Before the Timaru District Council
Independent Hearing Commissioner

Under	the Resource Management Act 1991
In the matter of	an application for resource consent by Bayhill Developments Limited

Statement of evidence of Louis Mervyn Robinson on behalf of Timaru Civic Trust

1 December 2016

Timaru Civic Trust's solicitors:
Jen Crawford | Georgia Cassidy
Anderson Lloyd
Level 3, Anderson Lloyd House, 70 Gloucester St,
Christchurch 8013
PO Box 13831, Christchurch 8141
DX Box WX10009 Christchurch
p + 64 3 379 0037 | f + 64 3 379 0039
jen.crawford@al.nz | georgia.cassidy@al.nz

anderson
lloyd.

Introduction

1 My name is Louis Mervyn Robinson.

Qualifications and experience

2 I have a Bachelor of Engineering degree in Civil and Structural Engineering with first class honours from the University of Canterbury (BE(Hons)), and a New Zealand Certificate in Engineering with Distinction (NZCE(Dist)).

3 I am a Chartered Professional Engineer (CPEng). My practice areas are structural, fire and geotechnical engineering. I am a member of the Panel of International Professional Engineers (IntPE(NZ)). I am a Fellow of the Institution of Professional Engineers, New Zealand (FIPENZ), and a Fellow of the New Zealand Society for Earthquake Engineering (FNZSEE).

4 I have been involved in engineering since 1960. I have worked for the New Zealand Railways, Utah Williamson Burnett on the Manapouri power scheme, and Duffill Watts and King, consulting engineers in Dunedin and Invercargill. During those periods of employment I studied part-time for the New Zealand Certificate in Engineering. I obtained that certificate with distinction, which allowed direct entry into the second professional year in the Bachelor of Engineering degree course at the University of Canterbury, which I attended in 1966 and 1967. In 1967 I joined the consulting practice Bruce-Smith Chapman and Amos in Wellington before co-founding Hadley & Robinson Limited, Consulting Engineers, in 1968. I am presently a director of that company.

5 I have been active in the development of building standards, having served on several committees of Standards New Zealand, including for NZS 3101:1982, Design of Concrete Structures, and NZS 4203:1992, General Structural Design and Design Loadings for Buildings.

6 I have also served on study groups of the New Zealand Society for Earthquake Engineering, including on the group for Seismic Design of Reinforced Concrete Walls and Diaphragms (published 1980), Structures of Limited Ductility (published 1986) and most recently on the group that developed the guidelines "Assessment and Improvement of the Structural Performance of Buildings in Earthquakes" for the Department of Building and Housing (published 2006) and on its revision, "The Seismic Assessment of Existing Buildings" (published 2016).

7 While this is not a hearing before the Environment Court, I confirm that I have read the code of conduct for expert witnesses contained in the Environment Court Consolidated Practice Note (2014). I have complied with it when preparing my written statement of evidence and I agree to comply with it when presenting evidence. I confirm that the evidence and the opinions I have expressed in my

evidence are within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

Preliminary Proposal (2013)

8 In 2013 prepared a preliminary report on possible restoration and redevelopment of the Hydro Grand Hotel (see **Appendix 1**). The report included an objective to restore the building to 100% of the new building standard (NBS). It used the procedures in the 2006 version of the NZSEE (New Zealand Society for Earthquake Engineering) Guidelines "The Assessment and Improvement of the Structural Performance of Buildings in Earthquake".

9 In 2013, an earthquake prone building was defined as one that would collapse in a moderate earthquake, defined as one that produces earthquake effects at the site one-third those of an earthquake that would be assumed for the design of a new building.

Changes in the Act and the NZSEE Procedures

10 The recent changes to the building act now define an earthquake prone building as one that reaches an ultimate limit state (a limit of strength or displacement capacity) in a moderate earthquake. The difference in earthquake intensity levels between reaching an ultimate limit state and reaching a state of collapse can be quite large, so the recent changes have introduced an increased level of expectation for buildings that are not earthquake prone.

11 The NZSEE procedures of 2006 that were used in the 2013 assessments already used the concept of reaching an ultimate limit state, and that remains so in the 2016 versions. That is, the recent changes to the act and the NZSEE procedures for assessment have not substantially changed.

12 I understand that nothing of substance has changed in the building since 2013. I therefore expect that the analyses undertaken then remains valid today.

Current expectations

13 In my opinion the proposed work outlined in my 2013 proposal would achieve 100% NBS.

14 Advances in analytical techniques, material performance parameters and knowledge since 2013 and our own experience suggest some improved detailing might be adopted, but essentially the concepts would remain as then presented.

15 I have seen the costs estimates undertaken by Mr Le Fevre of Harrisons Quantity Surveyors. These estimates were based on my 2013 preliminary proposal. The estimate is $980,090 excluding GST for the structural strengthening work.

16 This estimate is in the order of what I would expect for the structural strengthening work for buildings of this kind.

Louis Mervyn Robinson

1 December 2016

Hadley & Robinson Ltd.
Consulting Civil & Structural Engineers

9 April 2013

David McBride
PO Box
Timaru

By email: David McBride Architect dd@davidmcbride.co.nz

Dear Sir

HYDRO GRAND HOTEL, TIMARU
RESTORATION and REDEVELOPMENT
Preliminary Structural and Fire Safety Proposals

As instructed, we have investigated the restoration and redevelopment of the historically significant hotel in Timaru known as the Hydro Grand Hotel.

GENERAL REQUIREMENTS
As part of the restoration, several significant alterations will be necessary. Section 112 of the Building Act will therefore apply. This requires that means of escape from fire and access and facilities for people with disabilities is be upgraded to the standard required of a new building, as nearly as is reasonably practicable. Any proposal to restore a hotel should consider safety and access issues, so section 112 scarcely introduces anything that would not be upgraded anyway.

Alterations do not necessarily trigger any structural upgrade. However, sufficient work would be required to remedy any earthquake prone condition. Otherwise, the general requirement is that the building after the alterations is to comply with the building code to at least the same extent as before the alterations. This generally means that the structure not be weakened.

The requirements for the use as a hotel after the alterations are not likely to be additional to or more onerous than the requirements that applied for the previous use as a hotel, and so a change of use would not apply. A change of use would trigger a general upgrade for structural behaviour and fire rating behaviour. While this is not strictly required, because there is not to be a change of use, we have assumed that the objective for the structure would be the same as for a new building, as if a change of use did indeed apply.

There are other aspects that we assume would be part of the design brief. These include sound insulation between floors and between bedrooms or suitesð which is likely to be a quite challenging design problem.

Taken together, it is assumed that the building will generally be upgraded to the standard required of new hotel buildings.

Director L M Robinson BE (Hons), NZCE (Dist), FNZSEE, MIPENZ (Geotechnical, Structural), CPEng, IntPE
469 George Street, PO Box 6068, Dunedin, Phone (03) 477 8923, Fax (03) 477 0608
Email solutions@hadleyrobinson.co.nz Website: www.hadleyrobinson.co.nz

ACENZ

RETENTION of EXISTING

It is generally assumed that the external brick walls will be retained, stabilised as necessary against earthquake by connection of the walls to the floors and to the roof.

The existing timber floors are also to be retained. They will require relining for fire resistance following demolition of the existing lath and plaster ceilings. Additional ceiling may need to be installed under these for noise isolation and the practicalities of plumbing installations.

Upper levels will generally retain the timber partitions. They will need to be relined after stripping of lath and plaster linings with fire rated materials. These walls will be treated as load bearing and also as shear walls stabilising the building against lateral loads from wind and earthquake.

Layouts for the ground floor have not been produced as yet, but it is envisaged that the level will be generally fairly open spaces for the likes of reception, dining and conference facilities, restaurants and bars. For that reason, steel frames are assumed to support the upper levels and provide stability at through the ground storey.

GENERAL REQUIREMENTS for FIRE SAFETY

Risk Group

The hotel will include for temporary accommodation, though some permanent accommodation might also be included. Risk Group for fire design will be SM, and the appropriate acceptable solution will be C/AS2 which becomes mandatory from 10 April 2013.

Occupancy

When fully developed, each upper floor will accommodate 50 people (taken as the number of beds for floor). Among other matters, this will permit just one stairway.

Alarms

In general the requirements for alarms are for a Type 5 system. This involves heat detectors in all bedrooms and smoke detectors in all escape routes outside the bedrooms; plus additional smoke detectors in the bedrooms. The smoke detectors in the bedrooms will sound a local alarm and signal management to investigate if an actual fire has broken out. If it has, management will sound the general (evacuation) alarm. In addition, the heat detectors in the bedrooms and the smoke detectors in the escape routes will sound the general alarm.

There is an option to install a sprinkler system. This has some advantages, especially for fire resistance. That option should be pursued, but is not dealt with in detail here.

Fire Ratings

Fire ratings for life protection (e.g. protecting people escaping a fire) or for property protection (e.g. protection of neighbouring property) is 60 minutes. This may be halved with a sprinkler system.

Fire Separations

Each bedroom or each suite (group of bedrooms with other spaces such as lounges and kitchens) is to be fire separated from other bedrooms or suites and from the corridors. The fire resistance is to be 60/60/60 without sprinklers and 30/30/30 with sprinklers. Doors into the corridors and safe paths are to be fire doors, rated -/60/30 sm when there are no sprinklers or -/30/- sm when there are sprinklers.

Safe Path Stairs

The single stair is to be a safe path. It is to continue as a safe path through all levels, including through the ground floor, and discharge directly to the street. Any doors into the stairs are to fire doors rated -/60/30 sm without sprinklers and -/30/- sm with sprinklers.

GENERAL REQUIREMENTS for STRUCTURE

Earthquake Proneness and Upgrade levels

Appendix A outlines the formal definitions of earthquake proneness. Essentially, an earthquake prone building is one that would collapse in a moderate earthquake. A moderate earthquake is defined as one that would produce an intensity of shaking at the site one-third the intensity that would be assumed for the design of a new building. In terms that are not precise though common and perhaps acceptable, this is expressed as 33%NBS (33 percent of new building standard).

With an obvious meaning attaching to an extension of this notation, 100%NBS means that the building would not collapse in an earthquake with a level of shaking equal to that assumed in the design of a new building at the site.

This building will be designed for 100%NBS.

Design for Earthquake

Appendix B describes the various parameters used in the design of structures. Design for this building uses both the modal response spectrum method and the equivalent static method.

In brief, using the equivalent static procedure, design is based on a seismic coefficient of 0.23.

The external walls are assumed to contribute to the seismic resistance of the building. They need to be connected into the walls and roof to prevent falling out of the building under face loading and to accept shear loading along their plane to function as shear walls.

Otherwise the lateral force resisting system includes the partitions on the upper levels and the steel frames through the ground floor.

Distribution of the forces requires diaphragms. This is assumed provided by the existing floors and the new ceilings, which therefore require better than regular nailing. The roof is also assumed to contribute. The most convenient means of providing that function at roof level is to install a new ceiling there as well as under floors (because the existing lath and plaster will disintegrate if loaded in shear).

Yours faithfully

L M Robinson
DIRECTOR

Appendix A: Earthquake Proneness

Legal Requirements—earthquake proneness

The test for earthquake prone buildings is defined in section 122 of the Building Act 2004, and in associated regulations.

122 Meaning of an earthquake-prone building

(1) A building is earthquake prone for the purposes of the Act if, having regard to its condition and the ground on which it is built, and because of its construction, the building—

- *(a) will have its ultimate capacity exceeded in a moderate earthquake (as defined in the regulations); and*
- *(b) would be likely to collapse causing—*
  - *(i) injury or death to persons in the building or to persons on any other property; or*
  - *(ii) damage to any other property.*

(2) Subsection (1) does not apply to a building that is used wholly or mainly for residential purposes unless the building—

- *(a) comprises 2 or more storeys; and*
- *(b) contains 3 or more household units.*

The regulations referred to in s122 were promulgated in 2005/32 on 21 February 2005. Regulation 7 defines a moderate earthquake.

7. Earthquake-prone buildings: moderate earthquake defined

For the purposes of section 122 (meaning of earthquake-prone building) of the Act, moderate earthquake means, in relation to a building, an earthquake that would generate shaking at the site of the building that is the same duration as, but is one-third as strong as, the earthquake shaking (determined by normal measures of acceleration, velocity, and displacement) that would be used for the design of a new building at that site.

Appendix B: Earthquake Design Parameters

As a precursor to the analysis for earthquake effects using either the equivalent static or the modal response spectrum methods, eigenvalue extraction analyses were performed. Sufficient modes were extracted to ensure that 90% or more of the mass was mobilised. All modes were employed in the modal response spectrum analysis and effects combined using the CQC method.

In the design of new buildings using NZS 1170.5, the seismic coefficient is derived as follows:

$$C_d(T) = \frac{C(T)S_p}{k_\mu} \geq (Z/20 + 0.02)R_u \geq 0.03R_u$$

Where

$$C(T\ ) = C_h(T)ZRN(T_1, D)$$

In these expressions, T is the period of vibration in any mode. For the equivalent static procedure, only the first mode is considered, and T is then replaced with T_1.

For a short-period building in Timaru, assumed with 5% of critical damping, the hazard spectrum has the following values:

Period, T, seconds	Hazard spectral value, $C_h(T)$, g
0.0	1.33
0.1	2.93
0.2	2.93
0.3	2.93
0.4	2.36
0.5	2.00
0.6	1.74
0.7	1.55
0.8	1.41
0.9	1.29
1.0	1.19
1.5	0.88
2.0	0.66

For the equivalent static procedure, a short-period building is taken as having a period of 0.4 seconds. The building is of ordinary risk, with no more than 500 people accommodated in it. With the site remote from an active fault and composed of shallow soils,

$$C_h(T_1) = 2.36 \qquad Z = 0.15 \qquad R = 1.0 \qquad N(T_1, D) = 1.00$$

Hence,

$$C(T_1) = 0.354$$

In this building, there will be energy dissipation by two principal mechanisms:

1. Dissipation by ductile yielding, especially yielding of the structural steel frames and nails in the timber floors and partitions. This is taken into account with the factor k_μ and also in the structural performance factor S_p.

$$k_{\mu} = \frac{(\mu - 1).T_1}{0.7} + 1$$

and

$$S_p = 1.3 - 0.3\mu$$

If a ductility factor μ = 1.5 is assumed for compatibility with the brickwork, k_{μ} = 1.29 and S_p = 0.85,

$$C_d(T_1) = 0.234$$

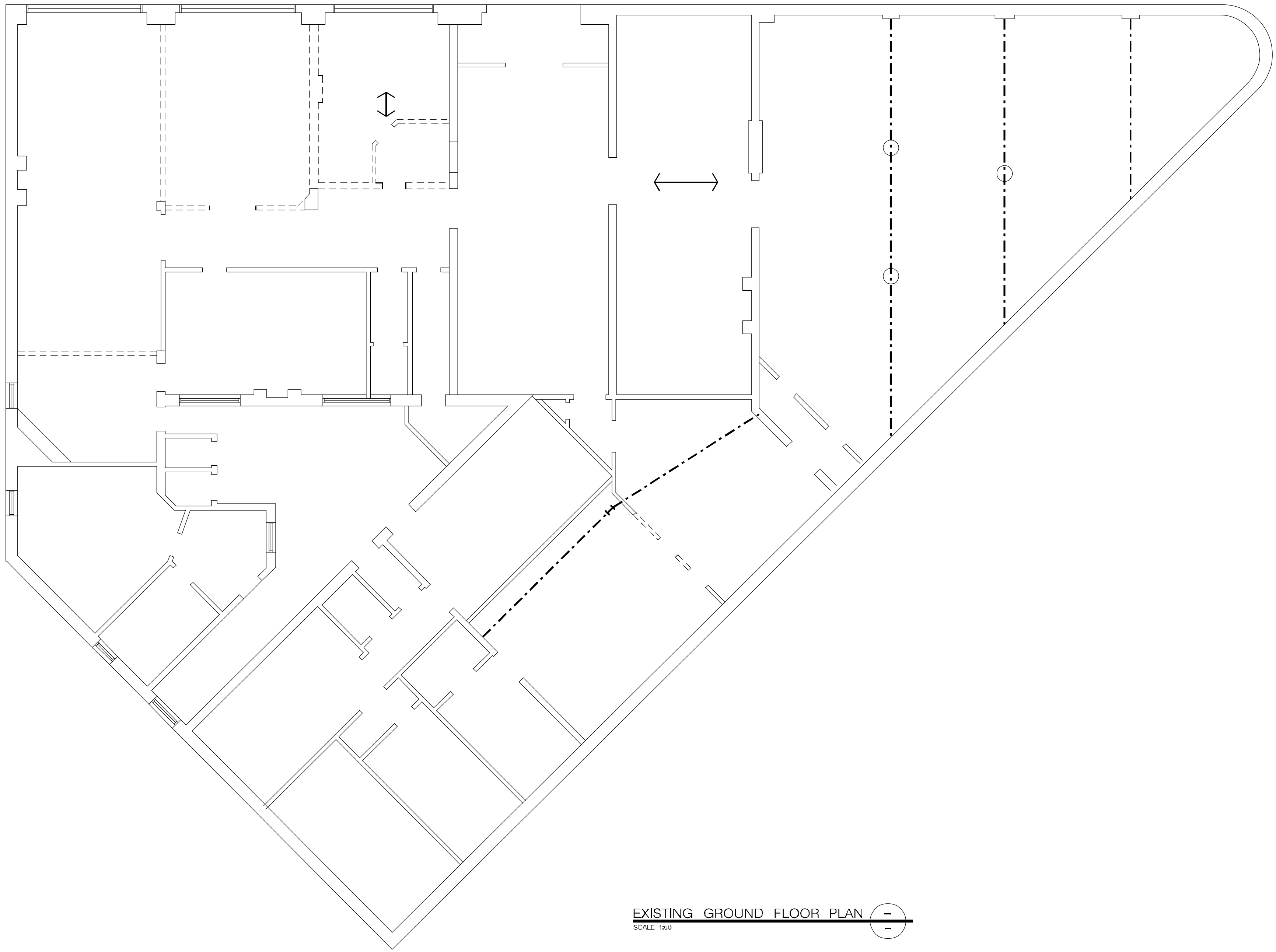
2. Dissipation will also occur through damping especially related to sliding shear in masonry. NZSEE Guidelines, Section 10, suggests that 15% equivalent viscous damping may be assumed for masonry, with similar sources of energy dissipation. This is taken into account by the additional factor

$$k_{\xi} = \left(\frac{7}{2 + \xi}\right)^{0.5} = 0.64$$

So, for the equivalent static procedure,

$$C_d(T_1) = 0.227$$

In the assessments undertaken on this building this factor is not taken as additional to that arising from ductile yielding. However, it is noted that the two coefficients are compatible, at roughly 0.23.



PRELIMINARY

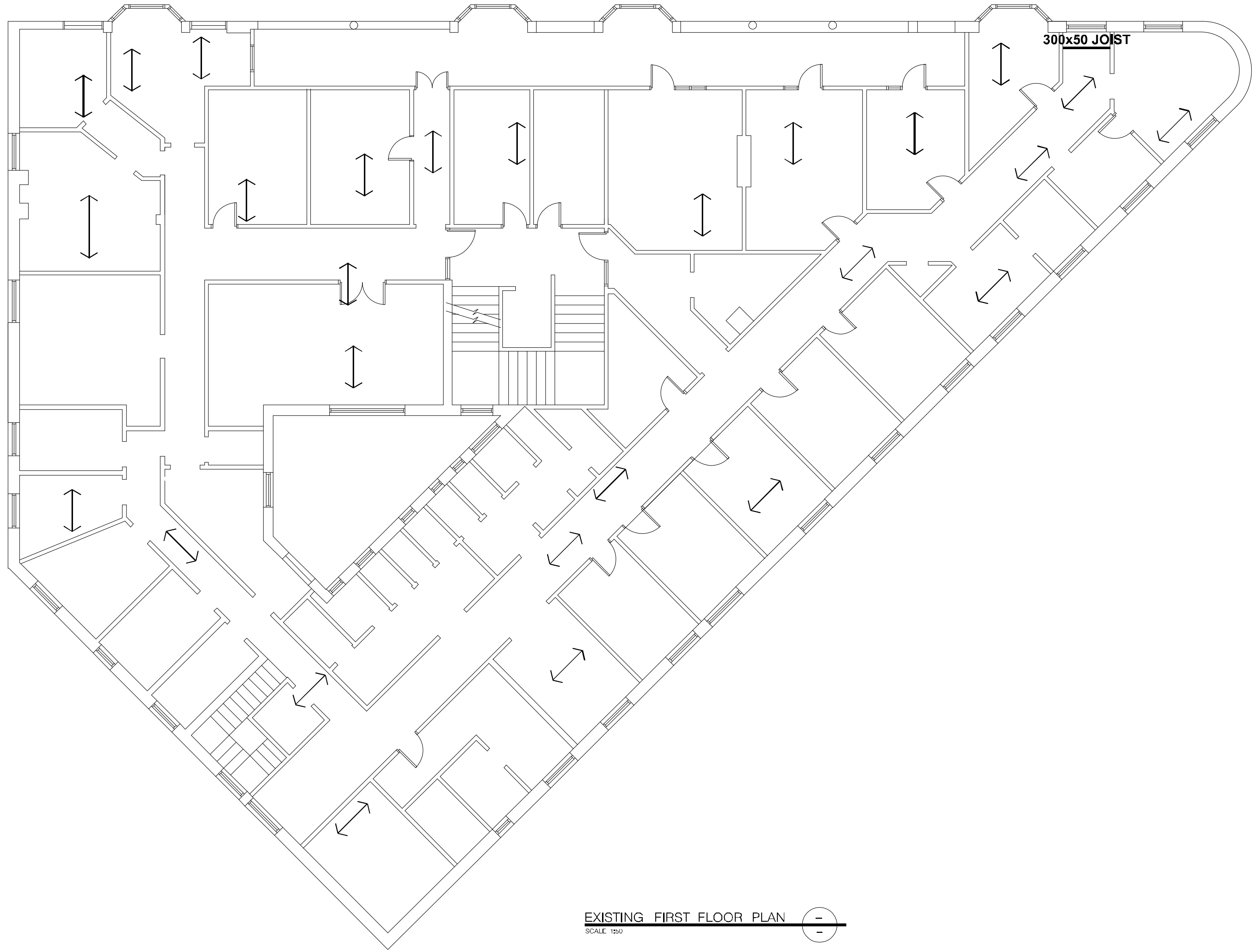
CONFIRM ALL DIMENSIONS AND PROFILES WITH DETAILS. CONTRACTOR TO CHECK ALL DIMENSIONS ON SITE. DO NOT SCALE

Model: S01
File: P:\12067-10-26_TheBayHill_Timaru_Hydro_Hotel\Stage 3 - Building Consent Design & DWG Files\Drawing CAD Files\MicroStation 12067-design.dgn

Hadley & Robinson Ltd.
Consulting Civil & Structural Engineers
469 GEORGE STREET, TELEPHONE (03)477-8923 FAX (03)477-0608 PO BOX 5068, DUNEDIN 9058

HYDRO GRAND HOTEL REDEVELOPMENT
10-26 THE BAY HILL, TIMARU.

CONTRACT No	DATE		REVISION	DESIGN LMR / DRAWN MCVB	EXISTING GROUND FLOOR PLAN	SHEET No
12067	-	-	-	DATE NOV 2012	SCALE As Noted @A1 PLOTTED: 9/04/2013 3:51:13 p.m.	S01 IN SET OF -



EXISTING FIRST FLOOR PLAN
SCALE 1:250

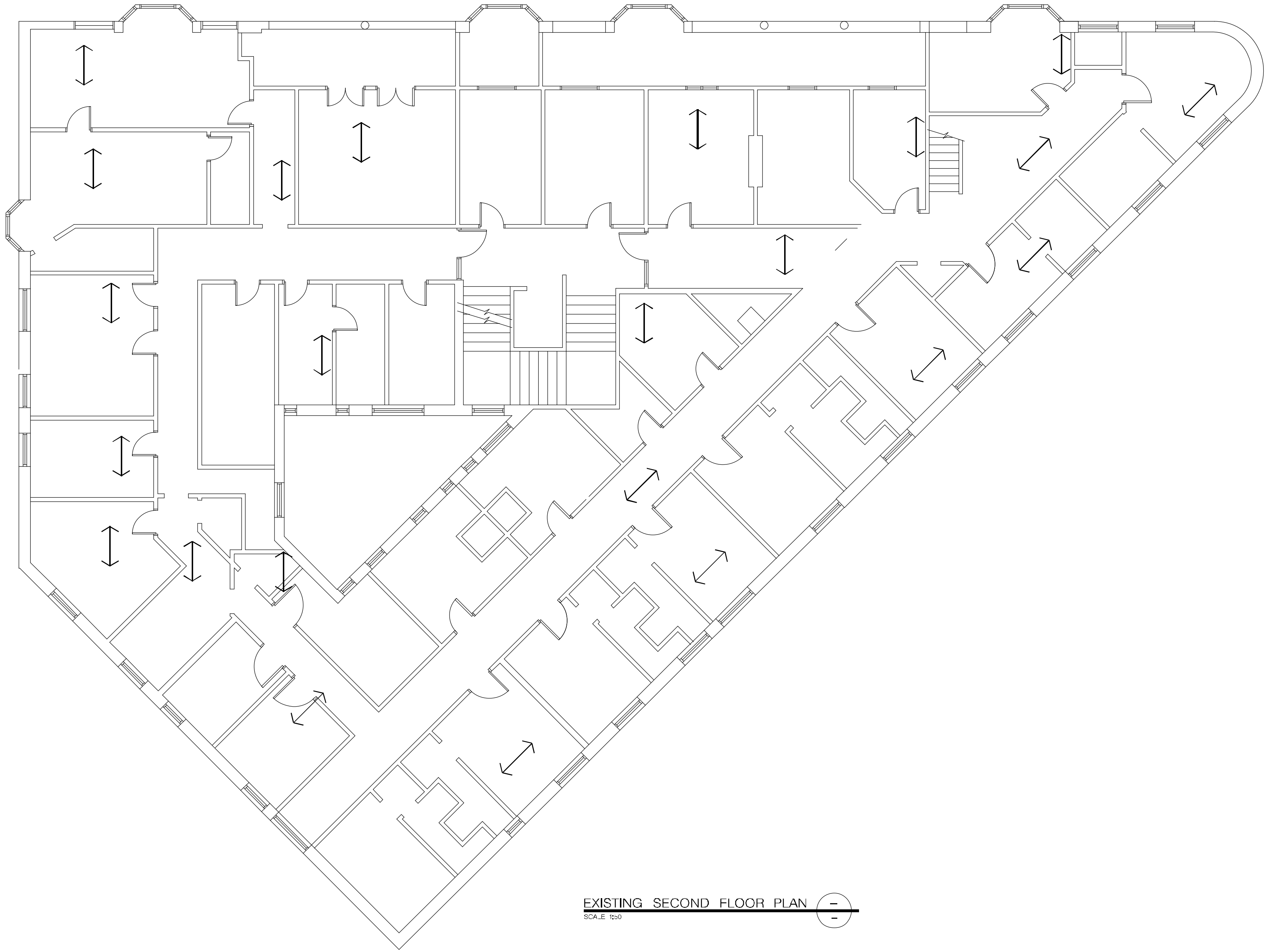
PRELIMINARY

CONFIRM ALL DIMENSIONS AND PROFILES WITH DETAILS. CONTRACTOR TO CHECK ALL DIMENSIONS ON SITE. DO NOT SCALE

Hadley & Robinson Ltd.
Consulting Civil & Structural Engineers

HYDRO GRAND HOTEL REDEVELOPMENT
10-26 THE BAY HILL, TIMARU.

CONTRACT No	DATE	REVISION	DESIGN / DRAWN		SHEET No
12067			JMR / MCVB	EXISTING FIRST FLOOR PLAN	S02
			DATE NOV 2012	SCALE As Noted @A1	



PRELIMINARY

CONFIRM ALL DIMENSIONS AND PROFILES WITH DETAILS. CONTRACTOR TO CHECK ALL DIMENSIONS ON SITE. DO NOT SCALE

Hadley & Robinson Ltd.
Consulting Civil & Structural Engineers

HYDRO GRAND HOTEL REDEVELOPMENT
10-26 THE BAY HILL, TIMARU.

CONTRACT No	DATE	REVISION	DESIGN / DRAWN		SHEET No
12067			JMR / MCVB	EXISTING SECOND FLOOR PLAN	S03
			DATE NOV 2012	SCALE As Noted @A1	

PROPOSED GROUND FLOOR STRENGTHENING PLAN
SCALE 1:50

NOTE:

ALL EXISTING PARTITIONS ASSUMED REMOVED FOR REDEVELOPMENT FOR RESTAURANTS AND BARS.
ALL BEAMS SHOWN ARE ABOVE.
POSITIONS OF BEAMS DICTATED BY EXISTING LAYOUTS ABOVE. REFER TO SHEET S05.
ALLOW NEW COLUMNS TO BE 406x9.5 CHS.
PRIMARY AND SECONDARY BEAMS TO BE 410UB54 BEAMS.
REFER TO COLUMN HEAD DETAIL FOR CONNECTION OF PRIMARY BEAMS.
FOUNDATION PADS TO ALL COLUMNS TO BE 2500x2500x750 REINFORCED CONCRETE.

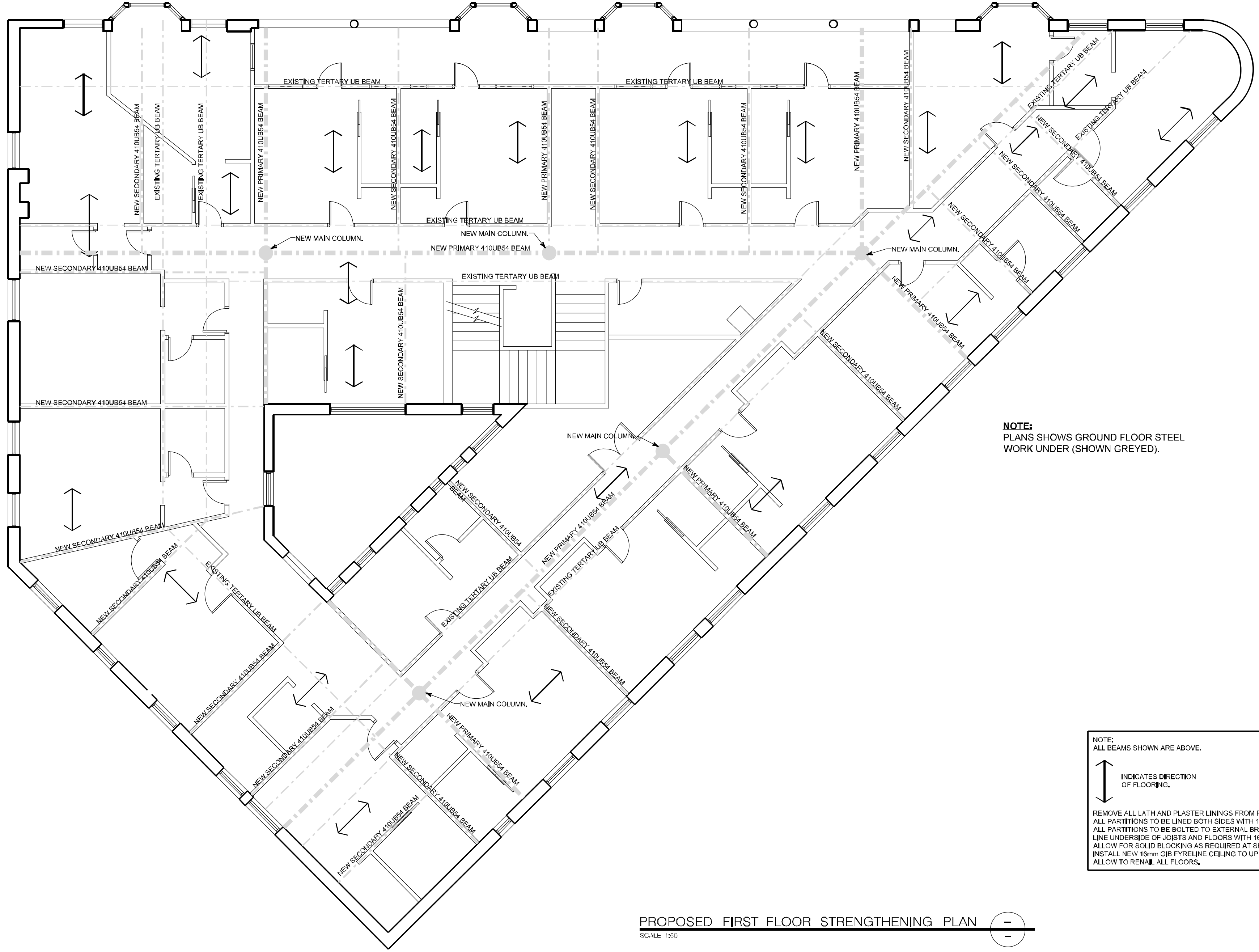
PRELIMINARY

CONFIRM ALL DIMENSIONS AND PROFILES WITH DETAILS. CONTRACTOR TO CHECK ALL DIMENSIONS ON SITE. DO NOT SCALE

Hadley & Robinson Ltd.
Consulting Civil & Structural Engineers

HYDRO GRAND HOTEL REDEVELOPMENT
10-26 THE BAY HILL, TIMARU.

CONTRACT No	DATE	REVISION	DESIGN / DRAWN		SHEET No
12067			JMR / MCVB	PROPOSED GROUND FLOOR STRENGTHENING PLAN	S04
			DATE NOV 2012	SCALE As Noted @A1	



PROPOSED FIRST FLOOR STRENGTHENING PLAN
SCALE 1:50

NOTE:
PLANS SHOWS GROUND FLOOR STEEL WORK UNDER (SHOWN GREYED).

NOTE:
ALL BEAMS SHOWN ARE ABOVE.

INDICATES DIRECTION OF FLOORING.

REMOVE ALL LATH AND PLASTER LININGS FROM PARTITIONS AND CEILINGS.
ALL PARTITIONS TO BE LINED BOTH SIDES WITH 13mm GIB FYRELINE TO PROVIDE 60/60/60 FRR.
ALL PARTITIONS TO BE BOLTED TO EXTERNAL BRICKWORK WALLS.
LINE UNDERSIDE OF JOISTS AND FLOORS WITH 16mm GIB FYRELINE TO PROVIDE 60/60/60 FRR.
ALLOW FOR SOLID BLOCKING AS REQUIRED AT SHEET EDGES.
INSTALL NEW 16mm GIB FYRELINE CEILING TO UPPER STOREY (UNDER ROOF).
ALLOW TO RENAIL ALL FLOORS.

CONFIRM ALL DIMENSIONS AND PROFILES WITH DETAILS. CONTRACTOR TO CHECK ALL DIMENSIONS ON SITE. DO NOT SCALE

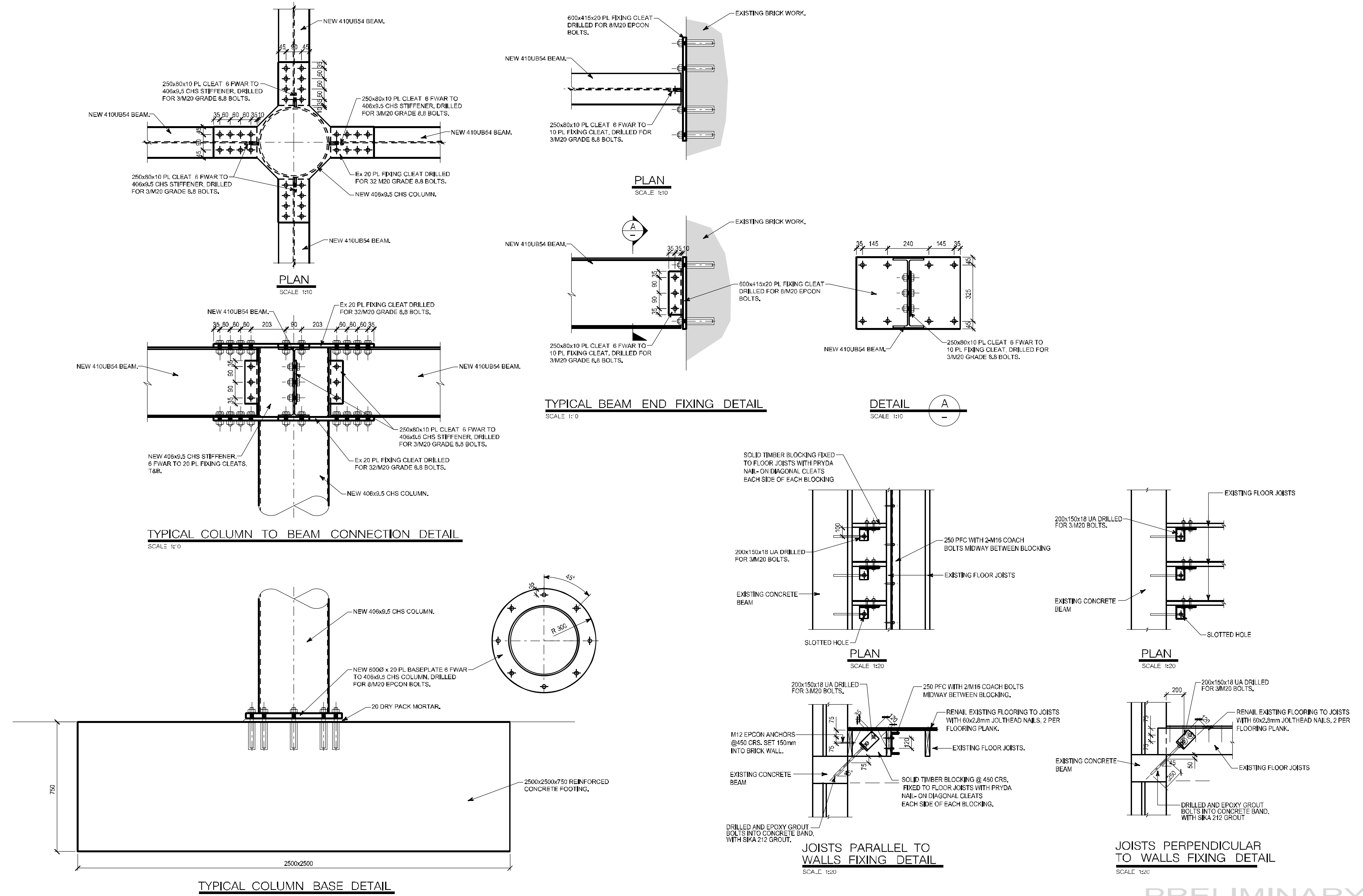
Hadley & Robinson Ltd.
Consulting Civil & Structural Engineers
469 GEORGE STREET. TELEPHONE (03)4774923 FAX (03)4774905 PO BOX 6069, DUNEDIN 9059

HYDRO GRAND HOTEL REDEVELOPMENT
10-26 THE BAY HILL, TIMARU.

CONTRACT No	DATE	REVISION	DESIGN / DRAWN	TITLE	SHEET No
12067			JMR / MCVB	PROPOSED FIRST FLOOR STRENGTHENING PLAN	S05

DATE NOV 2012 | SCALE As Noted @A1 | PLOTTED: 9/04/2013

Model: S05



PRELIMINARY

CONFIRM ALL DIMENSIONS AND PROFILES WITH DETAILS. CONTRACTOR TO CHECK ALL DIMENSIONS ON SITE. DO NOT SCALE

Hadley & Robinson Ltd.
Consulting Civil & Structural Engineers

HYDRO GRAND HOTEL REDEVELOPMENT
10-26 THE BAY HILL, TIMARU.

CONTRACT No	DATE	REVISION	DESIGN / DRAWN		SHEET No
12067			JMR / MCVB	PROPOSED STRENGTHENING DETAILS	S06
			DATE NOV 2012	SCALE As Noted @A1 PLOTTED: 9/04/2013	