



10 February 2021

Rotorua Lakes Council
1061 Haupapa Street
Rotorua 3010

Rotorua Museum - Earthquake Rapid Assessment

2-82142.00

Dear Stewart Brown,

A Post Earthquake Rapid Assessment was conducted at the Rotorua Museum on 26/01/21 in response to a cluster of earthquake events on 25/1/21, the biggest of which being 4.9 on the Richter scale at 8.12am. We do not believe these events have substantially affected the seismic capacity of the existing building.

Please accept this in place of the standard 'Complex Residential and all Non-Residential Buildings Level 2' form, as I do not believe the form was designed to inspect structures such as the Rotorua Museum.

Background

The information used was as follows;

- Jetstream data taken at various times before the event
- Various past photos
- Crack map of the basement by GDC called 'DOC494-v1-crack map 2016 final'
- List of crack widths by GDC titled 'DOC232-v1-all crack sheets'
- Site inspection on the 26/01/2021 by WSP

It is widely known that the Museum has a lot of existing defects and was shut down due to cracking following the Kaikoura quakes in 2016. As such this inspection was not to look for defects in an absolute sense, but to check for any substantial new defects, or obvious increases to existing defects.

I note I was unable to locate crack widths or marks for any cracks outside of the basement, which makes comparing the scale of the existing defects a rough order exercise. I can compare my photos to the Jetstream for an indicative crack length and check the scale of damaged macro-scale objects.

In this report I will document some of the observed defects, but this is not intended as a detailed report of all defects found in the museum.

Summary of Findings

Basement

Crack measurements were taken and compared to past readings. The exact position of crack width measurement was not always marked. I preferentially chose locations I could locate the mark in order to match the measurements more accurately. Going through old photos, it appeared that some crack measurement was done with a ruler, some with a crack gauge. I am uncertain which pieces were done with a crack gauge and which were done with a ruler.

Measured cracks as follows;

Crack reference	WSP measurement 25/01/2021	GDC measurement 2016
C127	2.4mm	1.4mm
C130	2mm	2mm
C24	3.5mm	3.5mm
C135	Mark not available – inconclusive – too much variation	
P106	.7mm	.7mm
C122	1.4mm	1.8mm
C14	1.8mm	2mm
C115	Mark not available – inconclusive – too much variation. Chips out of crack not visible on the polythene.	
C4	3mm	3.5mm
Unnamed north of C4	1mm	1.4mm

Considering some of the measurement by GDC appears to have been done with a ruler, the above is reasonably in line with the previous results. C127 shows a large increase in width, but it is not consistent with the rest of the values. Based on the results I've taken; I could not reasonably conclude that the basement floor is in a substantially worse condition after the 25/1/21 earthquakes.

Photos of cracks from the inspection could be matched with the Jetstream data, although cracking is extensive in the basement floor, and as mentioned this inspection is not full crack mapping.

Across cracks there were significant level changes. This was visible in GDC's previous photos (refer DOC271-v1-IMG_20161121_163351), although the level changes were not mapped so not comparison could be made.

External

Various cracks visible, in the new and old parts of the building. External crack documentation pre-quake was not located. I did not see any items that I believed changed the status of the building.

Internal;**New South Wing**

No visible damage outside of the basement. Cracking was present in the basement, although it was not the most significant area of concern.

On the first floor there were areas used for storage. Items were stacked in a not particularly orderly fashion. None of these items had clearly toppled. Indicating a limited strength of shake at the site.

Intermediate South Wing / Tarawera Gallery

Cracking of the 1.2m high unreinforced nib walls visible. Some loose material was present at the top of the cracks. Largest cracks observed were present on the Jetstream images.



Figure 1 - Image from 2020 Jetstream data



Figure 2 - Image from 26/1/21 inspection

Central Atrium Ground Floor

Large crack behind the north stairs. This was present in the Jetstream data.



Figure 3 - Large crack in the central atrium behind the north stairs - from 2020 Jetstream data



Figure 4 - Crack in Central Atrium Behind North Stairs - 26/1/20

Crack with what appeared to be a crack gauge on it was present behind the south stairs. The gauge has been drilled in, and there is cracking around one of these fixings. I note that will cause the gauge to give unreliable results. I note the crack including the cracking around the fixing was present in 2020. This should still be measured and compared, although the results may not provide much reliable information.



Figure 5 - Crack behind South Stairs in the Central Atrium - 2020 Jetstream



Figure 6 - Crack behind South Stairs in the Central Atrium - 26/1/21

A crack going right through a pumice concrete wall is present on a south west ground floor wall of the central atrium, as per the pictures. The crack appears to extend further on the 26/1/21, although this may be the resolution of the Jetstream image. Further photos need to be sourced if possible.

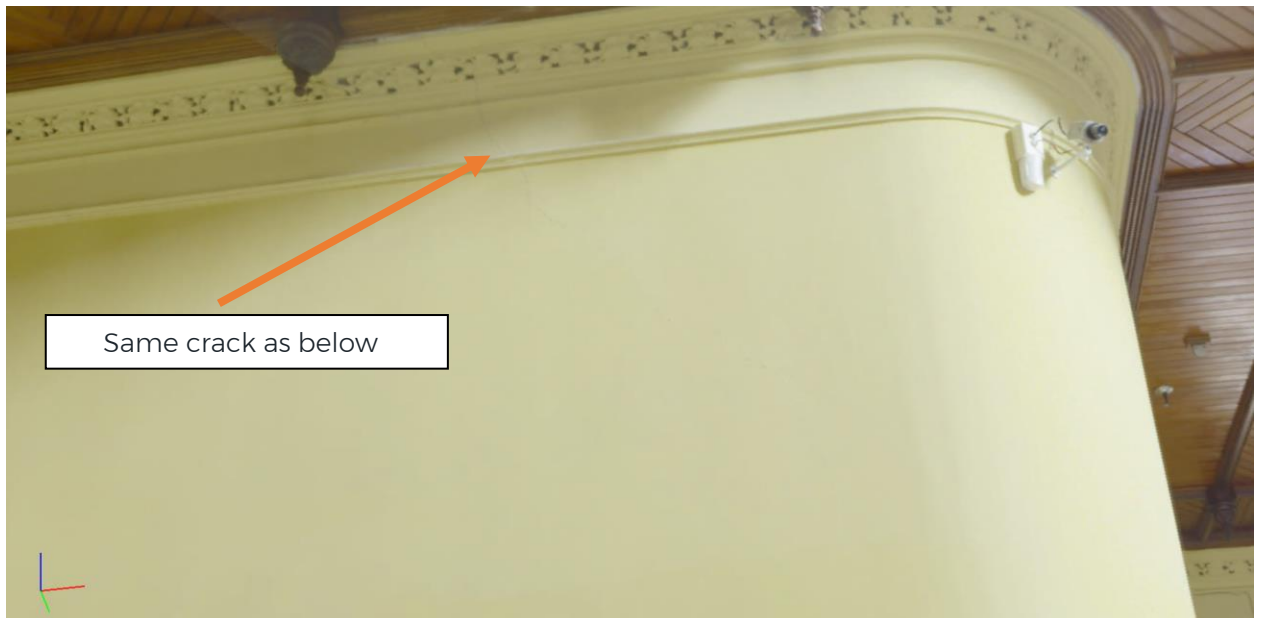


Figure 7 - Crack in SW of central atrium - Jetstream 2020



Figure 8 - Crack in SW of central atrium - 26/1/21

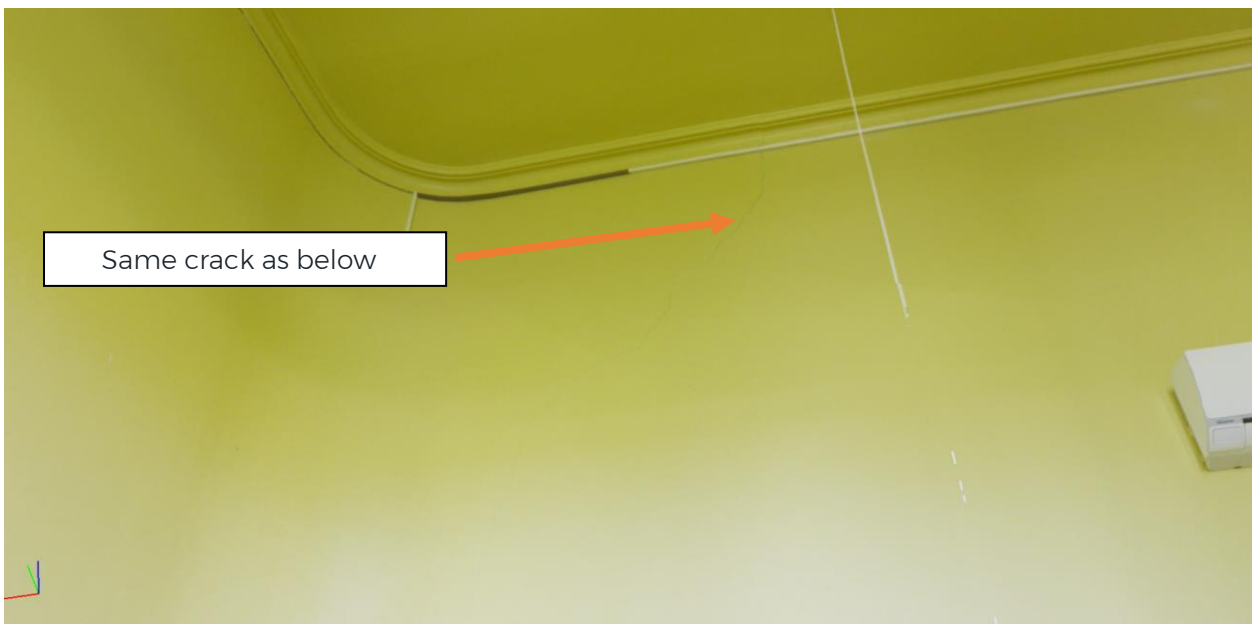


Figure 9 - Crack in SW of central atrium - Jetstream 2020, reverse side



Figure 10 - Crack in SW of central atrium – 26/1/21, reverse side

Central Atrium Mezzanine Level Including Adjacent Future Office Space to North

Cracks present in sections of exposed walls. These were visible on the 2020 Jetstream. The cracking in this area is less concerning than that documented in previous section.

It was noted standing in this area that some roof tiles had fallen off and landed on the lower levels of the building. This may have occurred in the quake. The surrounds are fenced off from the public, although gardeners do have access at times. I note the building is being re-roofed, so mitigation is being considered.



Figure 11 - Crack in SE of Mezzanine – 2020 Jetstream



Figure 12 - Crack in SE of Mezzanine - 26/1/21

Plant Room Above Central Atrium

Nothing of note. Some splitting timber observed which was present in the Jetstream data.

Intermediate North Wing / North Gallery

Cracks present. Detritus present in the largest crack and was visible on Jetstream. There was nothing in this area more concerning than present elsewhere. One very loose piece had fallen out between the Jetstream and the site inspection on the 26th. It's possible this was caused by the earthquake, but it's also possible it was dislodged by workers who have been

in the building. Other loose material I could dislodge by hand is visible as loose in the Jetstream data, so clearly the effect on the building was not profound.

There was a small amount of plaster on the floor beside some cracks, indicating movement may have occurred, however, some of that was visible in the Jetstream data, indicating it may have more to do with the demolition work than the earthquake.



Figure 13 - Int. North Wing 2020 Jetstream



Figure 14 - Int. North Wing 26/1/21

New North Wing Extension

No issues of note.

Conclusion

Inspection has shown that some existing cracking may have been exacerbated and there may be some new cracking, however from the measurements taken and lack of debris noted on the floor these are limited in extent. We believe the earthquake cluster of 25 January 2021 has not substantially affected the seismic capacity of the existing building.

A more robust crack map of the existing structure, which marks of where the measurements have been taken would make future inspections following event more meaningful.

Regards,

Tim Fowler
Senior Structural Engineer CPEng CMEngNZ