement of the Structural Performance of Buildings in Earthquakes" 2000 and Assessment and Improvements of Un-reinforced Masonry Buildings for Earthquake Resistance" 2011. Calculations using these documents indicate that a sound 225mm thick un-reinforced masonry wall spanning 3m from first floor level to roof level and adequately secured at roof level, would meet code requirements. Based on GNS Science records of measurements of accelerations in the Christchurch CBD during the 22nd February, 2011 earthquake, the building is likely to have been subjected to a ground accelerations of 0.9g. This level of ground acceleration equates to an acceleration of 1.25g acceleration at first floor level. The analysis assumes no vertical acceleration occurs when the wall is subjected to the horizontal acceleration. Clearly the front wall to 603 Colombo Street has significant penetrations that affect both the weight and strength of the façade. The above figures indicate that the facade may not have survived the Canterbury earthquake sequence had the facade been adequately secured at roof level.

Issues Arising from Review

Upgrading of un-reinforced masonry buildings

The building at 603 Colombo Street had remained in a relatively original condition up until the recent earthquakes. 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. As the end building of a series of interacted un-reinforced masonry buildings, the building at 603 Colombo Street suffered more significant damage than adjoining 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 meaningful programmes 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.

Records show that the Christchurch City Council was aware of the earthquake prone condition of the building in 1991. 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. It is unfortunate that the Christchurch City Council did not require building owners to remove or secure the parapets to buildings along the street frontages.

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

There is a need to adequately secure the upper level walls of un-reinforced masonry buildings, particularly the facades of buildings which present a fall hazard over public spaces or adjoining buildings. These buildings pose a serious risk to the public and those that work in or near the building in the event of a significant earthquake.

Consideration should be given to prioritising the strengthening and upgrading of un-reinforced masonry parapets, facades and other elements that have the potential to cause loss of life in public spaces and adjoining buildings in a significant earthquake.

Barriers

The building was damaged in the 4th September 2010 earthquake and assigned a yellow placard.

Photographs of the building following the 4th September, 2010 earthquake and prior to the 22nd February, 2011 earthquake established damage to the Mollett Street wall and barriers were noted as required along the Mollett Street frontage. (Refer photos in Appendix 2) The barrier requirements were extended on the 12th October, 2010. There is record of the yellow placard being changed to a red placard on the 26th December, 2010.

While the Christchurch City Council provided barriers to protect the public from a failure of the damaged Mollett Street façade, the barriers did not extend sufficiently out into Colombo Street to protect the public in Colombo Street from a failure of the apparently undamaged Colombo Street façade.

Clearly the focus of the barrier placement was on protection of the public from a failure of the damaged Mollett Street façade. After a significant earthquake, the risk of an after shock is high and controlling authorities need to recognise the risk of failure of building facades to un-strengthened un-reinforced masonry buildings if a repeat of the tragic loss of life that occurred on the 22nd February, 2011 is to be prevented. This would require barriers to be erected to isolate the full extent of the fall zone of un-strengthened un-reinforced masonry buildings where there is a risk of a significant aftershock.

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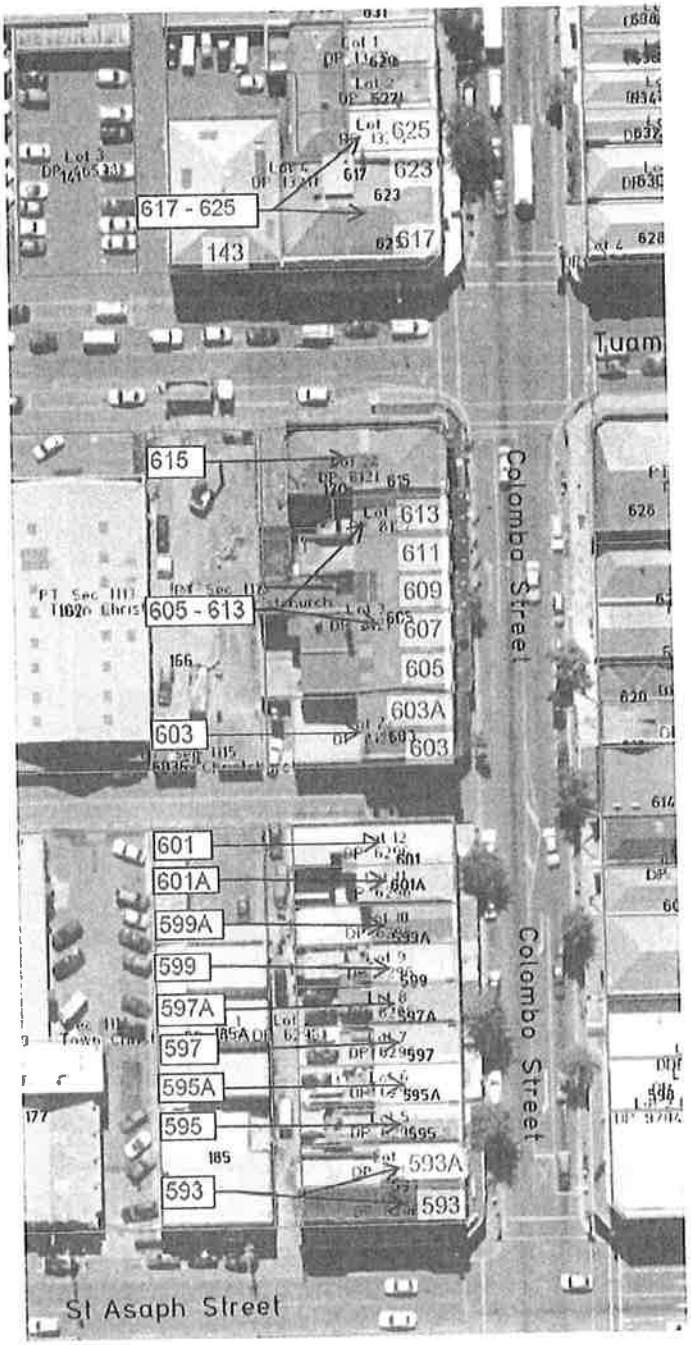
APPENDIX 1

Site Plans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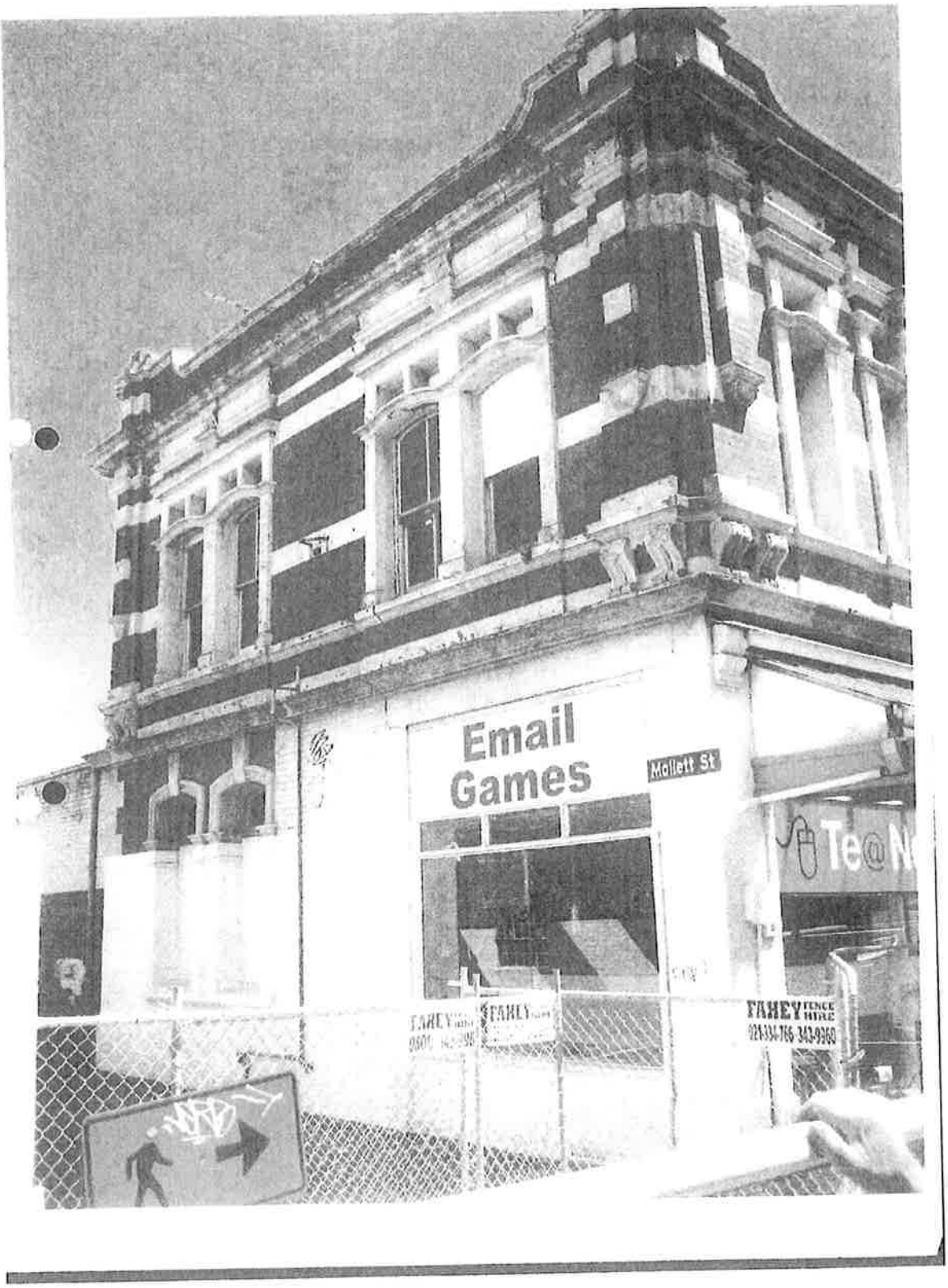
Colombo Street
Colombo Street
St Asaph Street

APPENDIX 2

Records of damage prior to 22nd February 2011 earthquake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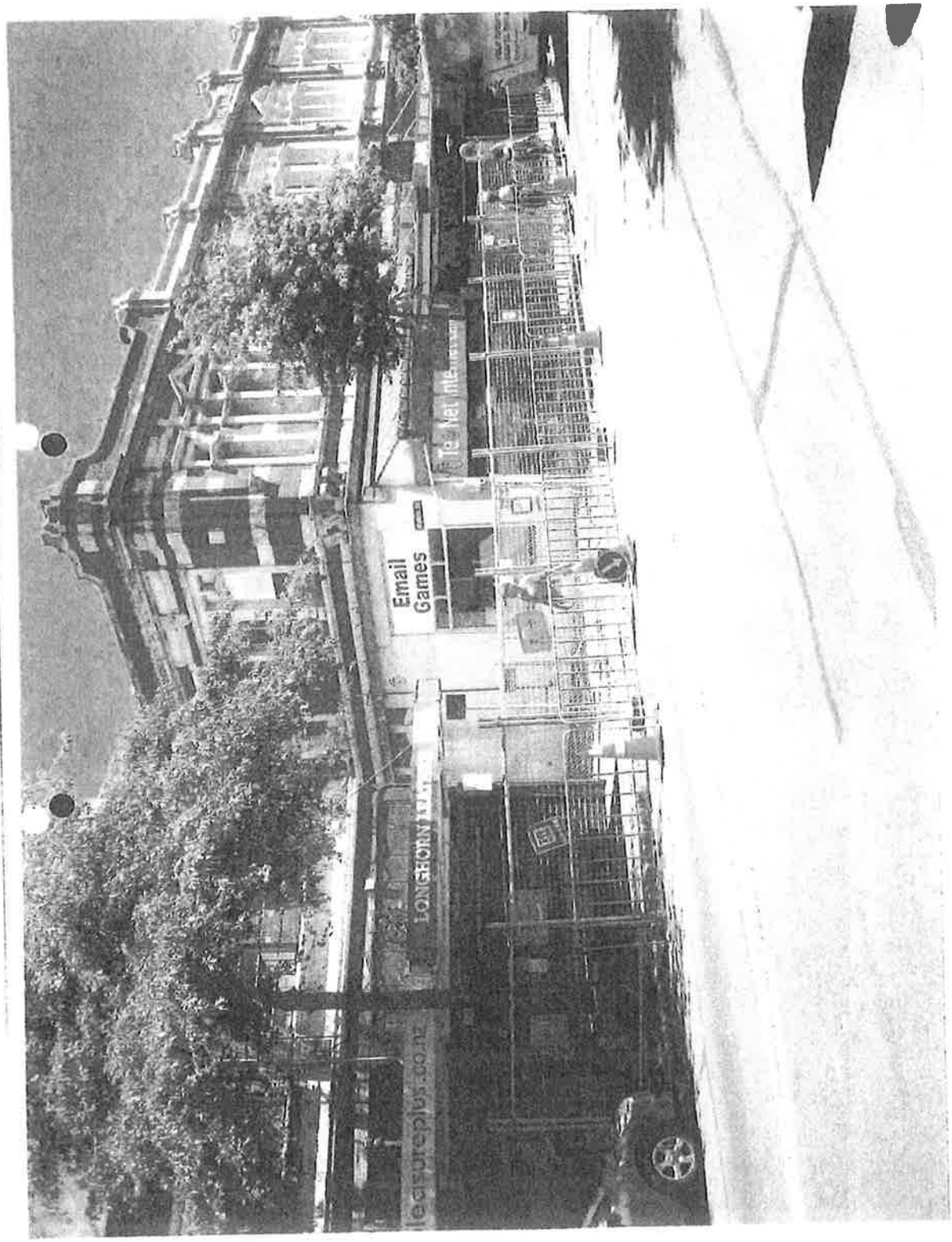
Games
Mollett St
FAHEY FENCE HIRE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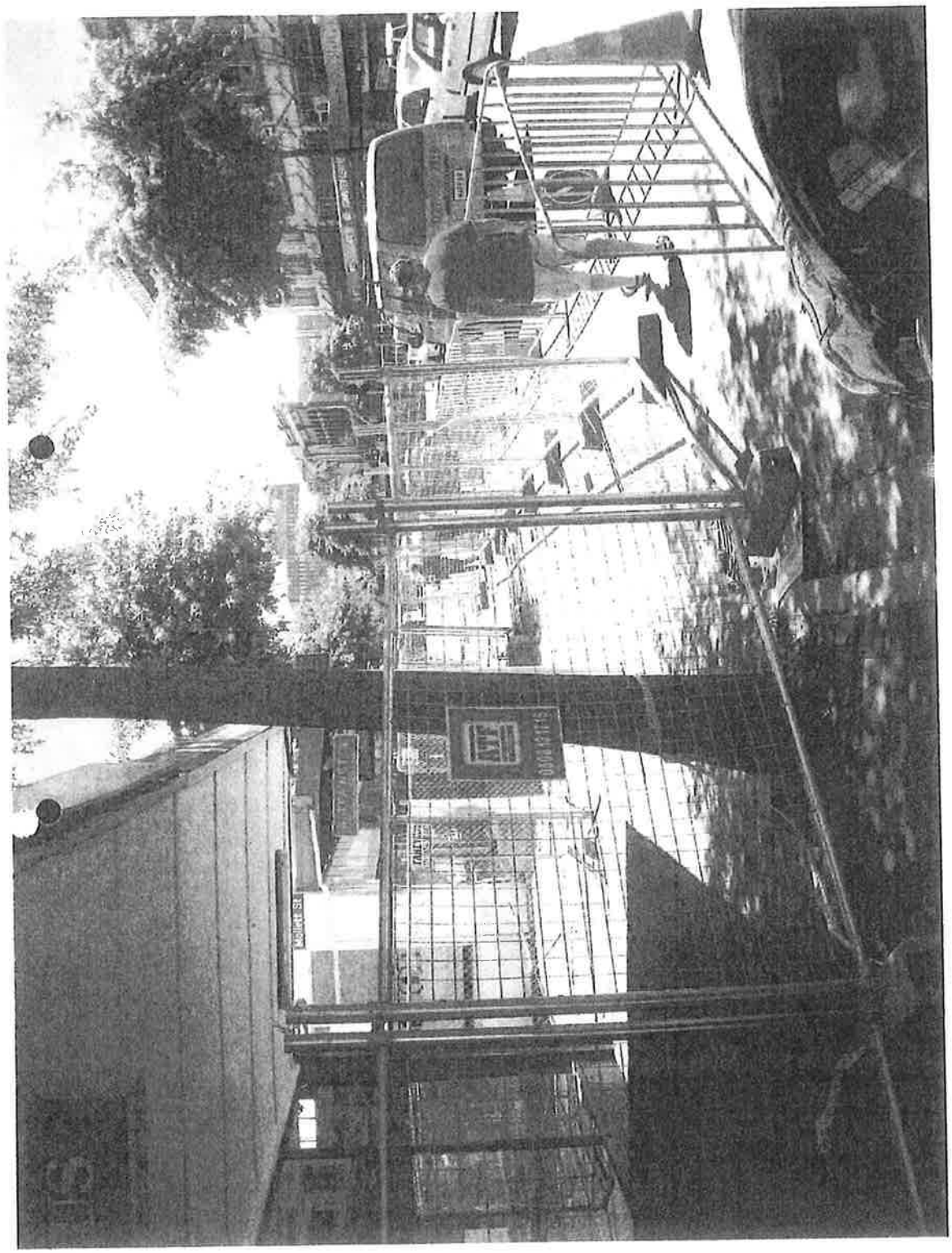
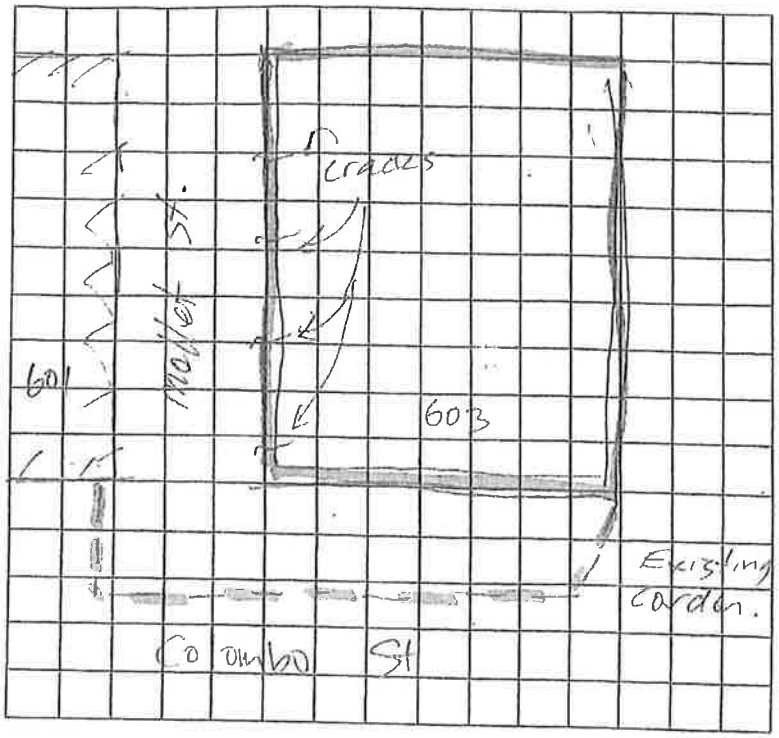


Sketch (optional)
Provide a sketch of the entire building or damage points. Indicate damage points.



Recommendations for Repair and Reconstruction or Demolition (Optional)

① Engineer's Report required
② Temp propping of Sth wall.

3 Inspection ID: _____ (Office Use Only)

APPENDIX 3

Photographic record of damage following 22nd February 2011 earthquake

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