

Laurie Hay
CHRISTCHURCH

12 November 2013

S0054 240 Annex Rd - DEE - 2012-10-23.docx

Dear Laurie

**240b and 240c Annex Rd, Christchurch - Detailed
Engineering Evaluation - Rev. B**



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Chartered Structural Engineers

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1 Building Address

240 Annex Rd, Christchurch.

Inspection date 24 September 2012.

2 Building description

The building at above address covers about 840m² and is situated on a larger site. It is about 17 years old and is a typical "tilt up" industrial/commercial/retail building of its era.

The occupancy of the building is commercial/retail.

Importance Level 2 (IL2).

3 Structural system

The building is a single structure comprising of three separate tenancies with two dividing walls. A small timber mezzanine areas exist in each of the three compartments.

Light weight metal profiled roofing is supported by DHS purlins along the building, in turn supported by precast panels and steel UB portal frames

Precast tilt-up reinforced concrete panels 120mm thick envelope the building on 4 sides, and provide division walls between units. Portal frames are encased in concrete to about 2/3 height. Reinforcement projecting from

adjacent precast panels are joined to about 2/3 height and cast in a reinforced concrete column at each panel joint.

Shallow post holes support portals and joints between precast panels.

4 Foundations and geotechnical

No geotechnical information was sighted.

5 Drawings

A comprehensive set of architectural drawings is available and was sighted. No structural drawings were sighted – however, the building is designed by the same consultant as 250 Annex Rd for which full structural set was sighted. Building at 240 Annex Rd is of same age, form and construction as building at 250 Annex Rd – therefore detailing has been implied to be the same. Visual comparison and intrusive investigation of the two buildings support this assumption.

6 Structural damage – intrusive investigation

Practically all precast panels and roof structure are visible. Some intrusive investigation into precast panels was carried out by a third party engineering consultancy and presence of brittle mesh confirmed. No foundations were exposed for inspection.

Damage includes:

- Cracking to precast panels
- Cracking to reinforced pilasters joining the panels

7 Reasons for damage.

Concrete cracking is due to natural performance of the panel under in-plane and out-of-plane seismic forces.

8 Generic issues.

- Brittle mesh in the precast panels, exposed by destructive investigation. Due to the size of panels, this issue is considered critical and repair of the panels by only epoxy injection of cracks is deemed inappropriate due to non-compliance with NZ Building Code. Addition of secondary steel framing (or similar) is required to reduce the panel spans, which would reduce expected stresses in the mesh and enable use of epoxy injection for crack filling. Other alternative is replacement of panels.
- Brittle connections between precast panels. Considered critical for longevity of the building and retrofit is recommended by installation of additional, more robust brackets than the existing ones.

9 Extent of review and inference.

Practically all precast panels have been visually inspected from the ground from inside and outside. It was considered unnecessary to expose foundations for inspection. Roof structure has been viewed from the ground.

10 %NBS before and after.

11% along and across before, 9% after. We note that, once repairs and retrofit are completed, a 67% NBS will be achieved.

11 Repairs and further investigation / assessment

Repair works required include:

- Epoxy injection of cracks over 0.2mm width.
- Introduction of steel elements in order to shorten panel spans.

No further investigation is deemed to be required.

12 Load paths – new and existing.

Across and along - seismic loads from roof level are transferred into portal frames and precast panels. Seismic loads in plane of precast panels are carried by panels themselves. Seismic loads perpendicular to panels are

carried by (strengthened) panel flexure to steel/concrete columns, then by cantilever action into the ground.

13 Proposed retrofit.

Retrofit of panel-to-panel connections is proposed (by installation of additional, more robust brackets).

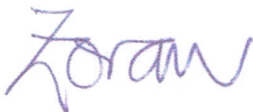
If you have any questions, please do not hesitate to contact the undersigned for further clarifications and amplifications.

Yours faithfully,

Report prepared by:

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on behalf of

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Site plan. Arrow shows "along" direction.