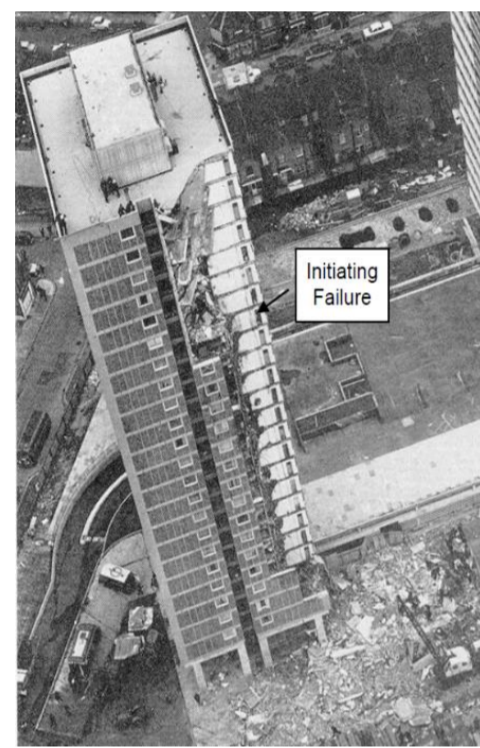


Introduction

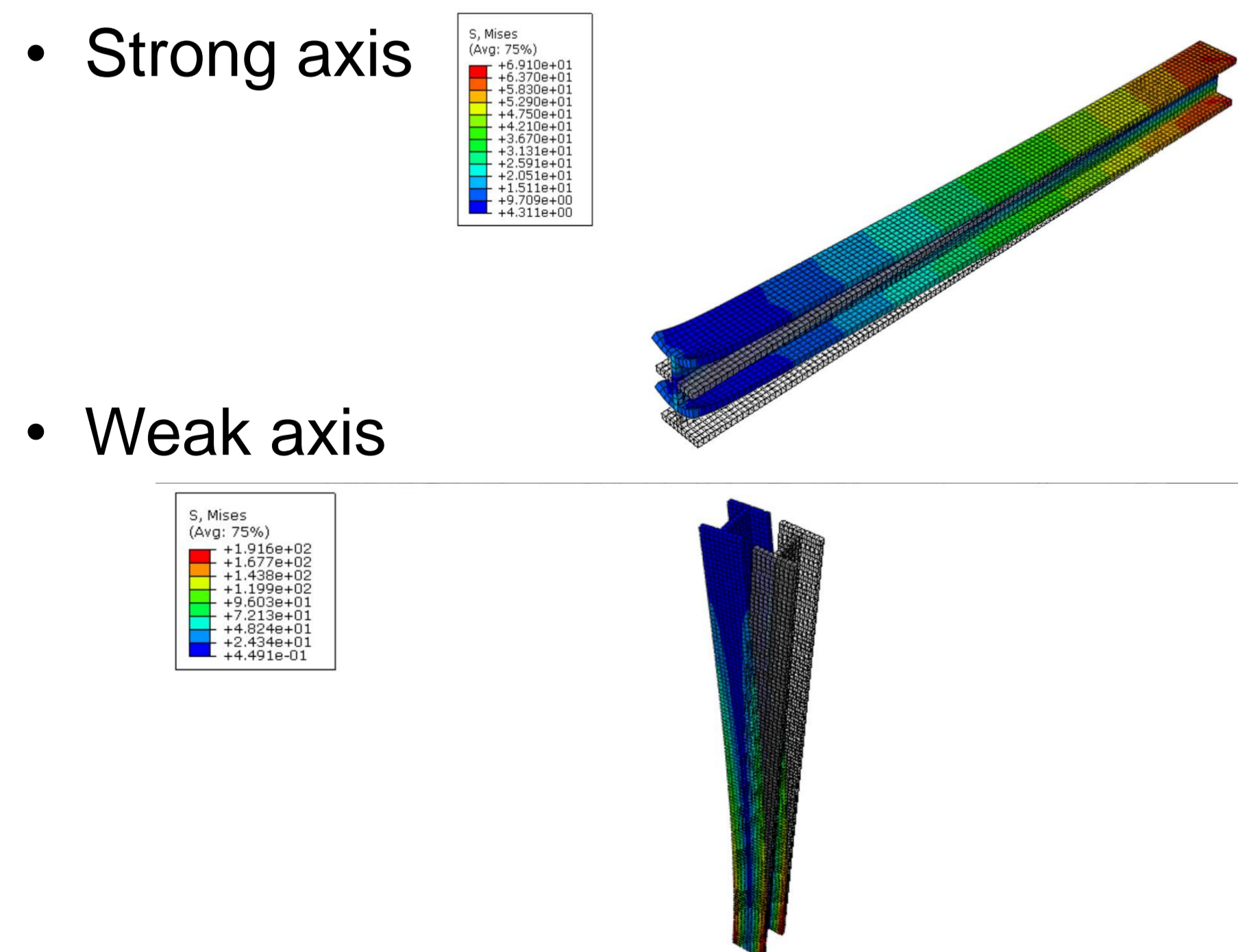
- Purpose of the study is to test the robustness of gravity frame buildings when a column is removed
- Progressive collapse is when a structural member is damaged or fails, and then collapses. The remaining structural members might not be able to support the increased amount of load, and collapse as well
- Example is the Ronan Point building in London, England



- How can we keep failure localized so a proportion of the building doesn't fail as well?

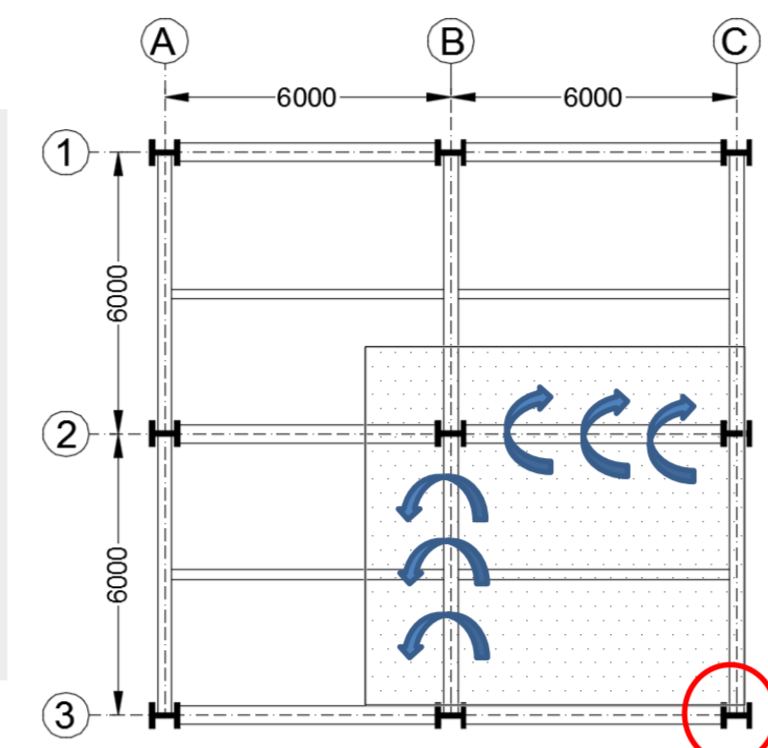
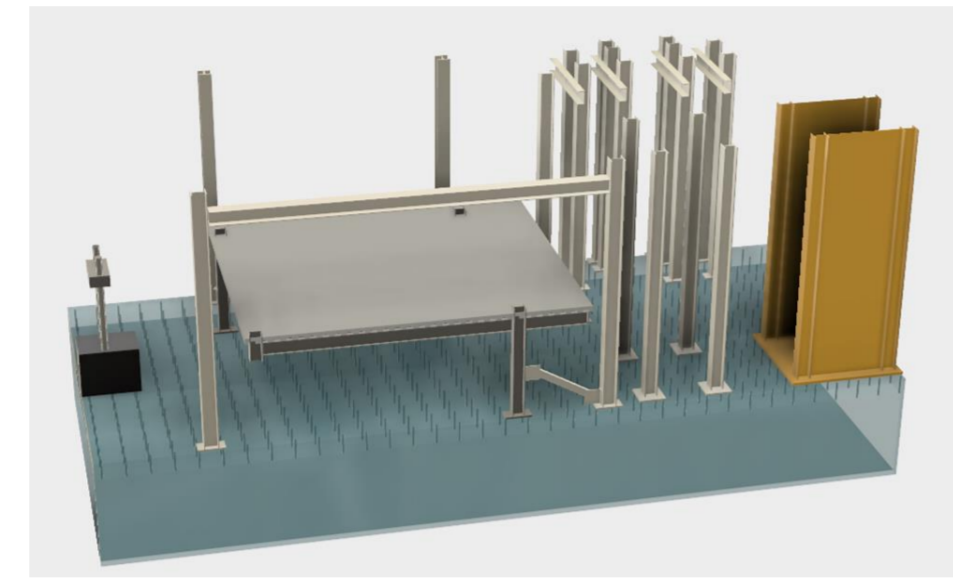
Strong and Weak Axis

- Using ABAQUS, I proved that there is a strong and weak axis on a beam. This can be compared to a beam that will be used in the progressive collapse experiment.
- The strong axis will have less deformation than the weak axis

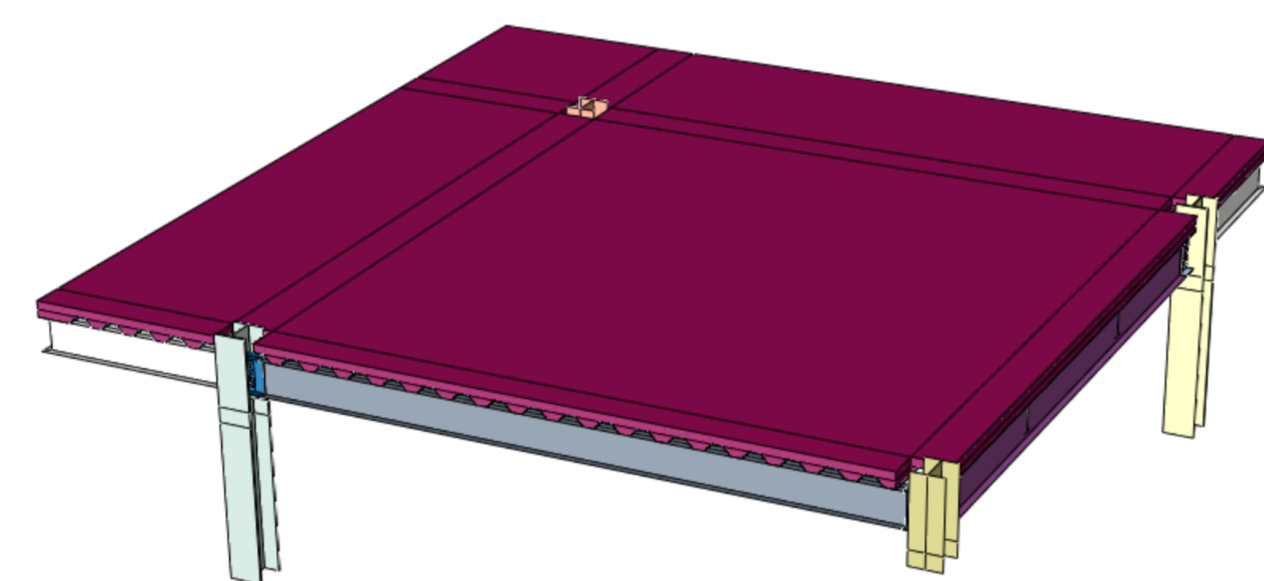


Methods

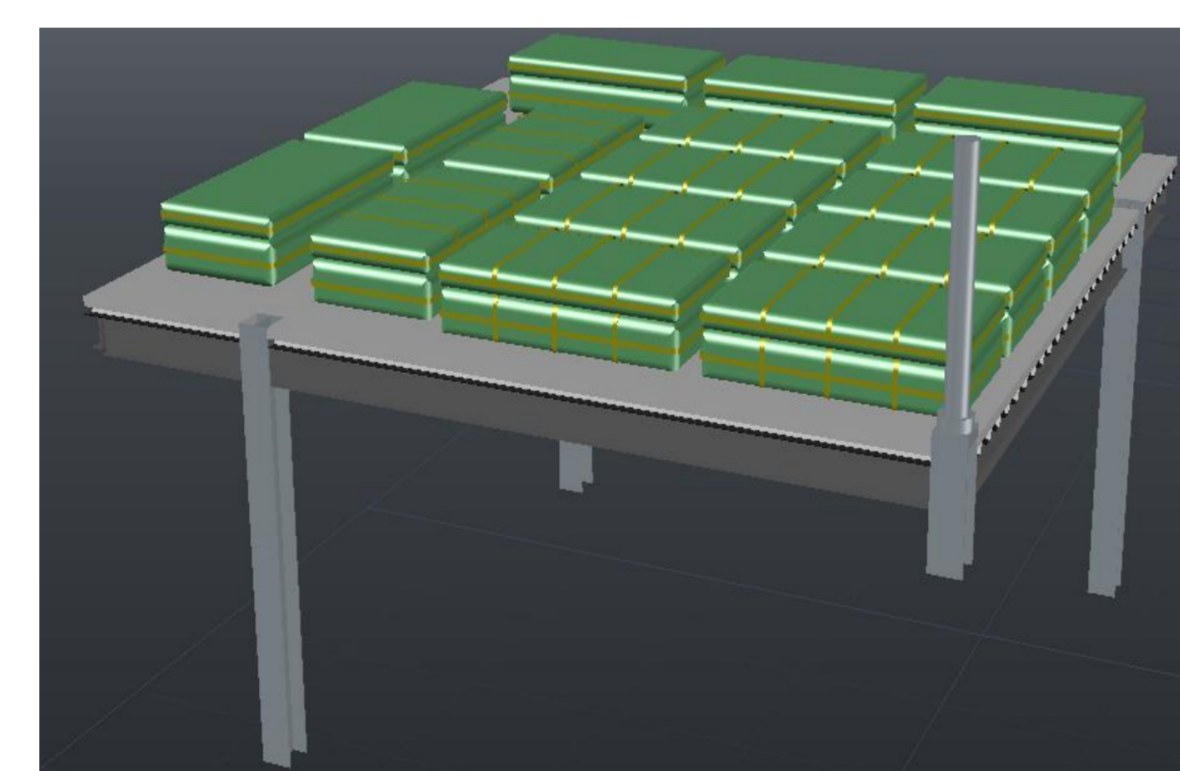
- Going to build experiment in the lab that is 8.7m X 8.7m X 3m



- Ran several finite element models to see how much the length of overhang should be so results are reliable
- Had to be comparable to a 2 X 2 bay model



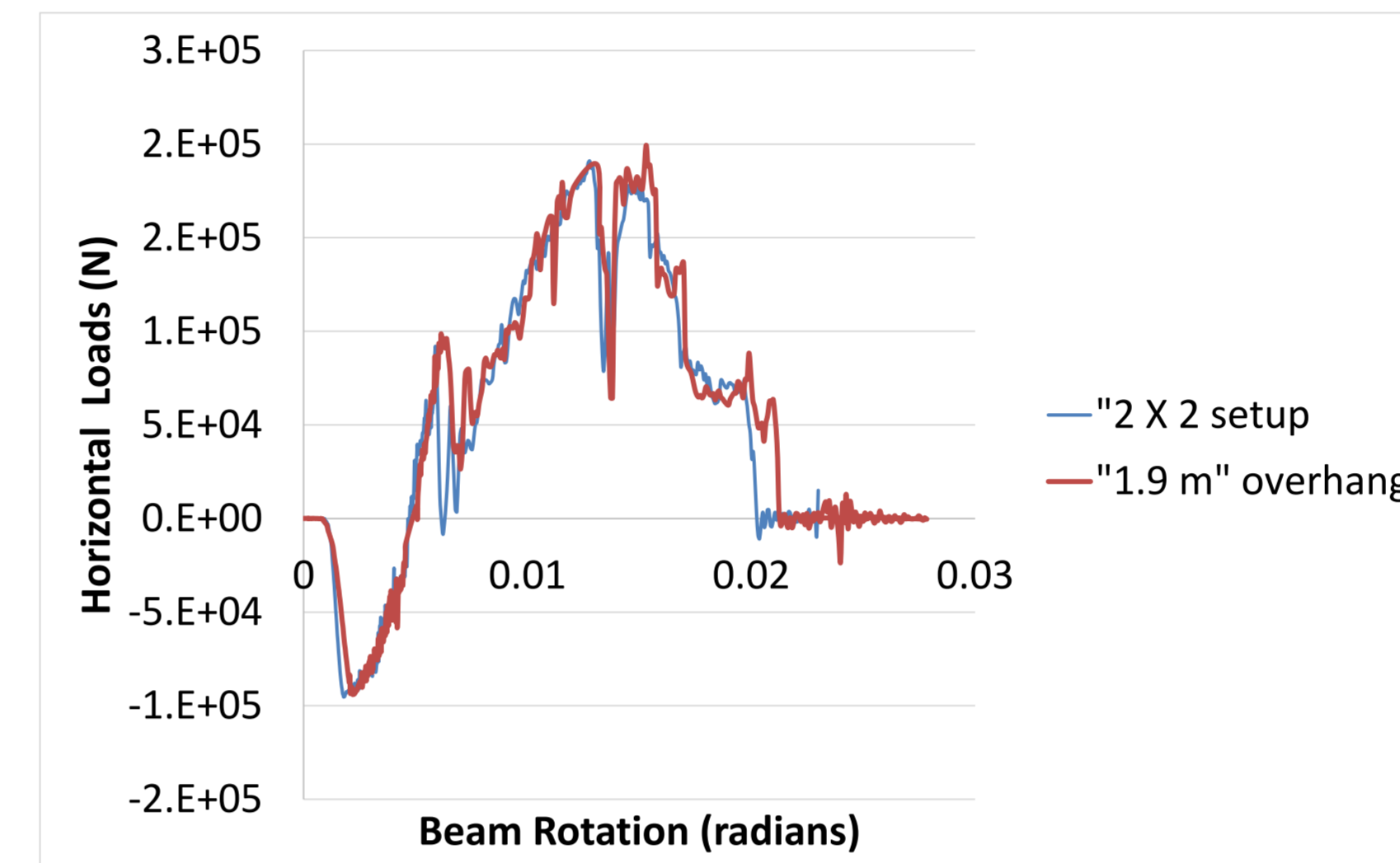
- Sandbags used to represent everyday load and an actuator to apply a load that would represent the weight of the above floors
- Sand bags will be put in Bagster Bags then secured using tie wraps



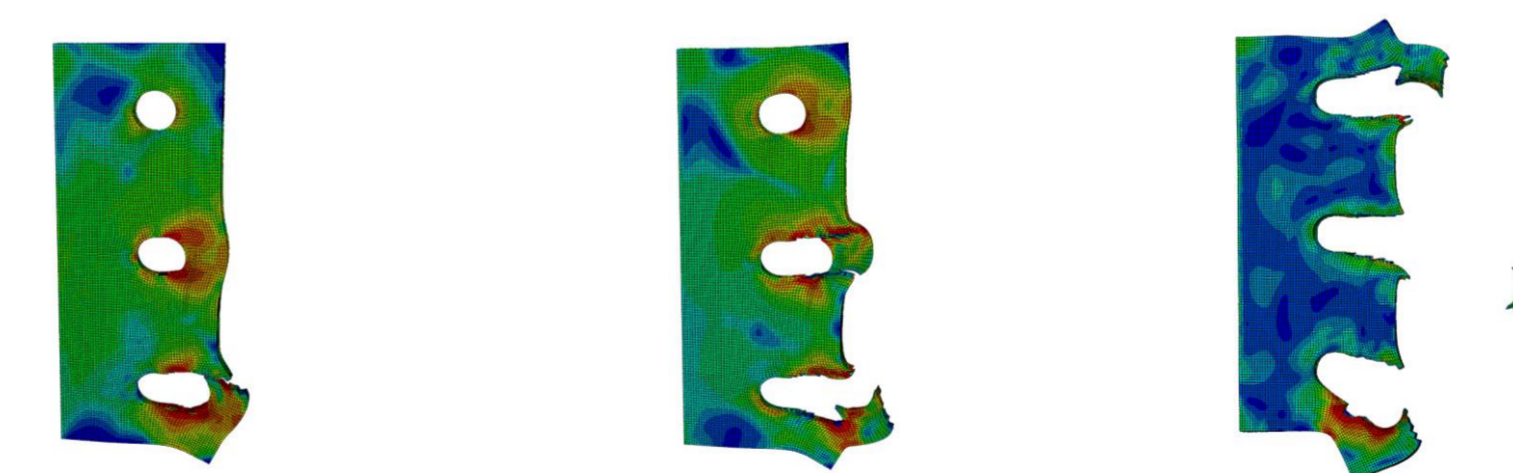
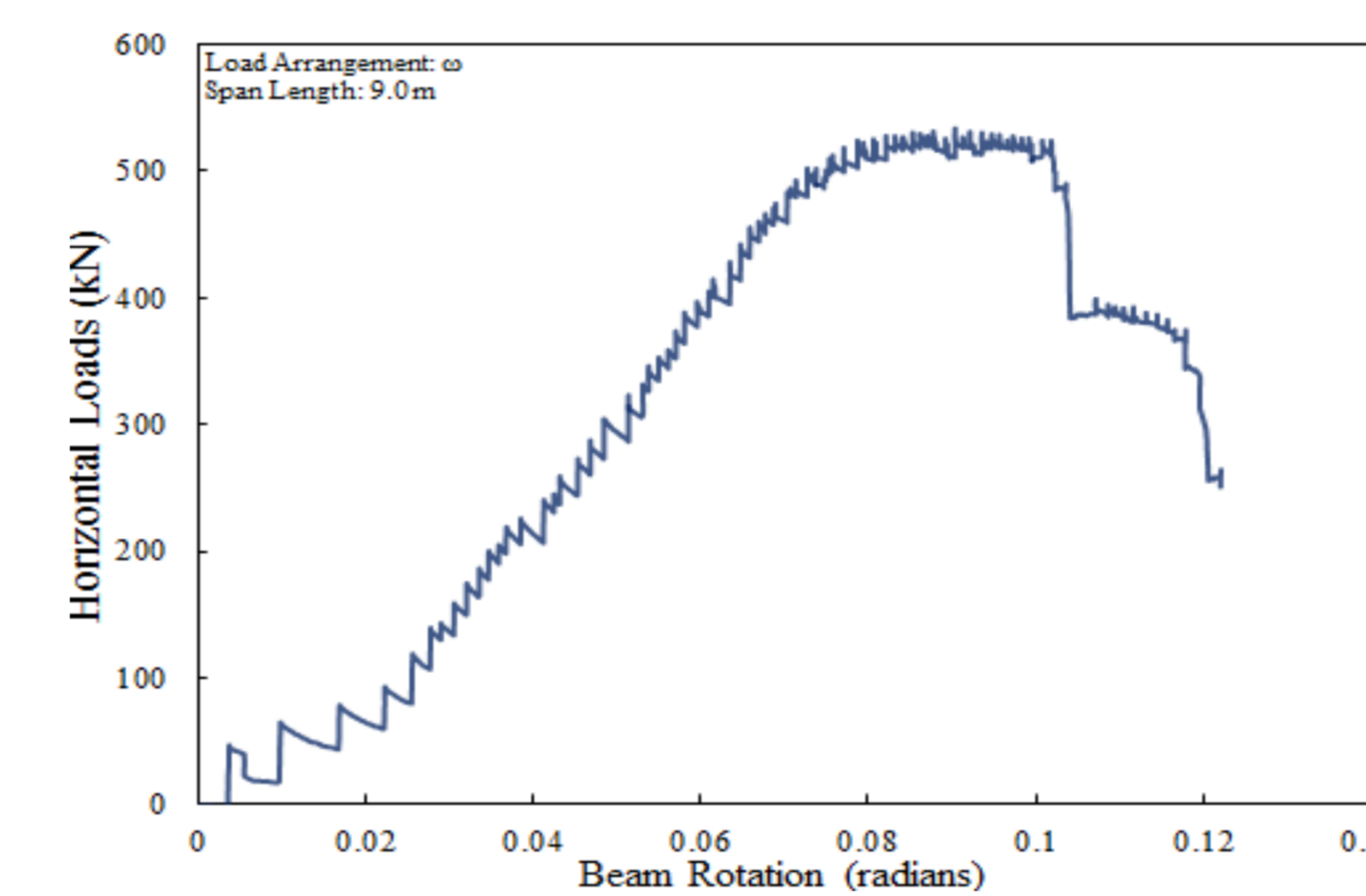
- Compare results from ABAQUS model and the lab experiment
- Current design criteria for progressive collapse is Catenary Action and Flexural Action

Results

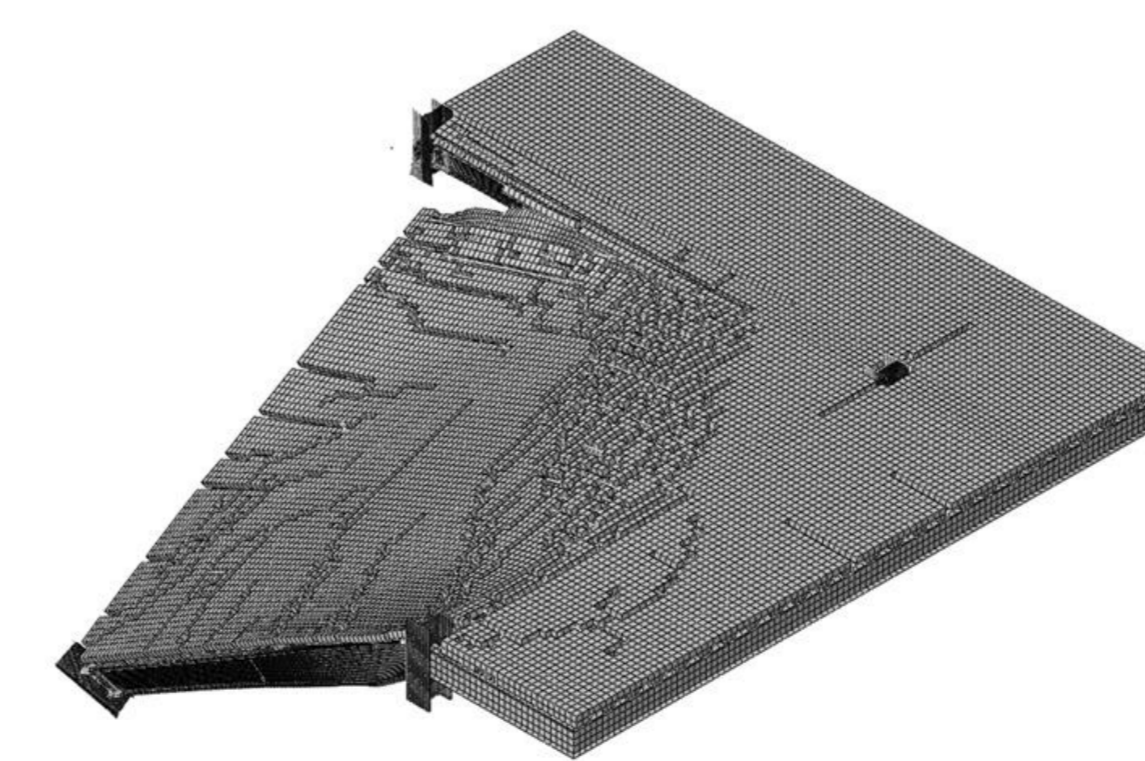
- 1.9 metres in length of overhang compared the best to the 2 X 2 bay's results and is going to be used in the experiment



- Shear tab failed, which caused more rotation to occur



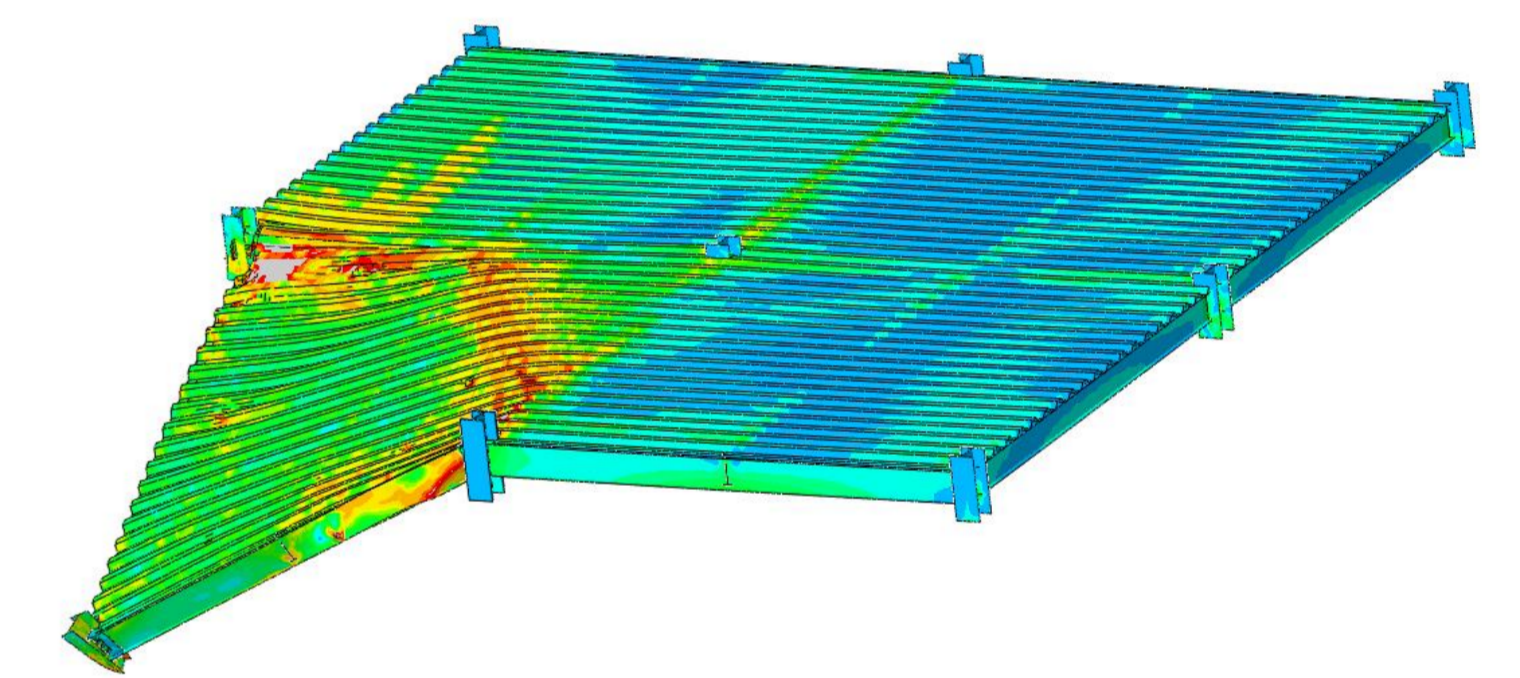
- What the 1.9 overhang model looked like when it was finished



- Overall displacement is 1.6 metres

Conclusions

- This research shows that a gravity frame structure has robustness but will eventually collapse
- This also proves that what was originally understood about gravity frame structures is incorrect
- But, there will be enough time to evacuate the building so there will be less fatalities and injuries
- Having this information will lead to a safer society
- With this new information, new design criteria can be made so it will be easier to keep the failure local rather than a global failure



References and Acknowledgements

- Progressive Collapse Resistance of Composite Steel Frame Structures under Corner Column Removal By Safa S. Masajedian, and Robert G. Driver (2016)
- Computational Simulation of gravity-Induced Progressive Collapse of Steel-Frame Buildings: Current Trends and Future Research Needs By Sherif El-Tawil, Honghao Li, and Sashi Kunnath (2013)
- I would like to give a huge thanks to Syncrude Canada and for all the Steel Centre members. Without them I wouldn't have been able to have the amazing experience that I did.