

04/20

# TECHNICAL BULLETIN 11

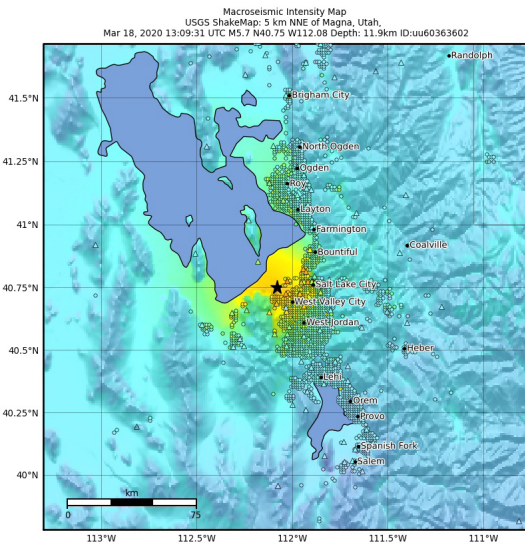
## Post-Earthquake Evaluation of a Building with DuraFuse Frames

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**Abstract:** The March 18, 2020, earthquake near Salt Lake City, Utah, caused strong shaking at a site where a DuraFuse Frame building was under construction. The building was the new Student Center for the Salt Lake Community College (SLCC) Jordan Campus. A post-earthquake evaluation of the steel frame confirmed perfect performance of the DuraFuse Frames DF360 system during the event, with no damage to the steel frames. DuraFuse Frames systems are the most resilient steel moment frames available.

### Earthquake Characteristics

On March 18, 2020, a magnitude 5.7 earthquake occurred near Salt Lake City, Utah. The earthquake was centered near Magna, Utah, (40.751° N, 112.078° W) and originated at a depth of 7.4 miles. The earthquake caused strong shaking throughout the Salt Lake Valley (Fig. 1). The M5.7 event was followed by multiple smaller aftershocks in the following hours and days.



SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
DAMAGE	None	None	None	Very light	Light	Moderate	Moderate/heavy	Heavy	Very heavy
PGA(%g)	<0.046	0.297	2.76	6.2	11.5	21.5	40.1	74.7	>139
PGV(cm/s)	<0.021	0.135	1.41	4.65	9.64	20	41.4	85.8	>178
INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X

Scale based on Worden et al. (2012) Version 23: Processed 2020-04-09T01:12:52  
 △ Seismic Instrument ○ Reported Intensity ★ Epicenter

### Salt Lake Community College Jordan Campus Site

The Jordan Campus of SLCC was located 13 miles SE from the epicenter of the M5.7 event. The estimated ground acceleration at the site was 0.07-0.13g (Fig. 1). This acceleration was about 33% of the design acceleration for the site (0.312g, 0.4SD<sub>S</sub>; ASCE, 2016).

### SLCC Student Center Building

The new Student Center at SLCC Jordan Campus was under construction at the time of the earthquake. Figs. 2 and 3 illustrate the stages of completion in March, 2020. At the time of the earthquake, the steel framing was completed and floor slabs had been poured.



**Fig. 1** ShakeMap for the M5.7 earthquake near Salt Lake on March 18, 2020 (USGS, 2020)

**Fig. 2** Level of completion at SLCC Student Center, March 6, 2020

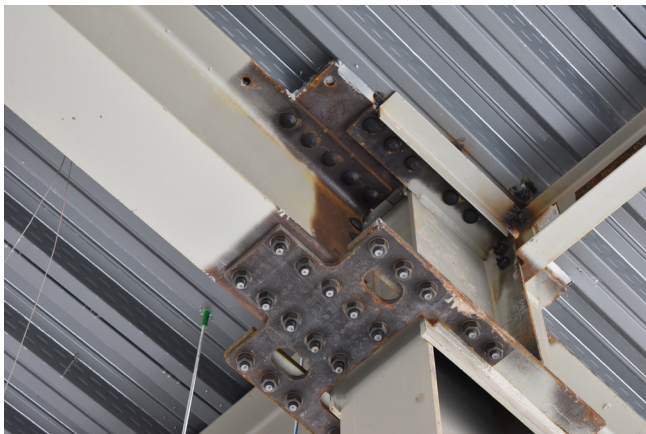


**Fig. 3** Level of completion of SLCC Student Center on March 18, 2020 (second floor)

For seismic resistance, the SLCC Student Center had DuraFuse Frames DF360 connections. DuraFuse Frames systems have rigid connections with fuse plates that can yield during severe earthquakes to prevent beam and column damage, the most resilient steel moment frames available. For small and moderate earthquakes, DuraFuse Frames systems do not experience any yielding. DuraFuse Frames systems exceed the requirements for Special Moment Frames (AISC, 2016; UES, 2019).

### Post-Earthquake Evaluation

Four hours after the M5.7 event, Dr. Paul Richards (DuraFuse Frames) and Graham Oxborrow (Reaveley Engineers) performed a visual inspection of the structural frame for the SLCC Student Center. All of the DuraFuse Frames DF360 connections were visually inspected. There were no indications of column yielding, beam yielding, fuse plate yielding, bolt slip, or weld distress at any of the connections. Fig. 4 shows one connection.



**Fig. 4** DuraFuse Frames DF360 connection with no damage after M5.7 earthquake

At the building level, all the frames were plumb and there were no indications of damage to the floor slabs.

### Conclusions

The perfect performance of the DuraFuse Frames DF360 connections at SLCC Student Center during the M5.7 event was consistent with the outstanding behavior observed in validation tests. DuraFuse Frames systems have been proven through testing (Reynolds and Uang, 2019) and actual earthquake loading to be the most resilient steel moment frames available.

### References

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- UES (2019), "DuraFuse Frame Technology," Uniform Evaluation Service ER-610, Uniform Evaluation Service, Ontario, CA.
- USGS (2020), ShakeMap for M5.7 – 4km NNW of Magna Utah, USGS National Earthquake Information Center, <https://earthquake.usgs.gov/earthquakes/eventpage/uu60363602/shakemap/intensity?source=uu&code=uu60363602>.



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