

Released by the Canterbury Earthquake Recovery Authority

**Majestic Church**  
**Structural Assessment &  
Strengthening Report**  
for building at  
**126 Manchester Street**  
**Christchurch**

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19 December 2011

Majestic Church Trust  
C/- [REDACTED]  
David Smith Architects Ltd  
PO Box 470  
Christchurch 8140

Dear [REDACTED]

**Re: Majestic Church – 126 Manchester Street, Christchurch  
Structural Assessment & Strengthening Report**

## Introduction

Structex Metro has been engaged by Majestic to carry out a damage survey and seismic assessment of the existing Majestic Church building at 126 Manchester Street, Christchurch.

Structex have previously carried out a visual survey of the building in late 2009 and early 2010 and completed a structural building report and seismic assessment, dated 6 April 2010.

Since then Christchurch has experienced a number of significant earthquakes, on 4 September 2010, 26 December 2010, 22 February 2011 and two on 13 June 2011. Various inspection of the building were carried out following these events and the reports are included in the appendix of this report. Although some damage occurred following the 4 September 2010 and 26 December 2010 earthquakes, most building damage has occurred as a result of the 22 February 2011 earthquake.

Since the previous seismic assessment was completed, the zone factor for Christchurch was amended in May 2011 from  $Z=0.22$  to  $Z=0.30$  representing a 36% increase in seismic design loads.

The purpose of this report is to:

- (a) Summarise the damage resulting from the earthquakes.
- (b) Assess the building to determine if it is earthquake prone.
- (c) If the building is earthquake prone, provide strengthening options to achieve 33% and 67% current code, and
- (d) Advise on any immediate safety concerns within and around the building.

### Limitations of Report

Findings presented as part of this report are for the sole use of our client, the Majestic Church and their consultants to assist with insurance assessments on this building. The findings are not intended for use by other parties, and may not contain sufficient information for the purposes of other parties or other uses.

Our professional services are performed using a degree of care and skill normally exercised, under similar circumstances, by reputable consultants practicing in this field at this time. No other warranty, expressed or implied, is made as to the professional advice presented in this report.

The assessment is carried out for the building in its pre-earthquake, undamaged state.

### Executive Summary and Recommendations

The Majestic Church building has had extensive damage as a result of the recent Christchurch earthquakes, the majority of the damage occurring as a result of the 22 February 2011 earthquake.

The Majestic Church building includes a stage area at the east end with basement below, auditorium located in the middle section of the building, and a 4-storey area complete with mezzanine concrete roof and part basement located at the west end.

The building was constructed in the late 1920s and is primarily constructed of reinforced concrete, although some walls are constructed of unreinforced masonry.

Building damage includes extensive cracking of concrete and masonry walls, and some dislodging of plaster ceilings in the auditorium. The most significant damage is a substantial bow of 162mm in the east stage wall and the proscenium wall. This has resulted in a partial collapse of part of the auditorium roof adjacent to the proscenium wall. The toilets in the north-east corner of the building have collapsed as a result of the adjacent building collapsing onto it.

The stage area will require demolition and reconstruction as a result of the nature and extent of the damage. The north-east corner toilets will also require reconstruction.

Other areas of damage can be repaired, although the repairs will be extensive.

The building has been assessed to have a seismic strength of between 17% and 65% current code in the transverse (north-south) direction, and a strength of between 36% and 100% current code in the longitudinal (east-west) direction. Other areas of the building such as the face load on the rear wall of the stage, face loaded masonry walls, particularly above the proscenium wall, have a seismic capacity of between 14% and 65% of current code.

Substantial areas of the building have a strength of less than 33% current code, and the building is therefore earthquake prone and will require seismic strengthening work to be carried out.



Strengthening in the form of insitu concrete skin walls at selected locations and roof bracing will increase the longitudinal strength up to 33% or 67% of current code, depending on the extent of structural work.

Removal of the stage area will eliminate the immediate hazard associated with the damaged rear wall of the stage and proscenium wall, however, this will also reduce the transverse capacity of the auditorium area, requiring additional temporary bracing to the auditorium as well as a new temporary end wall for security and weather tightness.

Alternatively, substantial props could be installed to the end wall of the stage to provide temporary support.



## Building Form

A number of visits have been made to the site, primarily to view structural elements of the building and compare the form of the current building with the original drawings that were available.

A number of alterations have been carried out to the building with the main structural alteration being the removal of the existing ground floor concrete columns in the south west corner, and replacing these with more slender steel posts.

A selection of the original John Fuller & Sons construction drawings were made available, as well as a set of 'as built' drawings from David Smith Architects.

The building was originally constructed in the late 1920s and measures approximately 56m long and 28m wide.

It can be divided into three main areas which include the stage area at the eastern end, the adjacent auditorium and a 4-storey office area and mezzanine floors at the west end.

A basement is located below the stage area, and the office area has a basement located below the western portion only.

The exterior of the building is constructed with concrete encased steel frames and 8" concrete walls which are perforated with window and door openings along the south wall facing Lichfield Street. Two internal transverse concrete encased steel frames are also present, one at each end of the auditorium which are in-filled with brick panels. Large portions of brick infill are present in the proscenium wall, each side of the stage and at high level above the archway.

The two side walls of the auditorium are also lined with brick on the inside face.

The office floors are reinforced concrete slabs, 5"-6" thick and are supported on a grillage of concrete encased steel beams. The roof of the office area is also concrete of similar construction and has been overlaid with a build-up of timber with a combination of butynol and long-run roofing.

The roof over the auditorium and stage includes metal roofing on sarking on timber purlins supported on long span steel trusses, spanning the full width of the auditorium. A different arrangement of trusses is present over the stage to provide support for the fly tower.

Extensive drilling work was carried out on site on 23 March 2010 to determine the extent of brick and concrete walls.

Parapets to the building perimeter are all reinforced concrete, while the large gable over the proscenium wall is constructed of brick.

Generally, internal walls are constructed of brick infill panels between the concrete encased steel frames, except for the reinforced concrete stairs which are bound by insitu concrete walls. The only exception to this is the south wall of the north-west stair which is brick.

Generally, prior to the commencement of the earthquakes the building was in structurally good condition for its age with little or no evidence of cracks to the internal walls. Normally this would be most apparent between the brick infill walls and the concrete frames, however the lack of cracking indicates that very little differential building settlement had occurred.

There were some notable cracks to the external concrete wall on the north side of the building as well as in the middle of the back wall of the stage. Water has penetrated these cracks, and corroded the reinforcing resulting in some cover concrete spalling off the building.

## Earthquake Damage

A graphical presentation of the extent of damage is outlined in the attached drawings.

The following is a summary of the areas and types of damage that has occurred:

- Cracking to unreinforced masonry and concrete internal walls and reinforced concrete external walls and frames.
- Cracking and spalling of lathe and plaster ceiling to the gallery floor soffit and auditorium ceiling.
- Partially collapsed roof over auditorium adjacent to the proscenium wall.
- Significant bow in proscenium and rear wall measured at 191mm out of vertical from the base of the wall, of 162mm bow relative to the two side walls.
- Flooding to east basement.
- The partially collapsed roof adjacent to the proscenium wall has leaked causing substantial damage to the proscenium archway, stage and carpets to the auditorium.
- The toilets in the north-east corner have collapsed as a result of the adjacent building collapsing onto it.
- Existing cracks to the building have enlarged in some areas.

A series of photographs taken on 16 November 2011 is included at the back of this report, highlighting the damage observed.

## Level & Verticality Survey

A level survey was carried out over the ground and third floor as well as a verticality survey of the perimeter walls.

The most significant area that is out of verticality is the east wall which is out of plumb by 190mm over the height of the building and has an outward bow of 162mm relative to the two side walls. This is reflected in the proscenium wall which is also significantly bowed. The rear wall and proscenium wall are both deformed beyond repair and will require reconstruction.

The verticality of the remaining areas of the building that were measured are generally acceptable, being out of plumb by up to about 30mm over the height of the building.

The floor at level 3 was generally level to within 0.25% (5mm over 2.0m) with one area being out of level by 0.44%, indicating that the main structure has not settled. Ground floor levels were also generally within 0.25% with one area in the south-west room being out of level by 25mm over 7m, which is 0.36%, although this may be historical.

Below is an explanation of recommended level tolerances for domestic floors published by the Department of Building & Housing, however these guidelines are being reviewed with the intention of relaxing the criteria.

*"Guidance on House Repairs and Reconstruction Following the Canterbury Earthquake" document issued by the Department of Building and Housing recommends the following action for floors and foundations that have settled:*



- Floors out of level by less than 0.25% (5mm over 2m), over a length of at least 2m, no action necessary.
- Floors out of level by between 0.25% and than 0.50% (5mm - 10mm over 2m), over a length of at least 2m, re-levelling required.
- Floors out of level by more than 0.50% (10mm over 2m), over a length of at least 2m, demolish and rebuild.

## Seismic Assessment

A seismic assessment of the building has been carried out to determine if the building or parts of the building are earthquake prone.

A building is regarded as earthquake prone if its ultimate strength is exceeded when subject to an earthquake load of 33% of an equivalent new building.

As this building has an auditorium which has seating for more than 300 people, it is classed as an importance level 3 structure and assessed for a 1/1000 year return period earthquake. This earthquake force is 30% greater than what a normal building is designed to, which is for a 1/500 year return period earthquake.

The geometry of this building is complex and earthquake forces must pass through dependable load paths to seismic resisting elements. The building has therefore been assessed in three parts (stage, auditorium and office areas) when assessing seismic lateral loads in the north-south direction, and in two parts when assessing seismic lateral loads in the east-west direction (stage and auditorium combined, and office area).

A seismic assessment of the building has been carried out using AS/NZS 1170.5 to determine the applied loadings to the building using the equivalent static method of analysis. The zone factor for Christchurch has recently been increased from 0.22 to 0.30, following the 22 February 2011 earthquake. This has resulted in an increase in seismic load of 36% and has been included in the building assessment. Relevant sections of the New Zealand Concrete Code NZS 3101, the NZ Society of Earthquake Engineering Guidelines, June 2006, have been used to assess the building capacity.

Various aspects of the building are assessed to determine load paths to the seismic resisting elements, such as frames and walls. The capacities of these elements are also assessed to determine their in-plane shear strength, in-plane flexural strength, rocking capacity, and out-of-plane strength when subject to face loads.

The assessed strengths are expressed as a percentage of the full code requirements which is summarised in the table below.

Elements that have less than 33% of current code strength are regarded as being earthquake prone and are highlighted in bold.



### Transverse Direction (north-south - across building)

Element	Mode	% Code
Stage Area plus ½ of auditorium east end <sup>(1)</sup>	shear	65%
	flexure	60%
Auditorium, central area <sup>(2)</sup>	deflection	<b>14%</b>
Office Area plus ½ of auditorium west end	shear	<b>17%</b>
	flexure	58%

### Longitudinal Direction (east-west - along the building)

Element	Mode	% Code
Stage & auditorium area	shear	100%
	flexure	100%
Office area	shear	36%
	flexure	39%

### Other Items

Element	% Code
Face Load – Side Walls Auditorium (assumes restraint at top of wall)	65%
Face Load – East Wall of Stage (allows for no restraint at top of wall)	<b>22%</b>
Face Load – Unreinforced masonry walls 220 thick skin office area	Ground 57% First 38% <b>Second 32%</b>
Face Load – Unreinforced masonry proscenium wall 220 thick skin	Ground 33% <b>Above Ground 14%</b>

- Notes <sup>(1)</sup> the distribution of load resisting elements in the stage end are poor and likely to result in reduced seismic performance of this area.
- <sup>(2)</sup> The auditorium is supported by side wall columns and a series of roof trusses, and is very flexible. While there is no dependable roof diaphragm, this area of the building appears to have performed well with redundancy in the structure associated with the ceiling, roofing, sarking and galley floor, assisting in distributing loads to the stage and office area.

The results of this assessment indicate that parts of the building are earthquake prone.

Significant structural work is required to the building to address the earthquake prone aspects. These are outlined in the following sections of the report.

One area of concern is the east wall of the stage and the proscenium wall which are bowed out significantly and have relatively low seismic strength under face loads.

It is recommended the area to the east of the wall be fenced off until a decision is made regarding the repair and strengthening of the building. Collapsing of the rear wall will also result in significant damage and possible collapse of other areas of the structure. It is therefore recommended that the rear wall is propped to stabilise this portion of the building.



Alternatively, the stage area would require demolition to remove this hazard. This would then require the installation of a large temporary end wall to the east end of the auditorium as well as temporary cross bracing to the auditorium to provide additional transverse stability to this area of the building. Installation of diagonal braces is most likely to require the removal of sections of the timber ground floor and gallery floor to allow footings and braces to be installed.

### Other issues:

The internal walls of the auditorium appear to be of cavity construction with a brick veneer placed on the inside of the exterior reinforced concrete wall. It is unlikely the veneer will be adequately tied to the structural wall and further investigation should be carried out to determine the extent of ties present, if any. It is likely that enhancement of these ties will be required, particularly at high level.

Other internal unreinforced masonry walls can fail under seismic face load where the height to thickness ratio is large. In this case, masonry walls will require removal or strengthening. Strengthening can be carried out by installing steel posts on the face of the wall at regular centres. The most vulnerable masonry walls are the infill panels associated with the high and large proscenium wall.

## Seismic Repairs & Strengthening

### (a) Repairs

A number of repairs are required to be carried out to reinstate the building to its pre-earthquake condition.

A summary of the building damage is included in this report, which is also outlined in the relevant drawings.

The costs associated with the repairs will require assessment by a quantity surveyor who will need to visit the site to view the extent of damage.

A general outline of repairs is as follows:

- Cracked mortar joints to unreinforced masonry wall shall be raked out to a depth of 40mm and re-pointed.
- Small cracks (<1.0mm) to concrete walls and concrete frames shall be injected with epoxy grout.
- Large cracks (<3.0mm) will require a section of the wall to be broken out and new reinforcing (H12 at 300 centres) to be drilled and epoxy grouted into place, and the wall section re-cast.
- Cracks between 1.0mm and 3.0mm may be repaired using one of the above options, but will require initial breaking out of the concrete to allow the reinforcing to be viewed and possibly tested for excessive strain, fatigue and corrosion.
- Lathe and plaster ceiling will require checking for any loose plaster. Loose plaster will require removal and reinstatement.
- The east wall of the stage and proscenium wall is significantly bowed and is impractical and dangerous to repair. It is strongly recommended that the stage structure (rear wall, side walls and proscenium wall, including stage and basement) is removed and reconstructed.

- The partially collapsed roof over the auditorium may be reinstated after the proscenium wall is reconstructed.
- The collapsed toilets in the north-east corner will require reconstruction.
- Existing cracks in concrete walls which have enlarged will require grout injection.

**(b) Strengthening to 33% Code**

In addition to the repairs outlined in the previous section, the following strengthening work is required to achieve a seismic strength of 33% current code.

Refer to the attached drawings for details of the required seismic strengthening.

- Remove internal masonry veneer from auditorium and replace with timber framing, or install brick ties to fix veneer to concrete wall.
- Remove and replace existing masonry walls, as shown, or strengthen with SHS posts.
- Remove part of masonry wall to rear of auditorium and replaced with 200mm reinforced concrete shear wall.
- Install new reinforced concrete frame from ground to first floor at west end of building.
- Install steel or concrete tie beam at level 3 and roof, each side of the auditorium to connect west end offices to auditorium.
- Install roof bracing over auditorium.

**(c) Strengthening to 67% Code**

In addition to the repairs outlined in section (a), the following strengthening work is required to achieve a seismic strength of 67% current code.

- Remove internal masonry veneer from auditorium and replace with timber framing, or install brick ties to fix veneer to concrete wall.
- Remove and replace existing masonry walls, as shown, or strengthen with SHS posts.
- Remove part of masonry wall to rear of auditorium and replaced with 250mm reinforcing concrete shear wall.
- Install new reinforced concrete frame from ground to second floor at west end of building.
- Install steel or concrete tie beam at level 3 and roof, each side of the auditorium, to connect west end offices to auditorium.
- Install roof bracing over auditorium.

Refer to the attached drawings for outline of the seismic strengthening required.

## Ground Conditions

No liquefaction was observed on the site, and the building does not appear to have settled as a result of the recent earthquakes.

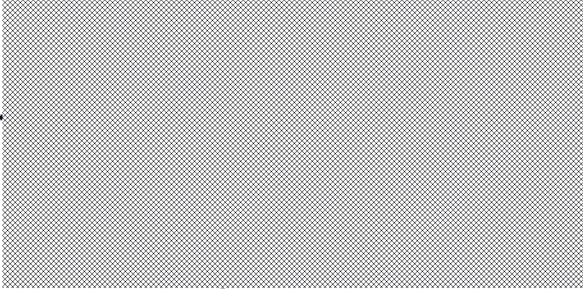
A gravel layer, near the ground surface is present along Lichfield Street, west of this site, and is classed as 'good ground', based on a desktop study for a nearby site.

A geotechnical site investigation has not been carried out, however this will be required prior to undertaking any repairs or reconstruction. Some initial information maybe obtained by carrying out a desktop study, based on geotechnical information in the area.

If you have any queries regarding the above Structural Assessment Report, please do not hesitate to contact the undersigned.

Yours sincerely

**Structex Metro Limited**



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## Appendix

### 1. Building Act Requirements

The Building Act 2004 came into force on 31 March 2005 along with the Building Regulations.

In considering the structure of existing buildings the relevant sections of the Act are as follows:

*Section 124 – Powers of territorial authorities in respect of dangerous, earthquake-prone, or unsanitary buildings*

If the Territorial authority is satisfied that a building is dangerous or earthquake prone, the Territorial Authority may:

- (a) put up a hoarding or fence to prevent people approaching the building;
- (b) place a notice on the building warning people not to approach the building, or
- (c) give written notice requiring work to be carried out on the building to reduce or remove the danger.

*Section 122 – Meaning of earthquake-prone building*

This section of the Act deems a building earthquake prone if its ultimate strength capacity would be exceeded, and the building would be likely to collapse causing injury or death, in a "moderate earthquake". The size of a "moderate earthquake" is defined in the Building Regulations as one third the size of the earthquake used to design a new building at that site.

*Section 112 – Alterations to Existing Buildings*

This section requires that after any alterations, the building shall continue to comply with the structural provisions of the Building Code to at least the same extent as before the alteration. This means that alteration work cannot weaken the building. Additional building strength would therefore be required where structural elements are to be removed or weakened, or additional mass to be added. The building will also need to be assessed in terms of the egress from fire, and access for persons with disabilities provisions of the Building Code and upgraded to comply, as nearly as is reasonably practicable.

*Section 67- Waivers and Modifications*

This section allows the Territorial Authority to grant a Building Consent subject to waivers or modifications of the Building Code. The Territorial Authority may impose any conditions they deem appropriate with respect to the waivers or modifications.

The Building Act was also altered by the Canterbury Earthquake (Building Act) Order 2010, which, amongst other things, gave additional powers to the Territorial Authorities, extended the definition of a dangerous building and extended the Schedule 1 list of building work exempt from Building Consent.



## 2. Christchurch City Council Requirements for Earthquake-Prone Buildings

The Christchurch City Council adopted a new policy for earthquake-prone buildings in September 2010.

The policy reflects the Christchurch City Council's determination to reduce earthquake risk to buildings and ensure that Christchurch "is a safe and healthy place to live in" and may be viewed on the Christchurch City Council website.

In summary, the relevant items of the policy are as follows:

- (a) Buildings are assessed using the New Zealand Society of Earthquake Engineering (NZSEE) guidelines with applied loadings from AS/NZS 1170.5 and are classed as earthquake prone if its strength is less than 33% of the applied loading from the loading standard AS/NZS 1170.5.
- (b) It outlines the Council's approach to earthquake-prone buildings including identification, prioritisation, timeframes and implementation. In general, Importance Level 4 buildings (Post-disaster facilities, as defined by AS/NZS1170) will have 15 years from 1 July 2012 to either be strengthened or demolished. Importance Level 3 (crowd or high value) buildings will have 20 years and Importance Level 2 (normal) buildings will have 30 years. There are also additional triggers for requiring assessment and strengthening work to be undertaken at an earlier stage (including "significant" alterations or earthquake damage).
- (c) The Council has a commitment to maintaining the intrinsic heritage values of Heritage buildings and has some discretion with regards to strengthening levels and methods. Each building will require discussion with Council Heritage team and Resource Consent prior to any strengthening or repair works being undertaken.

To date the Council has identified 67% of current Code as the target level for strengthening of earthquake-prone buildings. For buildings with a damaged building strength >33% current Code it is recommended (but not required) that the building also be strengthened to 67% of Code requirements

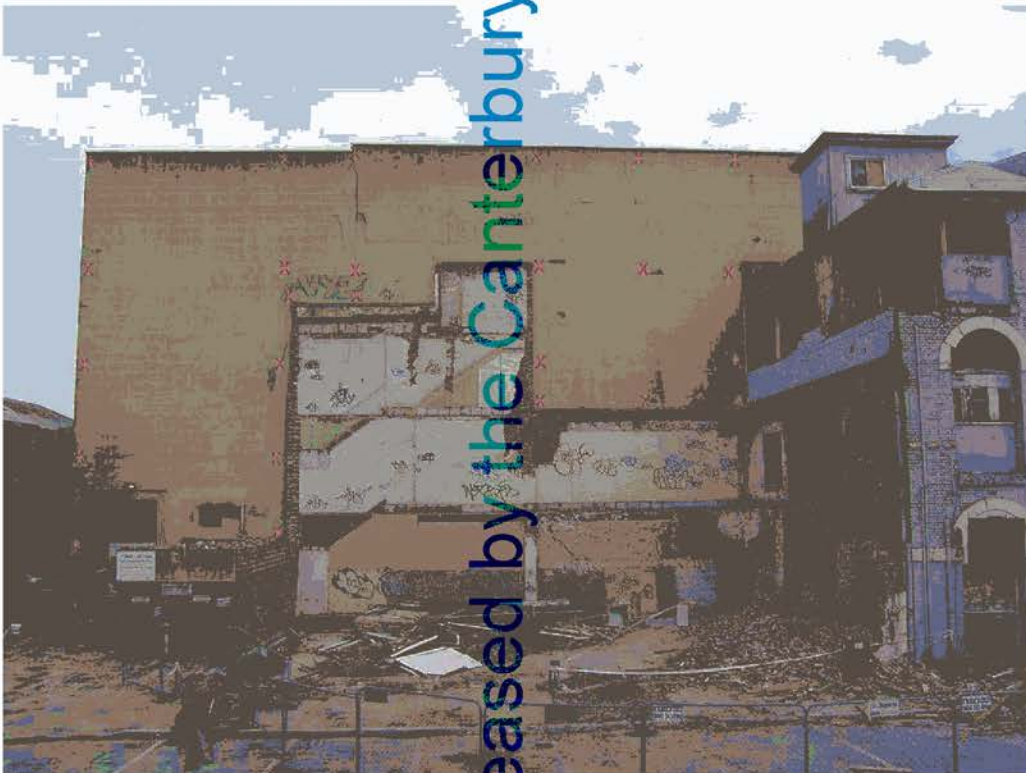
**3. Drawings:**

- **Damage**
- **Strengthening to 33% code**
- **Strengthening to 67% code**

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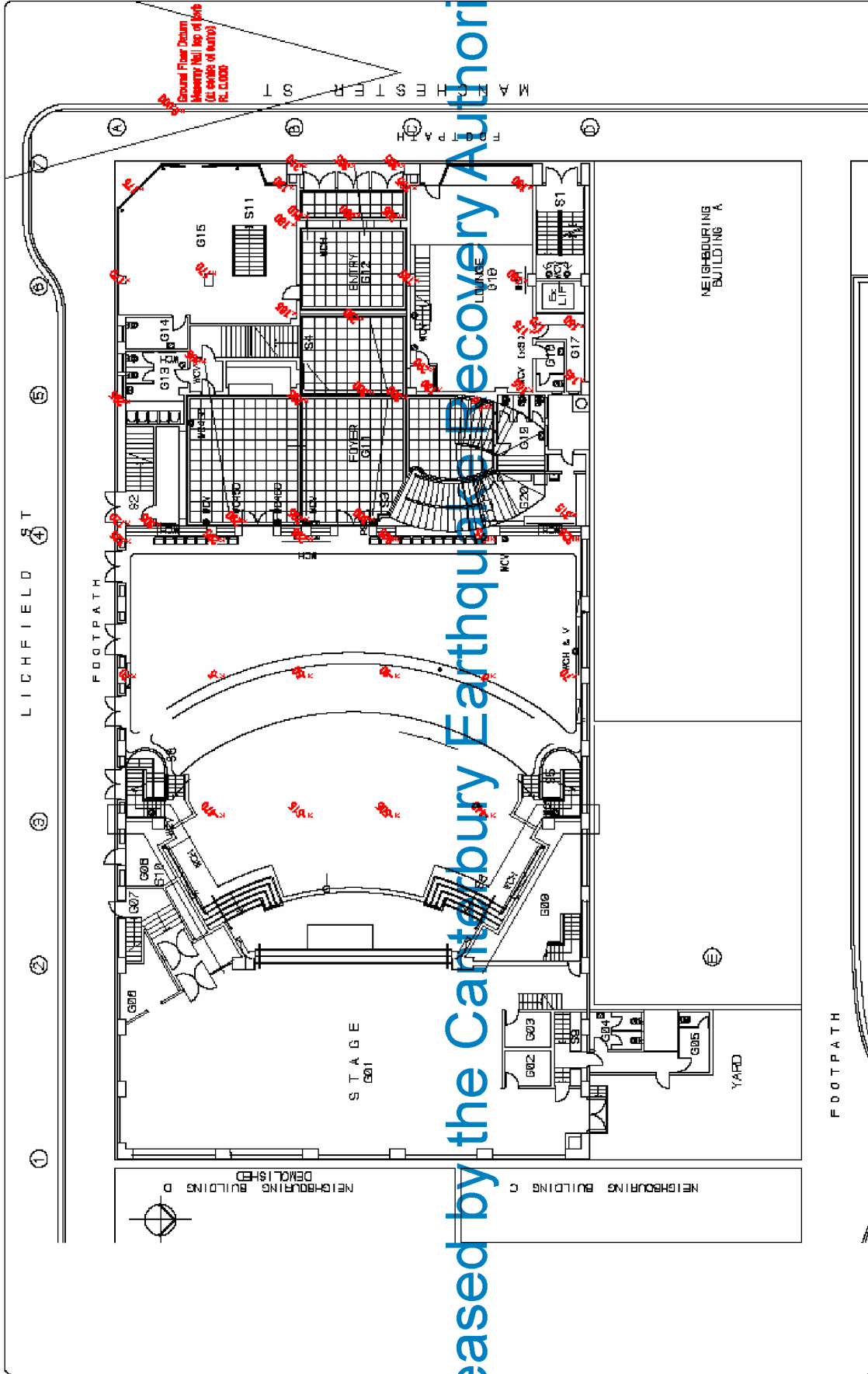
4. Level & Verticality Survey



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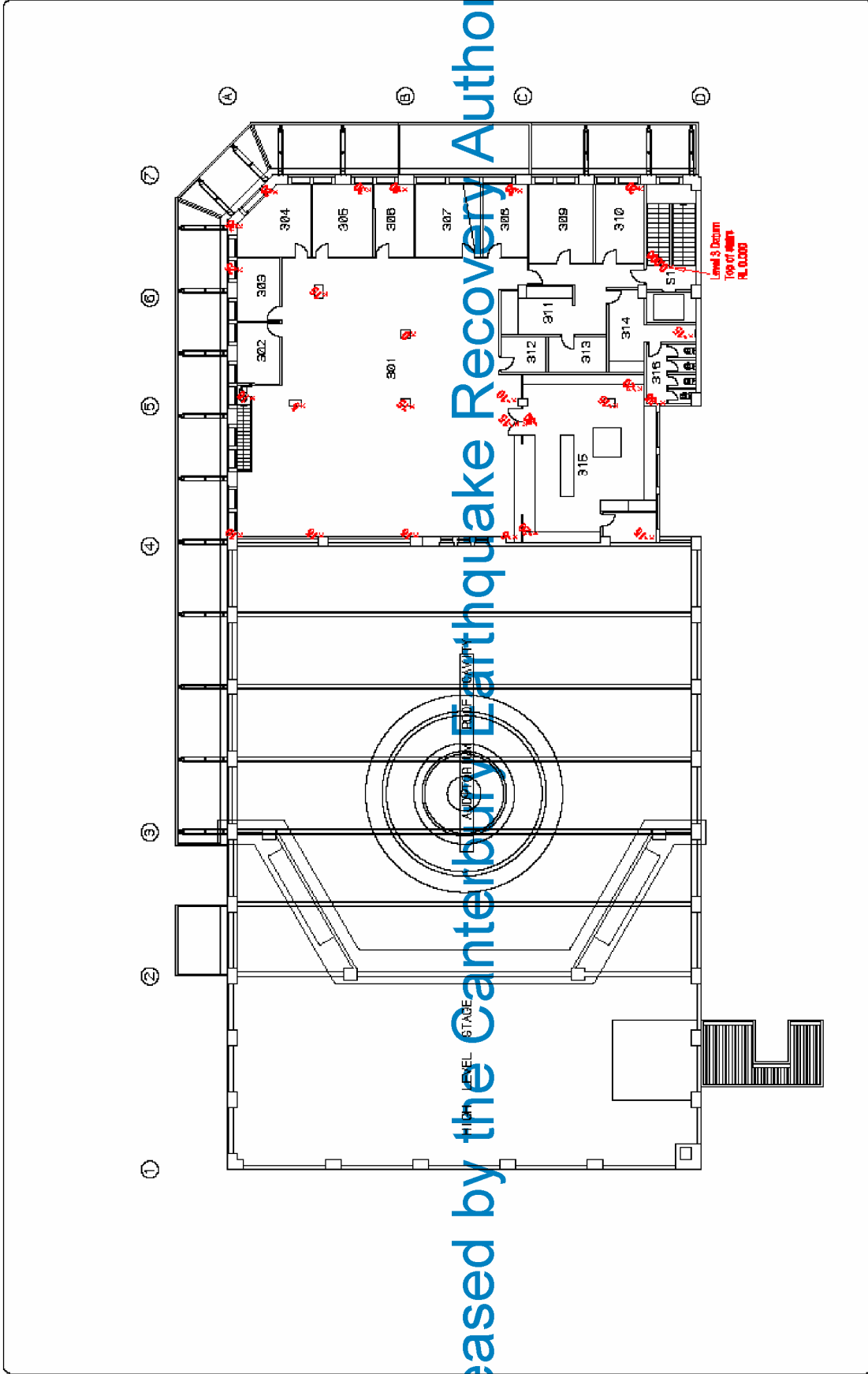
**ACCESS LAND SURVEYING LTD**  
 Access Land Surveying Ltd is a New Zealand company  
 registered in the Companies Office of New Zealand  
 with the following details:  
 1975 1975 (Company No) 1975 1975 (Company No)  
 1975 1975 (Company No) 1975 1975 (Company No)

**MAJESTIC HOUSE**  
 Ground Floor Levels

Issue Details	Date
Rev. Description A Issued for client	09/11/2011

Client/Ref No	GT ref.	All Sheet
Client/Ref No	Total area	Revision
Drawn L.S.	Client/Project Name	A
Checked R.V.	Scale	Scale: 1:100
Local Authority: Christchurch City Council		Plot No: 2113

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Drawn: BT/MS/D/11	CT File:	AS Sheet:
Checked: PH/BE	Total area:	Revision:
Drawn: LE	Client: Majestic House	A
Checked: RV	Scale: Proportional	Rev: 2 of 6
Level Authority: Canterbury City Council		Ref: 2113

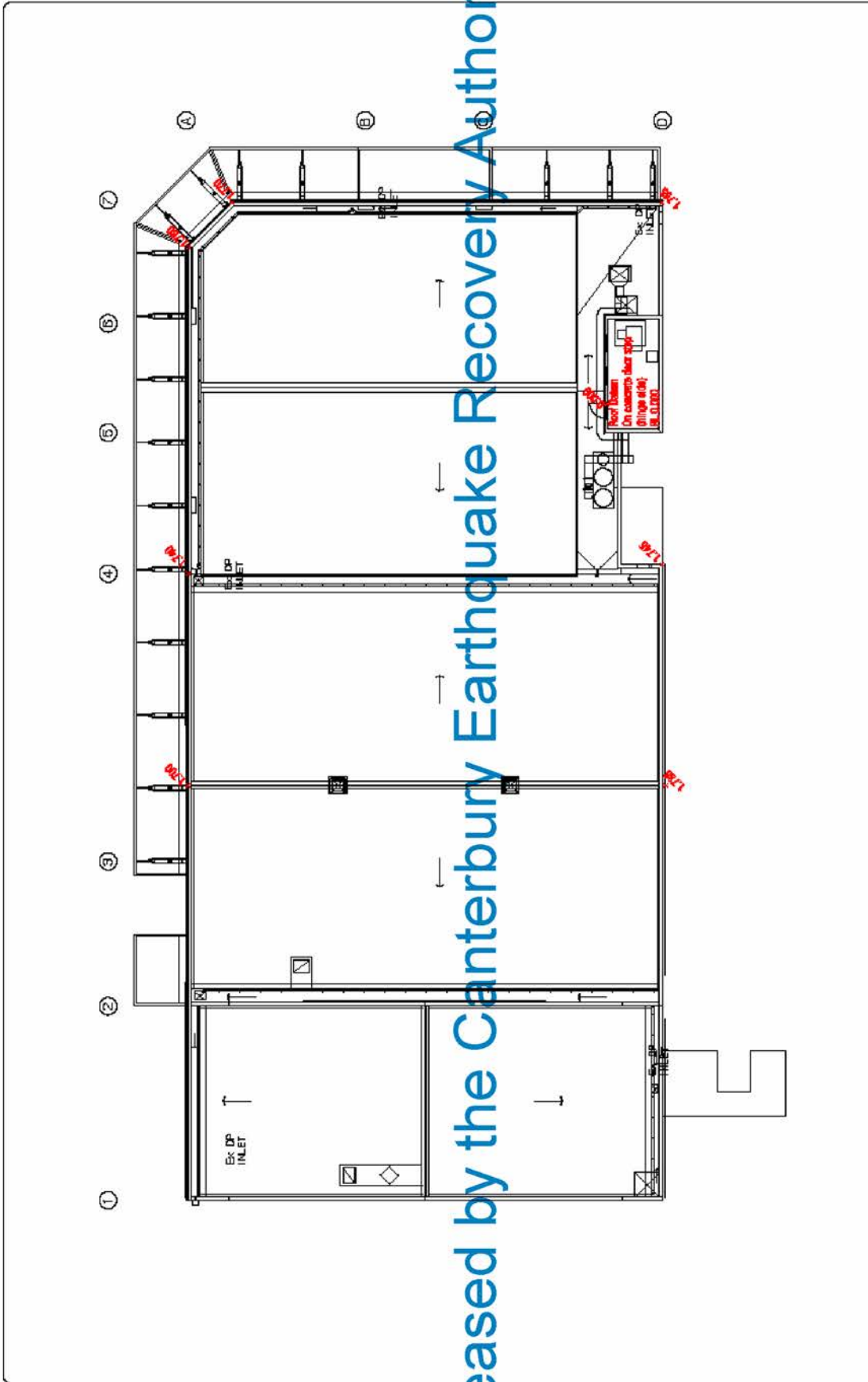
Issue Details	Date
Rev. Description	BY/DA/DT
A Issued for callout	

**MAJESTIC HOUSE**  
3rd Floor Levels

Notes:  
Levels to base of finished floor  
Floor above top of finished ceiling, RL 0.0000  
Height shown to top ceiling unless stated

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Released by the Canterbury Earthquake Recovery Authority



Drawn: BPT/MD/01	CT No:	AS Rev:
Checked: PWB/B	Total sheet:	Revision:
Drawn: LK	Client: Majestic House	A
Checked: JY	Scale: Proposed	Sheet: 3 of 8
Local Authority: Christchurch City Council		Ref: 2113

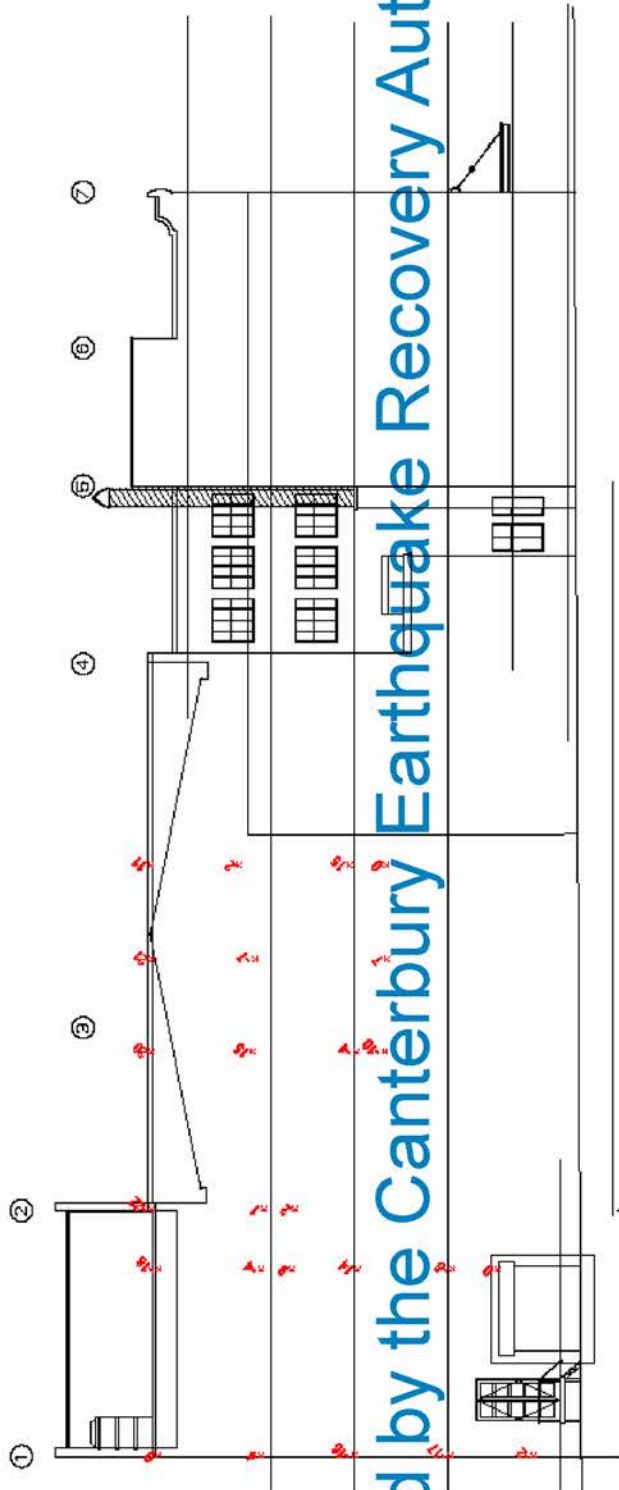
Rev.	Description	Date
A	Issued for client	BPT/MD/01

### MAJESTIC HOUSE Parapet Levels

**Notes:**  
Levels in terms of Finished Floor  
Steel sections to all steel tube columns R. 11.10  
Height shown to centre of column

**ACCESS LAND SURVEYING LTD**  
 Registered Professional Surveyors  
 100/102/104/106/108/110/112/114/116/118/120/122/124/126/128/130/132/134/136/138/140/142/144/146/148/150/152/154/156/158/160/162/164/166/168/170/172/174/176/178/180/182/184/186/188/190/192/194/196/198/200/202/204/206/208/210/212/214/216/218/220/222/224/226/228/230/232/234/236/238/240/242/244/246/248/250/252/254/256/258/260/262/264/266/268/270/272/274/276/278/280/282/284/286/288/290/292/294/296/298/300/302/304/306/308/310/312/314/316/318/320/322/324/326/328/330/332/334/336/338/340/342/344/346/348/350/352/354/356/358/360/362/364/366/368/370/372/374/376/378/380/382/384/386/388/390/392/394/396/398/400/402/404/406/408/410/412/414/416/418/420/422/424/426/428/430/432/434/436/438/440/442/444/446/448/450/452/454/456/458/460/462/464/466/468/470/472/474/476/478/480/482/484/486/488/490/492/494/496/498/500/502/504/506/508/510/512/514/516/518/520/522/524/526/528/530/532/534/536/538/540/542/544/546/548/550/552/554/556/558/560/562/564/566/568/570/572/574/576/578/580/582/584/586/588/590/592/594/596/598/600/602/604/606/608/610/612/614/616/618/620/622/624/626/628/630/632/634/636/638/640/642/644/646/648/650/652/654/656/658/660/662/664/666/668/670/672/674/676/678/680/682/684/686/688/690/692/694/696/698/700/702/704/706/708/710/712/714/716/718/720/722/724/726/728/730/732/734/736/738/740/742/744/746/748/750/752/754/756/758/760/762/764/766/768/770/772/774/776/778/780/782/784/786/788/790/792/794/796/798/800/802/804/806/808/810/812/814/816/818/820/822/824/826/828/830/832/834/836/838/840/842/844/846/848/850/852/854/856/858/860/862/864/866/868/870/872/874/876/878/880/882/884/886/888/890/892/894/896/898/900/902/904/906/908/910/912/914/916/918/920/922/924/926/928/930/932/934/936/938/940/942/944/946/948/950/952/954/956/958/960/962/964/966/968/970/972/974/976/978/980/982/984/986/988/990/992/994/996/998/1000/1002/1004/1006/1008/1010/1012/1014/1016/1018/1020/1022/1024/1026/1028/1030/1032/1034/1036/1038/1040/1042/1044/1046/1048/1050/1052/1054/1056/1058/1060/1062/1064/1066/1068/1070/1072/1074/1076/1078/1080/1082/1084/1086/1088/1090/1092/1094/1096/1098/1100/1102/1104/1106/1108/1110/1112/1114/1116/1118/1120/1122/1124/1126/1128/1130/1132/1134/1136/1138/1140/1142/1144/1146/1148/1150/1152/1154/1156/1158/1160/1162/1164/1166/1168/1170/1172/1174/1176/1178/1180/1182/1184/1186/1188/1190/1192/1194/1196/1198/1200/1202/1204/1206/1208/1210/1212/1214/1216/1218/1220/1222/1224/1226/1228/1230/1232/1234/1236/1238/1240/1242/1244/1246/1248/1250/1252/1254/1256/1258/1260/1262/1264/1266/1268/1270/1272/1274/1276/1278/1280/1282/1284/1286/1288/1290/1292/1294/1296/1298/1300/1302/1304/1306/1308/1310/1312/1314/1316/1318/1320/1322/1324/1326/1328/1330/1332/1334/1336/1338/1340/1342/1344/1346/1348/1350/1352/1354/1356/1358/1360/1362/1364/1366/1368/1370/1372/1374/1376/1378/1380/1382/1384/1386/1388/1390/1392/1394/1396/1398/1400/1402/1404/1406/1408/1410/1412/1414/1416/1418/1420/1422/1424/1426/1428/1430/1432/1434/1436/1438/1440/1442/1444/1446/1448/1450/1452/1454/1456/1458/1460/1462/1464/1466/1468/1470/1472/1474/1476/1478/1480/1482/1484/1486/1488/1490/1492/1494/1496/1498/1500/1502/1504/1506/1508/1510/1512/1514/1516/1518/1520/1522/1524/1526/1528/1530/1532/1534/1536/1538/1540/1542/1544/1546/1548/1550/1552/1554/1556/1558/1560/1562/1564/1566/1568/1570/1572/1574/1576/1578/1580/1582/1584/1586/1588/1590/1592/1594/1596/1598/1600/1602/1604/1606/1608/1610/1612/1614/1616/1618/1620/1622/1624/1626/1628/1630/1632/1634/1636/1638/1640/1642/1644/1646/1648/1650/1652/1654/1656/1658/1660/1662/1664/1666/1668/1670/1672/1674/1676/1678/1680/1682/1684/1686/1688/1690/1692/1694/1696/1698/1700/1702/1704/1706/1708/1710/1712/1714/1716/1718/1720/1722/1724/1726/1728/1730/1732/1734/1736/1738/1740/1742/1744/1746/1748/1750/1752/1754/1756/1758/1760/1762/1764/1766/1768/1770/1772/1774/1776/1778/1780/1782/1784/1786/1788/1790/1792/1794/1796/1798/1800/1802/1804/1806/1808/1810/1812/1814/1816/1818/1820/1822/1824/1826/1828/1830/1832/1834/1836/1838/1840/1842/1844/1846/1848/1850/1852/1854/1856/1858/1860/1862/1864/1866/1868/1870/1872/1874/1876/1878/1880/1882/1884/1886/1888/1890/1892/1894/1896/1898/1900/1902/1904/1906/1908/1910/1912/1914/1916/1918/1920/1922/1924/1926/1928/1930/1932/1934/1936/1938/1940/1942/1944/1946/1948/1950/1952/1954/1956/1958/1960/1962/1964/1966/1968/1970/1972/1974/1976/1978/1980/1982/1984/1986/1988/1990/1992/1994/1996/1998/2000/2002/2004/2006/2008/2010/2012/2014/2016/2018/2020/2022/2024/2026/2028/2030/2032/2034/2036/2038/2040/2042/2044/2046/2048/2050/2052/2054/2056/2058/2060/2062/2064/2066/2068/2070/2072/2074/2076/2078/2080/2082/2084/2086/2088/2090/2092/2094/2096/2098/2100/2102/2104/2106/2108/2110/2112/2114/2116/2118/2120/2122/2124/2126/2128/2130/2132/2134/2136/2138/2140/2142/2144/2146/2148/2150/2152/2154/2156/2158/2160/2162/2164/2166/2168/2170/2172/2174/2176/2178/2180/2182/2184/2186/2188/2190/2192/2194/2196/2198/2200/2202/2204/2206/2208/2210/2212/2214/2216/2218/2220/2222/2224/2226/2228/2230/2232/2234/2236/2238/2240/2242/2244/2246/2248/2250/2252/2254/2256/2258/2260/2262/2264/2266/2268/2270/2272/2274/2276/2278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**Notes:**  
 - Numbers indicate deviation from the vertical in mm  
 in relation to the bottom of the wall.  
 - Positive figures show wall leaning into building  
 - Negative figures show wall leaning out.  
 - Accuracy of measurements +/- 5mm

Drawn: 01/06/11	ECT ref.	AD Ref. no.
Reviewed: RW	Total area	Regulation
Drawn: L.E	Client: Majestic House	A
Checked: RW	Scale: As per drawing	Sheet: 6 of 8
Local Authority: Christchurch City Council		Ref: 212

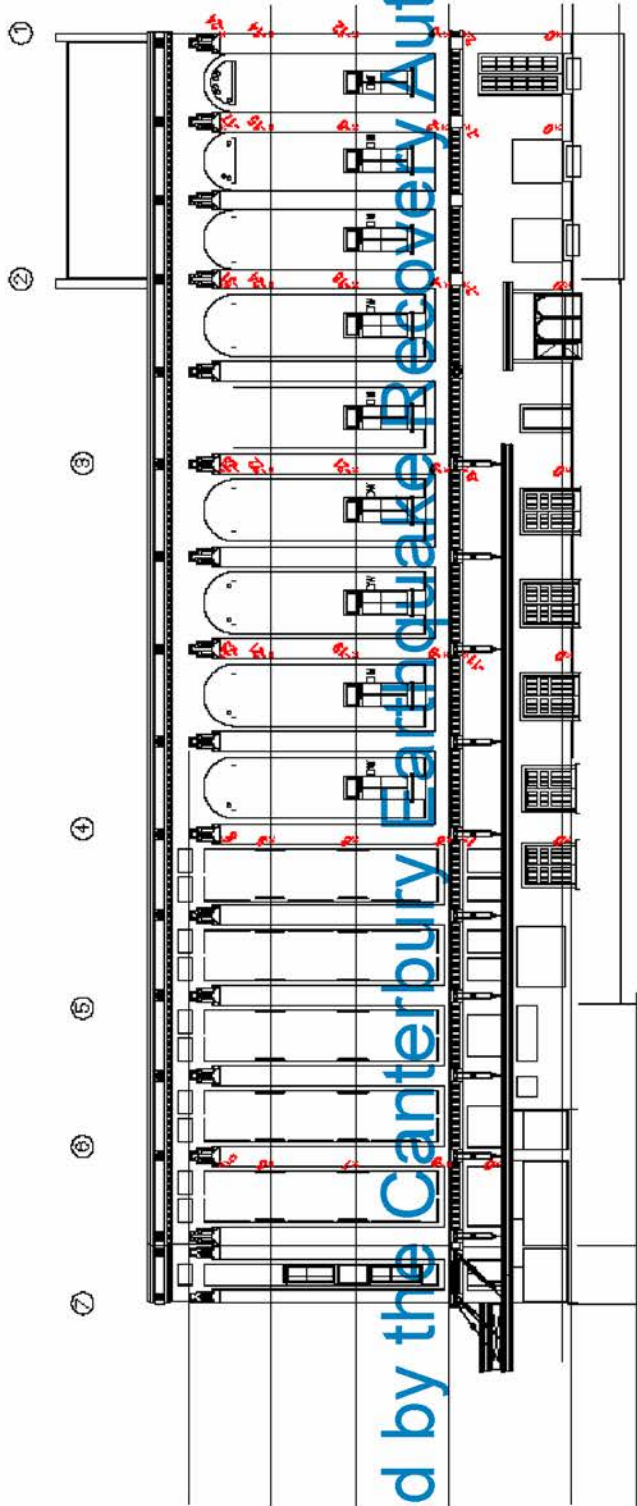
Issue Details	Date
Rev. Description	09/11/2011
A. Issued to client	

**MAJESTIC HOUSE**  
 North Elevation Verticality Check

Scale:

**ACCESS LAND SURVEYING LTD**  
 Access Land Surveying Limited  
 101 The Arcade, Christchurch 8011, New Zealand  
 03 378 0000 • 0274 562 888 • 140-148 St. Asaph St. Christchurch  
 accesslandsurveying.co.nz

Released by the Canterbury Earthquake Recovery Authority



- Notes:**
- Numbers indicate deviation from the vertical in mm
  - In relation to the bottom of the wall
  - Positive figures show wall leaning into building
  - Negative figures show wall leaning out.
  - Accuracy of measurement  $\pm 5$  - 5mm

**ACCESS LAND SURVEYING LTD**  
 Access Land Surveying Ltd  
 100/101 Coleridge Street, Christchurch, New Zealand  
 PO Box 2807, Christchurch 8142, New Zealand  
 contact@accessland.co.nz | Tel: 03 378 1500 | Fax: 03 378 1501

**MAJESTIC HOUSE**  
 South Elevation Verticality Check

Item No.	Description	Date
1	Issued for Client	20/11/2011

Client: B11/0971	CT 46	AS Drawn
Prepared by: JH	Client Name: Majestic House	Revision: A
Checked by: JH	Scale: As Shown	Rev No: 6 of 6
Local Authority: Christchurch City Council		Date: 2/12

5. **Majestic Church Photographs**  
**Pre-earthquake photographs April 2010**

Released by the Canterbury Earthquake Recovery Authority

Stage viewed from auditorium



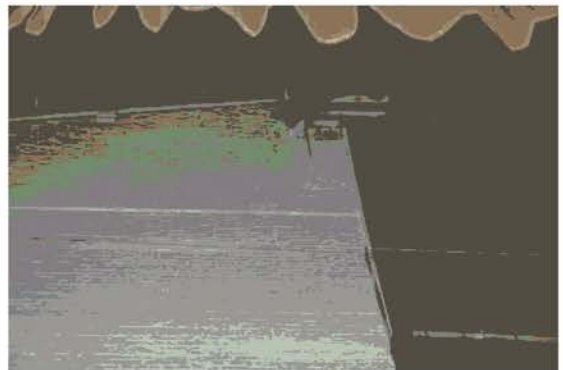
Auditorium viewed from stage







Ground floor foyer below office area



Concrete encased steel frames with brick infills between stage and auditorium



<p>Brick lining to internal walls of auditorium</p>	
<p>Cracking to north wall</p>	
<p>Cracking to east wall stage parapet and wall</p>	
<p>Cracking to north wall</p>	



Concrete parapet to roof

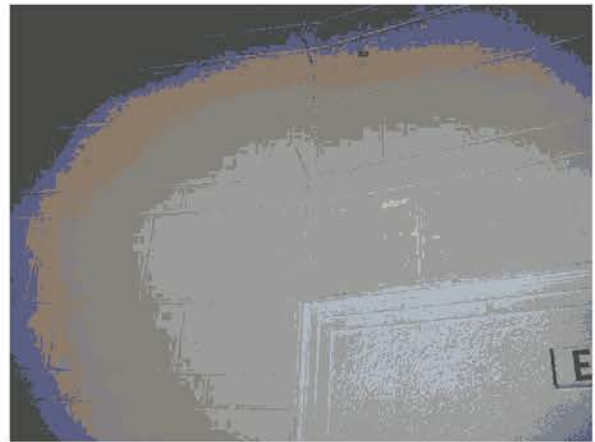


Brick parapet over proscenium wall

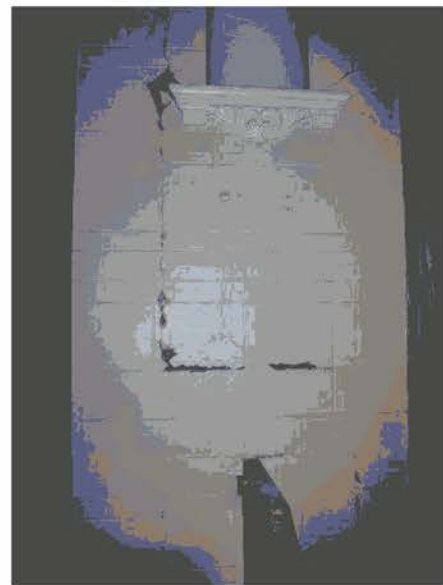


Post earthquake photographs 22 February 2011

Cracking to rear wall of auditorium



Cracking to side wall returns adjacent to galley stairs, at junction between masonry and concrete wall.

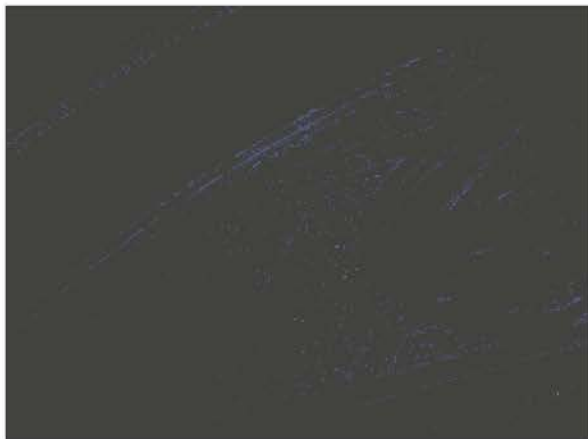


Cracking to side wall returns adjacent to galley stairs, at junction between masonry and concrete wall.



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Water damage to proscenium wall arch.



Cracking to concrete walls near stage at front of auditorium.



Cracking to brick infill panels in proscenium wall.



Exterior cracking to east rear wall of stage.



Cracking to south side exterior wall with separation occurring between auditorium and 3-storey area.



Cracking to north wall with separation between stage and auditorium wall.



North wall elevation.



## 6. Design Parameters

**Table 1 – Design Parameters & Assumed Material Strengths**

Type	Description	Value	Reference
<b>AS/NZS 1170:2002</b>			
<b>General</b>	Location	Christchurch	
(Part 0:2002)	Building Importance Level	3	Table 3.2
<b>Live</b>	Category		
(Part 1:2002)	Floor (office area)	3.0 kPa	Table 3.1
	Roof	0.25 kPa	Table 3.2
<b>Earthquake</b>	Hazard factor, Z	0.3 (Christchurch)	Table 3.3
(Part 5:2004)	Site subsoil class	D (Deep / soft soil)	
	Return period factor, R	1.3	Table 3.5
	Near-fault factor N(T,D)	1.0	Cl 3.1.6
	S <sub>p</sub> - existing concrete work	.925	Cl 4.4
	S <sub>p</sub> - Unreinforced masonry	0.7	
	S <sub>p</sub> - Rocking	0.7	
<b>Ductility μ</b>	Existing concrete work	1.25	
	Rocking walls	2.0	
	Masonry walls	2.0	
<b>Materials</b>	Concrete	25 MPa	
	Mortar f <sub>j</sub> (average)	7.4 MPa	
	Unreinforced masonry density	16.7 KN/m	
	Reinforcing f <sub>y</sub>	240 MPa	

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