3. STRENGTHENING OF JAMES SMITH LTD CUBA STREET, WELLINGTON

D.J. Munro*

BRIEF DESCRIPTION OF ORIGINAL BUILDING:

The building requiring strengthening was one of a complex of five which make up the James Smith Ltd retail site in Wellington. It was constructed around 1908 of solid masonry walls with timber floor and roof framing supported on steel beams and cast iron columns on concrete foundations. The building is five storeys in height and is located on the corner of Cuba and Manners Street covering a total plan area of 620 sq metres. The building also has a basement which extends some 3 metres below pavement level.

Flooring is tongue and groove timber with a flat timber sarked roof.

As the other buildings in the complex were constructed around it the eastern boundary wall of the Winders building was demolished and its steel floor beams tied through to the new steel framed structures which had reinforced concrete floors, and the north boundary wall up to third floor level had large openings created in it. The facade walls have openings over about 25% of the projected elevation area with the windows being formed by arched brickwork.

When the building alongside was constructed in 1934 the parapet was modified to match the new facade adjacent, and following the 1942 earthquake when a significant degree of cracking was noted, a series of reinforced concrete horizontal bands and vertical straps was installed to secure the facade against face loading. There were also reinforced concrete bands placed on the remaining north masonry wall.

Apart from this damage which had been attended to and other maintenance matters the building was generally in good heart with little sign of settlement or distress.

SPECIFIC REQUIREMENTS:

The request to strengthen the building had come about as a response by the client to the Wellington City Council programme for the seismic upgrading of buildings in the central retail area.

Specifically it was requested that the strengthening solution be programmed in such a way that minimal disruption to retail operations resulted. In addition the work was to be spread over three financial years to assist in cash flow commitments.

DESIGN STANDARDS:

Wellington City Council bylaw requirements - NZS 1900 Chapter 8 using .08g load level.

SOLUTIONS ADOPTED:

Initial attempts at analysis proved it was not practical to isolate one structure from another in the total complex. As a consequence although only one of the buildings was required to be strengthened the complex was instead regarded as one entity for the purpose of this project. As all buildings other than the corner structure were tied in continuously at each floor level through reinforced concrete slabs, a completion of the diaphragm action was possible by ensuring additional steel ties were placed from the facade wall of the corner building to the surrounding slabs.

Primary structural resistance was already available in the form of two interior walls of reinforced concrete which were aligned orthogonally and it required only to construct a third shear wall to take out the torsion component.

This new wall was placed immediately adjacent to the subject building on its northern side and enabled the removal of its full height masonry wall from that boundary thus reducing further seismic weight.

Above third floor level however the subject building was not completely surrounded by its neighbours but instead one building only continued up to roof level on its eastern side.

Above that level two diagonally braced walls were constructed to take out direct and torsional shear requirements and a much more complicated system of diagonal floor bracing was installed to insure diaphragm action.

Although use was made of existing boundary walls one of these had to be strengthened because of the location of openings within it and this was achieved by the use of reinforced sprayed concrete of 150mm thickness. The new shear wall installed was approximately 13.5 metres long and was also constructed by the use of sprayed concrete techniques. To avoid overturning four 120 tonne ground anchors were placed at each end.

PARTICULAR CONSTRUCTION ASPECTS:

The requirement that the shop continued trading was the greatest constraint based upon the contract. However as most of the work had been carried out in vertical planes the area on each floor required to be closed off

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for construction operations was minimised and a suitable programme of construction was suggested to the contractor.

Dustproof partitions with taped joints and corrugated cardboard sound absorbing lining on the interiors managed to reduce the construction noise to an acceptable level. Where demolition was to be carried out, large extractor fans were used to remove dust and to induce a pressure differential to avoid the prospect of dust being blown through any unsealed cracks. Although some retail space had to be taken over for various operations the aspect of relocating departments proved to be less of a problem than first anticipated with the client taking the opportunity to reorganise the shop layout.

The only area of significant problems which arose on the project related to the drilling of ground anchors because of the presence of a high water table at the level of the basement floor slab. As the foundation material was alluvial gravel it was necessary to case the holes and the presence of water made it difficult to extract the gravels from the bore holes.

Further complications arose when at a depth of approximately 12 metres an increased flow of water was encountered. When extra lengths of casing were attached to form a stand pipe the static head was found to be approximately 2.5 metres above the original water table. As the drilling was being carried out from the ground floor these stand pipes could remain in position and so avoid the necessity for continual pumping out of the foundation area. By perseverance the holes were finally completed successfully.

COST BREAKDOWN:

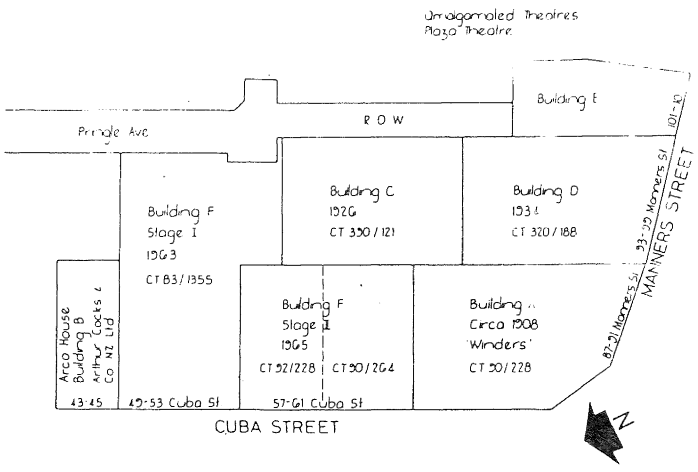
The cost of the work which included the construction of the new fire egress stairway, relocation of two lifts and general upgrading to the sprinkler system amounted to approximately 30% of the replacement cost for the corner building.

COMMENT SUMMARY:

The structural system which was devised provides a stiff seismic resisting structure intended to protect as much as possible the brittle nature of the subject building. The contractor encountered very few problems on the site with the extended construction programme no doubt assisting in this aspect, and the ongoing retail operation proved so successful that many of the store's clients did not know that strengthening work was being carried out.

Although further work may be required in later years to complete the modernising work intended, the structural solution has proved economic compared with the replacement prospect.

Current Owner: James Smith Ltd, Wellington
Engineer: Smith Leuchars Ltd, Wellington
Architect: Mitchell & Mitchell and Partners
Quantity Surveyor: Hallen Eames & Partners
Contractor: Downer & Co. Ltd



LOCATION PLAN