Timaru District Council S42A Report

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By Beca Limited (Beca)

20 October 2016

Timaru District Council S42A Report

High Level Review of Hydro Grand Hotel

To:	*Timaru District Council*	**Date:**	20 October 2016
From:	*John Heenan*	**Our Ref:**	4393740
Copy:			
Subject:	**High Level Commentary of Powell Fenwick Consultants Ltd Detailed Seismic Assessment of the Hydro Grand Hotel, Timaru**		

Key Information

- Address: ***Corner of Bay Hill Street and Sefton Street***
- Structural Engineer: ***Powell Fenwick Consultants Ltd***. (PFCL) DSA ***< 33 %NBS***
- *The Hydro Grand Hotel is a three storey Unreinforced Masonry (URM) building constructed in 1912 approximately triangular in footprint with an internal services / light well.*
- *The building is constructed with URM walls (Red Brick) and timber framed floors with a light weight profiled metal roof.*
- The building is characterised by the circular turret and cupola in the south-east corner, in Edwardian Mediterranean style with arched window openings, recessed balconies, bay windows and has a category 2 Heritage New Zealand listing.

- The purpose of this review is to consider the seismic assessment and retrofit proposals put forward by PFCL for the Hydro Grand hotel in Timaru with respect to the Resource Consent application to redevelop this site.

Detailed Seismic Assessment High-Level Review (Date: April 2009)

- Information provided for our high-level review:
    - Hydro Grand Hotel, Stafford Street, Timaru. Structure, Fire, Electrical and Mechanical Report for the existing building. Powell Fenwick Consultants Ltd (dated April 2009)
    - Post Inspection Summary of Building at Corner of Sefton East Street and the Bay Hill, Timaru. Powell Fenwick Consultants Limited. (dated 09 November 2015)
    - Preliminary Design Report, The Hydro Grand, Timaru. Structural, Building Services, Fire. Powell Fenwick Consultants Limited (dated 13 April 2016)
    - No calculation or designer feature report is available for report.
- The PFCL engineer has identified the lateral bracing system to be *"(extracts from the PFCL report)"*
    - *"The existing building system comprises of flexible tongue and groove timber diaphragms at level one and two spanning between relatively stiff masonry walls which transfer the seismic loads to ground level by means of in-plane response."*
    - *"In-plane loads on brick walls for the existing building have been calculated based on a tributary area approach due to the flexibility of the existing diaphragms."*
    - *"No strength has been attributed to the lightweight timber framed walls as they are significantly less stiff than the masonry walls."*
    - *"At roof level there is currently no system for transfer of the seismic loads to the second floor brick walls as there is no sarking to the underside of the roofing."*
- The PFCL engineer has made the following assumptions in their assessment of the buildings structural performance

- *"Building design life of 50 years."*
- *"NZS1170 building importance category 2."*
- *"NZS1170 site subsoil class D for sites with deep or soft soil."*
- *"Brick and Mortar Strength Parameters as recommended in the NZSEE guidelines."*
- *"For the assessment of the in-plane capacity of the brick walls the Equivalent viscous damping ratio of 15% as recommended in the NZSEE document has been adopted along with a structural ductility level of 1.00."*
- *"For the assessment of the out-of-plane capacity of the brick walls the seismic coefficient for parts has been calculated using a ductility of 1.00 and a damping ratio of 5%."*
- *"Due to the apparent lack of header bricks acting to tie the individual wythes of the brick walls together the skins/wythes of the walls have been treated as spanning individually between floors and not as monolithic elements."*

- The following structural capacity of the building has been assessed by the PFCL engineer as

Structural Element	In-Plane Assessed capacity	Out-of-Plane Assessed capacity
Ground Floor URM Walls	>100% NBS	<33% NBS*
First Floor URM Walls	64% - 93% NBS	<33% NBS*
Second Floor URM Walls	53% - 71% NBS	<33% NBS*
Roof Level diaphragm	No strength consider appropriate	
Second Floor diaphragm	8% NBS**	
First Floor diaphragm	19% NBS**	
Diaphragm connections	<33% NBS	
Parapets		33%NBS < Parapet < 67% NBS
Chimney's		<33% NBS
Turret and Cupola	No apparent seismic system	

*This assessment relates to a single skin of 110mm wide masonry wall acting in isolation.

**Considers discontinuity of timber floor diaphragms and internal load bearing walls

Table 1 : Assessed Building Capacity

- From our high-level review of the available DSA report (Powell Fenwick Consultants Ltd.), there are several issues which we note
  - The site subsoil class has been assessed as "class D". In lieu of a more detailed site geotechnical investigation this is considered appropriate but maybe conservative
  - The URM walls have been specifically noted as have a lack of header courses in the masonry construction and as such the URM walls have been assessed as individual skins (wythes) of brick. We consider that it is unlikely, given the age of construction with multiple skins of brick, that header courses are absent from the wall construction. Therefore we consider that the strength analysis of the URM walls is probably overly conservative. There is a general lack of description of the URM wall construction. If the URM walls indicate that there is a lack of header courses then there is the possibility that the wall construction consists of a structural wythe of multiple layers of brick and an external veneer with a weather cavity between. URM cavity construction is more prone to earthquake effects than normal solid URM construction, therefore the URM out-of-plane capacity may have been underestimated.

- The seismic assessment has been undertaken based on the assumption that there is a positive connection between the internal timber floor diaphragms and the lateral load resisting URM walls. In practice this connection is likely to be gravity load only connection however will transfer some lateral load by friction / mechanical interlock between the floor joist and the mortared pocket in the URM walls. Where the floor joists are parallel to the URM walls this connection and load path is less defined. Therefore the assessment of the building maybe less than conservative in some areas.

- It has been noted in the Engineers report that there is not significant earthquake damage to the building
- The engineer identified the structural deficiencies in the seismic resisting system as follows:
    - URM walls both in plane and out of plane capacity
    - Floor diaphragm capacity
    - Cupola

Based on our high level review of the DSA report, we consider the non-earthquake risk rating determined by Powell Fenwick Consultants Limited for the building primary structure to be reasonable, though due to the form of the building PFCL have had to make numerous assumptions which would impact on the overall risk rating. The assessment approach adopted appears to be consistent with the NZSEE recommendations.

Seismic Upgrade High-Level Review

- Information provided for our high-level review: of the retrofit options: *Powell Fenwick Consultants Limited*'s DSA report dated April 2009 and concept drawings for earthquake strengthening dated *April 2009*) and the subsequent building condition report update (dated 09 November 2015) No original structural drawings are available for review.
- The proposed strengthening schemes presented appear to be appropriate for retention of the façade and / or strengthening of the building for future development.
    - *It is noted that the strengthening of the floor diaphragms does not take into account the removal and temporary support of internal load bearing walls to provide continuity to the reinstated floor diaphragms.*
    - *The retention of the existing facade option does not consider the construction of an entirely new internal structural frame with larger spans and open spaces behind the existing façade.*
- It is noted that the retention of and strengthening of the existing building and or façade does provide challenges both in respect of economics' of the strengthening and the functionality of the building for modern uses.
- We note that the most recent condition inspection and report indicates further degradation of the internal floor diaphragms and although not inspected or mentioned this could also be inferred to the connections between the floors and the URM walls if leaking has occurred on the external walls. This may compromise further the ability of the floors to be suitably secured and strengthened to provide a reliable transfer mechanism to distribute lateral loads.

Summary

We consider that the Powell Fenwick Consultants Limited structural assessment of the building earthquake capacity is appropriate albeit possibly slightly conservative.

We consider that the Powell Fenwick Consultants Limited earthquake strengthening methodology to be a reasonable assessment, at concept stage, for increasing the building lateral earthquake capacity to 34%NBs and 67%-80% NBS.

Action	Name	Signed	Date
Prepared by	John Heenan		20 October 2016
Reviewed by	Jared Keen		20 October 2016
on behalf of	**Beca Ltd**		

Limitations

These high level reviews are of defined scope and for reliance by ***the Timaru District Council*** only, and only for this commission. Beca accepts no responsibility or liability to any third party for loss or damage whatsoever arising out of the use of or reliance on our review by that party or any party other than ***the Timaru District Council***

The reviews are high level and cannot be qualified as a peer review. Beca does not accept any responsibility for the work of the ***Owners engineers***; this will reside with the engineer undertaking the seismic assessment.

Each review is limited by the information provided by ***the Timaru District Council*** at the time of requesting the review. In the context of this review, Beca has not visited the building and has relied on the inputs used and assumptions made by the ***Owners engineer*** undertaking the Assessments/Retrofit Design. We have not sought to validate these inputs and assumptions.