

**INDEPENDENT ASSESSMENT ON EARTHQUAKE PERFORMANCE
OF
382 Colombo Street**

**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 382 Colombo Street, Christchurch during the Canterbury earthquake sequence where a portion of the south wall of this two storey building collapsed onto and through the roof of the building at 380 Colombo Street.

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 before the building was demolished.

Location of Building

The building was located on the eastern side of Colombo Street between Wordsworth Street and Waverley Street.

The location of the site which is outside the Christchurch CBD is identified in the site plan in Appendix 1.

Description of Building

The building at 382 Colombo Street was a two storey un-reinforced masonry building constructed with timber roof framing and timber first floor. The building was constructed as part of an integrated development involving the buildings 382 to 402 Colombo Street; the buildings having common party walls. The adjoining building at 380 Colombo Street was a single storey building with a light metal roof.

The ground floor façade of the building at 382 Colombo Street was open, being essentially shop front and the first floor had significant penetrations for windows. The south wall of the property 382 Colombo Street, which adjoins the common boundary with the property 380 Colombo Street, was free of penetrations.

The building had prominent parapets to Colombo Street and lesser height parapets along each side wall. The building is recorded in the Council records as being built in the 1920's. Christchurch City Council have no drawings of the original construction.

Compliance

The Christchurch City Council records in respect of the property at 382 Colombo Street indicate that there had been very few alterations to the building since construction. The upstairs tenancy was altered to create living quarters in 2007. Council records provide no basis for assessing what appears to be a change of use of the upstairs tenancy at that time. In all other respects the building appears to have complied with the requirements of the Building Act 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 Section 301A of the Municipal Corporations Act and that the Christchurch City Council adopted a passive approach to the upgrading of earthquake risk buildings.

The Christchurch City Council undertook a Seismic Risk Buildings-Survey of the building on the 19th January, 1993. The survey identified 1.2 metre high parapets and the chimneys at the rear of the building and classified the building as B/C with a numerical rating of 12. Under the scheme proposed by the Christchurch City Council at that time, this rating required action within a period of 2 years. The results of the Seismic Risk Building-Survey in January 1993 do not appear to have been communicated to the owner.

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

This policy was reviewed in early 2010.

Events Subsequent To 4th September 2010 Earthquake

The extent of damage to the building at 382 Colombo Street as a result of the 4th September, 2010 earthquake is uncertain. A Rapid Assessment-Level 1 was undertaken of the buildings 382 to 402 Colombo Street on the 7th September, 2010. The assessment identified minor damage to brick façade. The assessment did not provide details of the damage to the building but assigned a yellow placard to the building. A Rapid Assessment-Level 1 was undertaken on the adjoining building at 380A Colombo Street on the same date and assigned the building a green placard.

Mr Yan, representing his mother who was the owner of the building 382 Colombo Street, commented that he inspected the building a couple of days after the 4th September, 2010 earthquake. Mr Yan comments that he did not see any damage to the exterior of the building. On inspection of the interior of the building, he noticed cracking in the plaster of the walls and ceilings and also some broken plaster throughout the building.

About 10 days after the 4th September, 2010 earthquake, he called Robert Ling of Ling Design Consultants to inspect the building. Mr Yan's understanding of Mr Ling's assessment was that the damage was superficial and repairable.

On the 16th September 2010 the Christchurch City Council prepared a IntraRFS, containing a request for a section 124(1)(c) Building Act notice to be issued for the property.

On 29th October, 2010 Esther Griffiths, Property Manager of Christchurch City Council emailed Garry Lennan advising "we have attempted to no avail to contact the owner of the above properties, Katie Smith (S&P) managed to make contact with the owner's representative (Robert Ling) this morning. Apparently nothing has yet been done about these properties. No indication of urgency was given by Mr Ling."

"In our opinion, it is timely that a 124 (1) (c) notice is served on these properties with a response date of 15 November, 2010. The properties are contributing to the traffic congestion on Colombo Street. With this in mind, we will prepare the requisite documentation and forward to the Enforcement team. If we do not receive word to the contrary by 1pm, the notice will be served". A 124 (1) (c) notice was served on the owners on 29th October, 2010. The notice

recorded that the building had been damaged and that there were structural defects to the building. Councils records show that there was significant damage to structural walls, party walls, fire walls and/or structural frame (cracking, bowing, failed connections, spalling). The notice records that the building had a yellow placard at the time.

There is no record of a Rapid Assessment having been undertaken following the 26th December, 2010 earthquake.

A Christchurch City Council engineers re-inspection of damaged buildings form of 4th February, 2011 notes cracks in rear walls. Moderate damage to walls and neighbouring property hazard. General comments made were “buildings abandoned, however signs of occupation in upper storey. Not investigated as comments from neighbouring tenants indicated occupants “slightly unhinged” “The form identified significant damage “do not enter.” Under Protection fencing required, the assessment commented “propping to canopy and strengthening to canopies should be carried out or extend barriers to in front of shops.”

In David Yan’s response to the Canterbury Earthquake Royal Commission, there is comment that confirms that the building was yellow stickered at the time of the 22 February, 2011 earthquake.

In an email of the 18th October, 2011, Mr Ling advised the Commission that the following damage was identified as a result of the 4th September, 2010 earthquake.

“Exterior

Shop front (facing Colombo Street)

Minor damage only.

Verandah holding well and no signs of stays loosening.

Parapet appeared stable,

Shop front (western wall) looks stable apart from a few minor cracks.

Southern wall

This is one of the better walls where there was no sign of damage and remains plumb. The parapet too remained sound.

Northern wall – mostly obscured by the building next door but parapet appeared damaged.

Rear wall –

A fair bit of damage at the rear walls to shop 382A, 384 and 384A. Rear wall of shop 382 was ok.

Roof

Parapet and chimneys damaged.

Interior

The interiors of all shops and upstairs accommodation suffered considerable amount of damage with substantial diagonal cracks in the walls (both brick and timber).

We note that in correspondence received from Peter Avnell that he states: “I made note of some cracking in a wing wall on the southern side.(See Photograph). This cracking appeared to be old..... It was on a tilt, by 3 degrees lean but going back towards the roof, not the neighbouring property... I was concerned about the wing wall...I considered it a potentially dangerous.”

Mr Ling commented that after September and Boxing Day earthquakes, although the buildings were damaged, since the shops were not occupied except for a free lodger, I didn't consider the buildings dangerous and hence did not consider make safe as necessary.

The Engineers Re Inspection of damaged Buildings form dated 4th February 2011 ticked "Damage to parapets and/or chimneys and/or ornamental features that may pose a risk to the public and/or adjacent property.

In the 22nd February, 2011 earthquake, the parapet and a section of the south wall of the building 382 Colombo Street fell on and penetrated the roof of the building at 380A Colombo Street.

Structural Failure

We consider it likely that the failure mechanism in the 22nd February, 2011 earthquake was an outward rotation of the south wall parapet and the upper portion of the south wall approximately above first floor ceiling level in the building 382 Colombo Street. Refer photos Appendix 2. The wall appears to have rotated about the top of the remaining wall. We suspect that the inertia from internal party walls to the building 382 – 402 Colombo Street may have been transferred to the south wall through the roof framing, initiating the collapse. The failed section tragically fell on and penetrated through the roof of the single storey building at 380A Colombo Street. The failure occurred principally due to inadequate restraint of the wall at roof level.

In its poorly secured condition, failure of the parapet and upper portion of wall was almost inevitable in the severity of shaking experienced in the 22nd February 2011 earthquake.

Issues Arising from Review

Condition of building prior to 22nd February earthquake

There is confusing evidence as to the extent of damage present in the building at the time of the 22nd February 2011 earthquake.

A Rapid Assessment-Level 1 was undertaken of the buildings 382 to 402 Colombo Street on the 7th September, 2010. The assessment identified "minor damage to brick façade –could be damaged in future after shock" and the assessment assigned a yellow placard to the building.

We are uncertain of the basis that the Christchurch City Council assessed that the building had been damaged and that there were structural defects to the building. In the section 124(1)(c) notice, Councils records that there was significant damage to structural walls, party walls, fire walls and or structural frame (cracking, bowing, failed connections, spalling).

Mr Ling is reported by Mr Yan as advising that damage was superficial. In a response to the Royal Commission Mr Ling advises that the southern wall "is one of the better walls where there was no sign of damage and remains plumb". Mr Ling then proceeds to support demolition. Mr Avnell, the loss adjustor, expressed concern over the damage and identified an out of vertical of the south wall. The Engineers Re Inspection of damaged Building form dated 4th February 2011 is not specific as to what the risk was or to whom the hazard posed a risk.

While there is variation in the opinions on the condition of the building after the 4th September, 2010 earthquake, the parapet was clearly a hazard, although there is some doubt as to the extent of recent earthquake damage to the wall prior to the 22nd February, 2011 earthquake. The

incomplete Christchurch City Council records do not assist in assessing the condition of the south wall immediately prior to the 22nd February 2011 earthquake.

We do note with concern that the Christchurch City Council knew that the building was being occupied when assigned a yellow placard and yet took no action to enforce evacuation.

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 inadequately restrained un-reinforced masonry walls in many un-reinforced masonry buildings.

The opportunity for the Christchurch City Council to require structural upgrading of un-reinforced masonry buildings occurs when the Christchurch City Council adopt and enforce a policy on earthquake prone buildings or there is a change of use to the building.

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 following the severe 22nd February, 2011 earthquake. It is however unfortunate that the Christchurch City Council did not require the removal or securing of parapets to un-reinforced masonry buildings as a priority after being granted powers under Section 301A of the Municipal Corporations Act.

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

Rapid assessment-treatment of adjoining buildings

The building was assigned a yellow placard following the 4th September, 2010 earthquake.

Our understanding of the Rapid Assessment procedure is that if a building is assigned a yellow placard, and that building is assessed as creating a fall hazard to the adjoining site, the adjoining site should also be assigned a yellow placard. It appears that the Christchurch City Council's concern related to the street frontage and rear walls and not the south wall of the building 382 Colombo Street.

Where un-reinforced masonry buildings pose a threat to the public or adjoining properties it is suggested that the territorial authority adopt a conservative approach and require a comprehensive assessment of the building to a nominated minimum strength before occupancy of the building, adjoining building or adjoining public space. Where an un-reinforced masonry wall poses a threat to an adjoining property, the adjoining property should not be occupied.

Basis of rapid assessment

The Rapid Assessment process focuses on damage caused to the building by a recent earthquake. The process assumes that the risk that existed before the earthquake is acceptable in the period following the earthquake, subject to only limited damage to the building. Historically aftershocks have caused lesser levels of shaking than the initial earthquake.

When there is a risk of significant aftershock, it would be prudent to red placard unreinforced masonry buildings and require a structural assessment to a minimum strength prior to occupancy or public access in the vicinity of the building.

With the increased seismicity that occurs following a significant earthquake, consideration should be given as to the appropriate basis for the assessment of un-strengthened un-reinforced masonry buildings in the period following a significant earthquake.

The Canterbury series of earthquakes have highlighted that an aftershock located closer to a developed area may cause more severe shaking than the initial earthquake.

Report Prepared By:-

Peter C Smith
BE, FIPENZ, CP Eng IntPE
Director

Report Reviewed By:

Jon Devine
BE(Hons) ME (Civil) CP Eng IntPE
Director

APPENDIX 1

Site Plans

CCC WebMap

Page 1 of 1



<http://maps.ccc.govt.nz/webmap/framesetup.asp>

21/07/2011

APPENDIX 2

Damage resulting from 22nd February, 2011 earthquake





