

**INDEPENDENT ASSESSMENT ON EARTHQUAKE PERFORMANCE
OF
Boundary Wall to 90 Coleridge Street
(Classique Furniture)**

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

**Report prepared by Peter C Smith and Jonathan W Devine
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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 boundary wall on the property 90 Coleridge Street, Sydenham, 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 wall was possible before the collapsed wall was removed.

Location of Building

The property at 90 Coleridge Street is located on the south side of Coleridge Street between Brisbane Street and Hawdon Street, Sydenham. The location of the building is shown on the aerial photographs of Christchurch included in Appendix 1. The wall was located on the eastern boundary of the property.

Description of Wall

Classique Furniture occupy a single storey industrial building on the site 90 Coleridge Street, Sydenham. On the eastern side of the building there is a driveway which accesses a sliding door providing access into the factory. The east wall of the building is off-set by the width of the driveway from the eastern boundary. Prior to the earthquake, a blockwork wall, approximately 6 metre high extending a length of 3 metres existed alongside the adjoining neighbours wall opposite the doorway providing access into the industrial building.

It is understood that the wall was used to support a timber roof connecting the wall to the industrial building. The roof providing shelter for the access door into the industrial building. At some stage in the past, the roof had been removed and the wall left standing adjoining the wall of the adjoining property.

The wall was constructed on a concrete foundation and was nominally reinforced. The wall is understood to have been in the pre-earthquake condition for at least 10 to 12 years.

Compliance

We have no documentation relating to the construction of the wall or the compliance of the wall with the New Zealand building standards applicable at the time of construction. Prior to the 1980's, the New Zealand Standard NZS 1900 Chapter 5 required walls on a boundary to be self supporting after fire.

It would appear that the wall did not comply with these requirements

Events Subsequent to 4 September 2010 Earthquake

The building at 90 Coleridge Street was apparently undamaged as a result of the 4th September, 2010 earthquake, although the owner did have a builder inspect the building for damage after the earthquake.

To our knowledge no Rapid Assessment of the building was undertaken as part of the Civil Defence emergency.

The wall collapsed during the 22nd February, 2011 earthquake. A Rapid Assessment-Level 1 was undertaken on 11th March, 2011. The building was assigned a yellow placard on account of the collapse of the wall. Following the collapse, blockwork to the external walls of the building was established to be lightly reinforced. Some securing of the parapet to the west wall of the factory was undertaken in March, 2011.

Structural Failure

The wall failed at two locations. The top two courses of blockwork separated from the remainder of the wall and landed on the roof of the adjoining building. This failure was undoubtedly initiated by pounding between the wall and the adjoining building.

The remainder of the block wall rotated about the concrete foundation up-stand and collapsed towards the industrial building, tragically killing a worker who was running from the building at the time of the earthquake.

We understand that the wall was reinforced with 1 - D20mm reinforcing rod at each end of the wall. Photos of the foundation following demolition of the wall show little or no concrete adhering to the reinforcement and the bent shape of the reinforcement indicates that the cells containing reinforcement were either not filled or filled with poor quality concrete. (Refer Appendix 2)

The dislodging of the top two courses of the wall would also suggest that the upper portion of the wall was not reinforced.

Assuming that the reinforcement projecting from the foundations extended up through the wall and that the cells were filled, the wall could be expected to withstand a seismic loading equivalent to 0.03g. Clearly the failure of the wall was almost inevitable under the severity of shaking on the 22nd February, 2011.

Issues Arising From Review.

A review of the photos of the wall after the 22nd February, 2011, earthquake established that the wall was inadequately reinforced and that the infilling of the reinforced cells of the wall was either of low quality or did not exist. The extent of reinforcement was sufficient to meet the minimum reinforcement ratios of NZSS 95, but did not meet spacing requirements or strength requirements. Failure of the wall was inevitable under the severe shaking of the 22nd February, 2011 earthquake.

The introduction of the Building Act 1991 required appropriate inspections of building work and for the Territorial Authority to issue a Code Compliance Certificate when satisfied that the work had been constructed in accordance with the building code requirements.

These provisions should prevent a repeat of the construction of sub standard masonry in any future construction.

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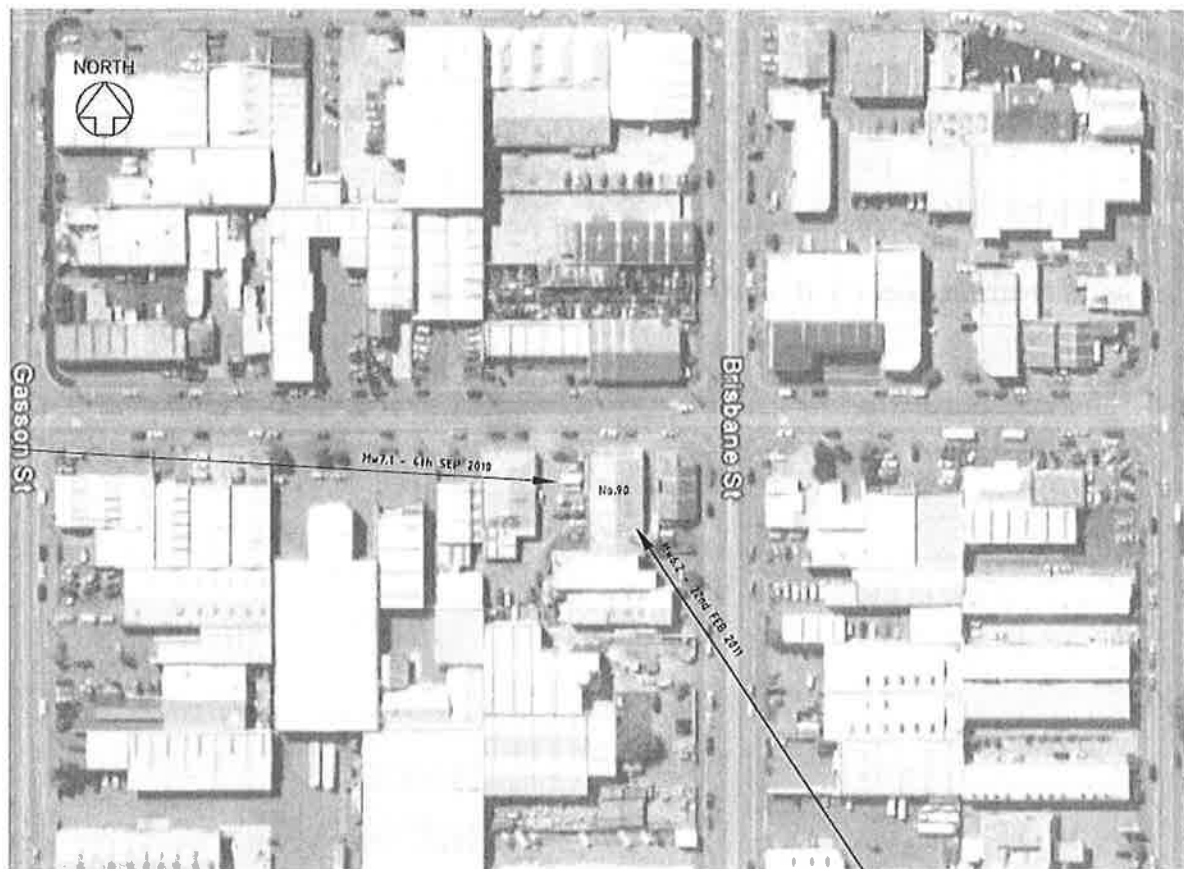


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APPENDIX 1

Site Plans





APPENDIX 2

Photos recording aspects of construction of masonry wall.

