

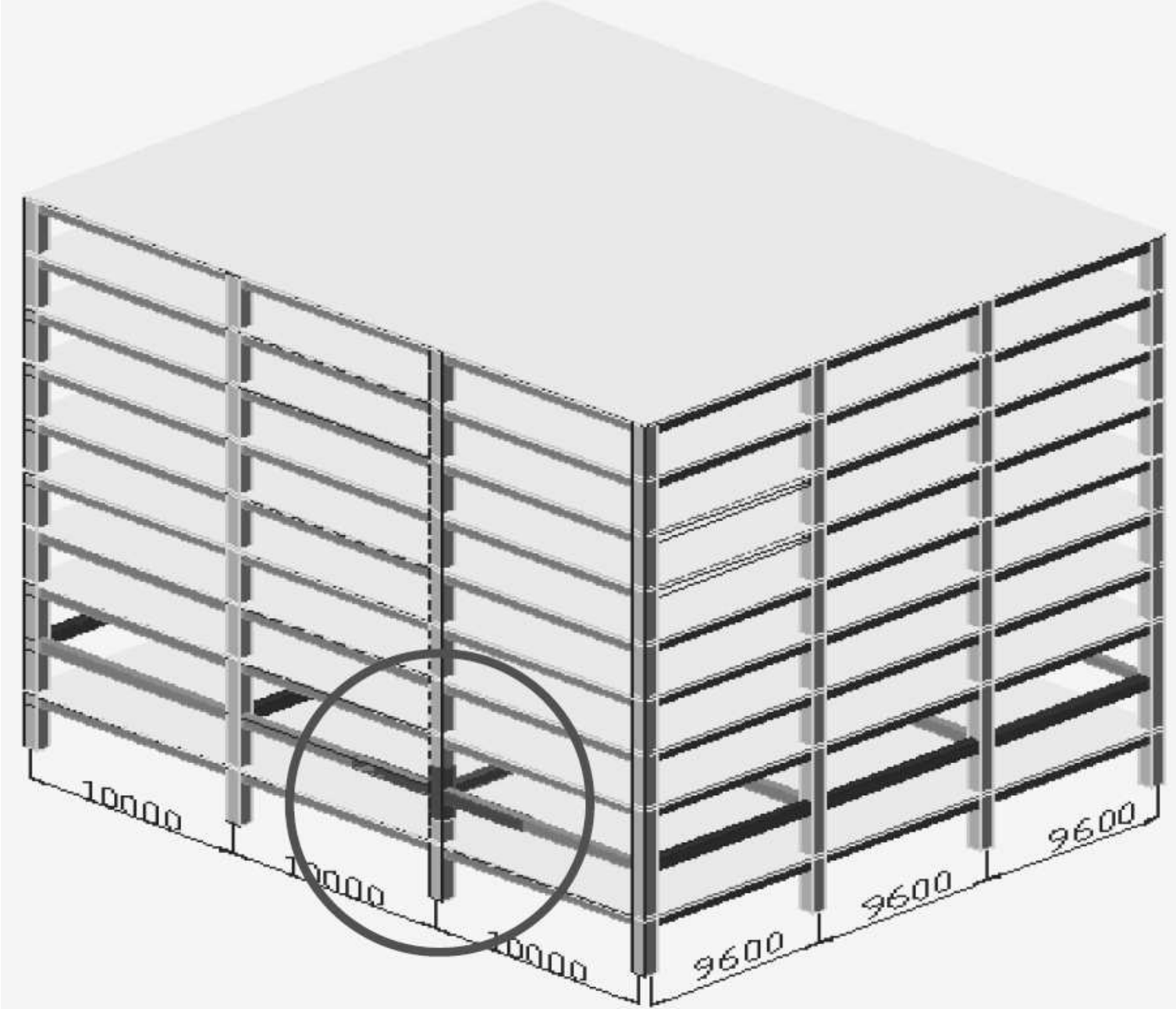
**Multi-Level Seismic Performance Assessment
of a Damage-protected
Beam-column Joint
with Internal Lead Dampers**

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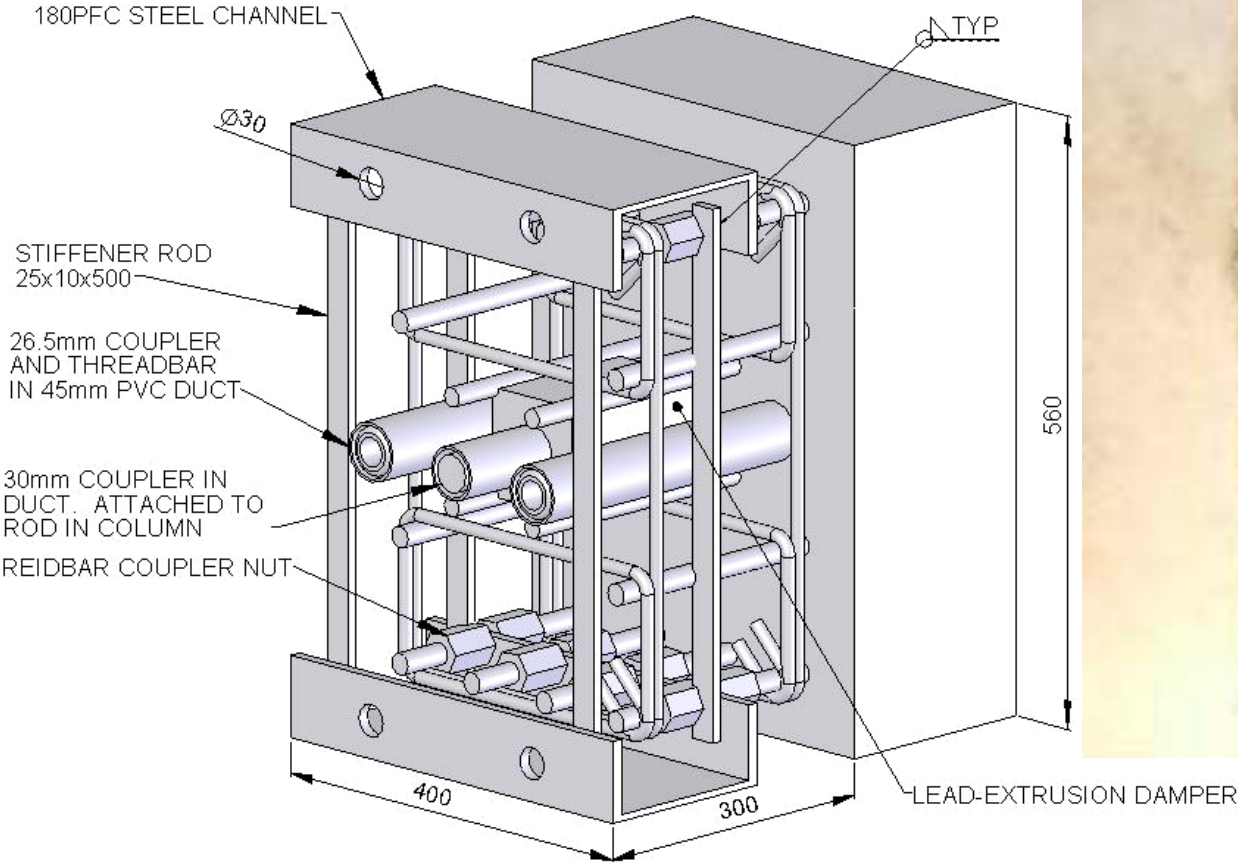
Outline

- Motivation
- DAD concept
- Experimental specimen development
- Key construction hardware
- Computational modeling using IDA
- QED testing
- Results
- Conclusions

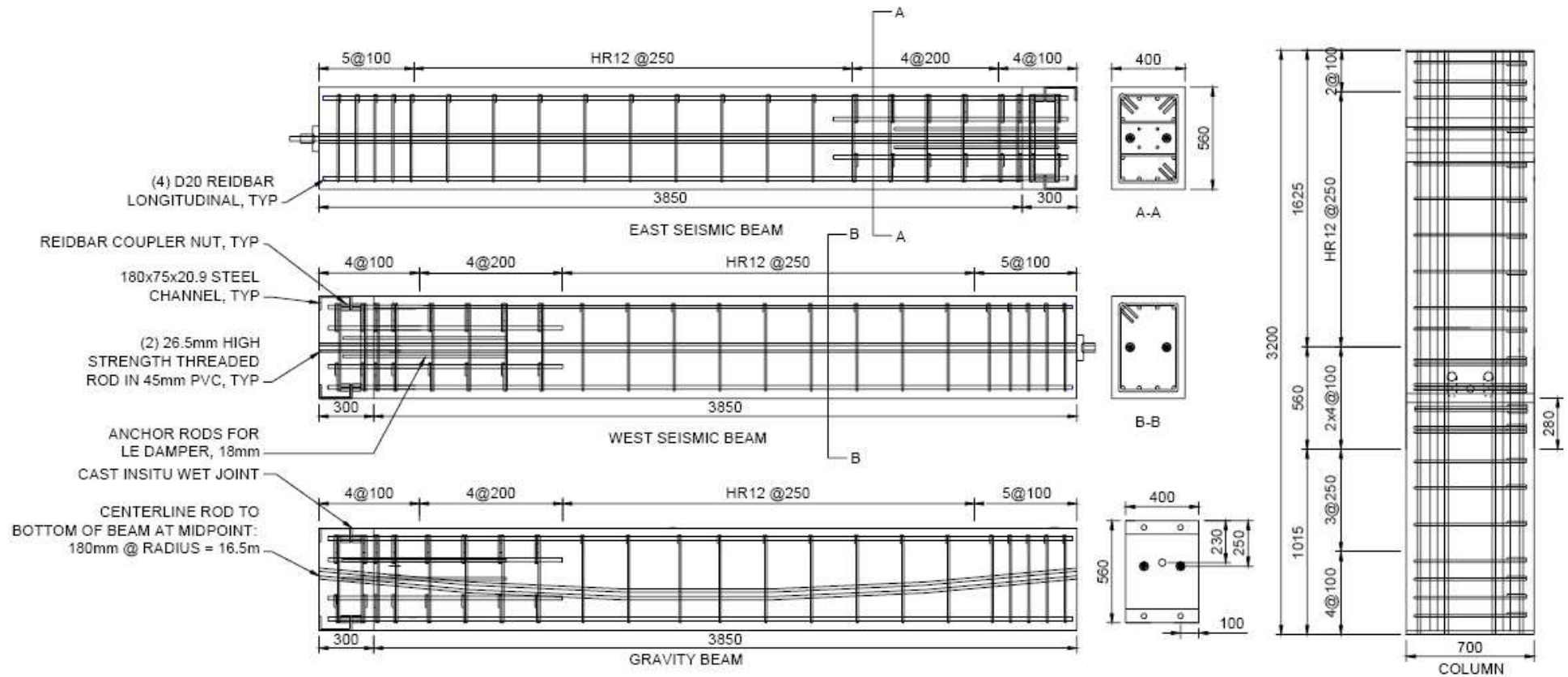
Development of the experimental specimen



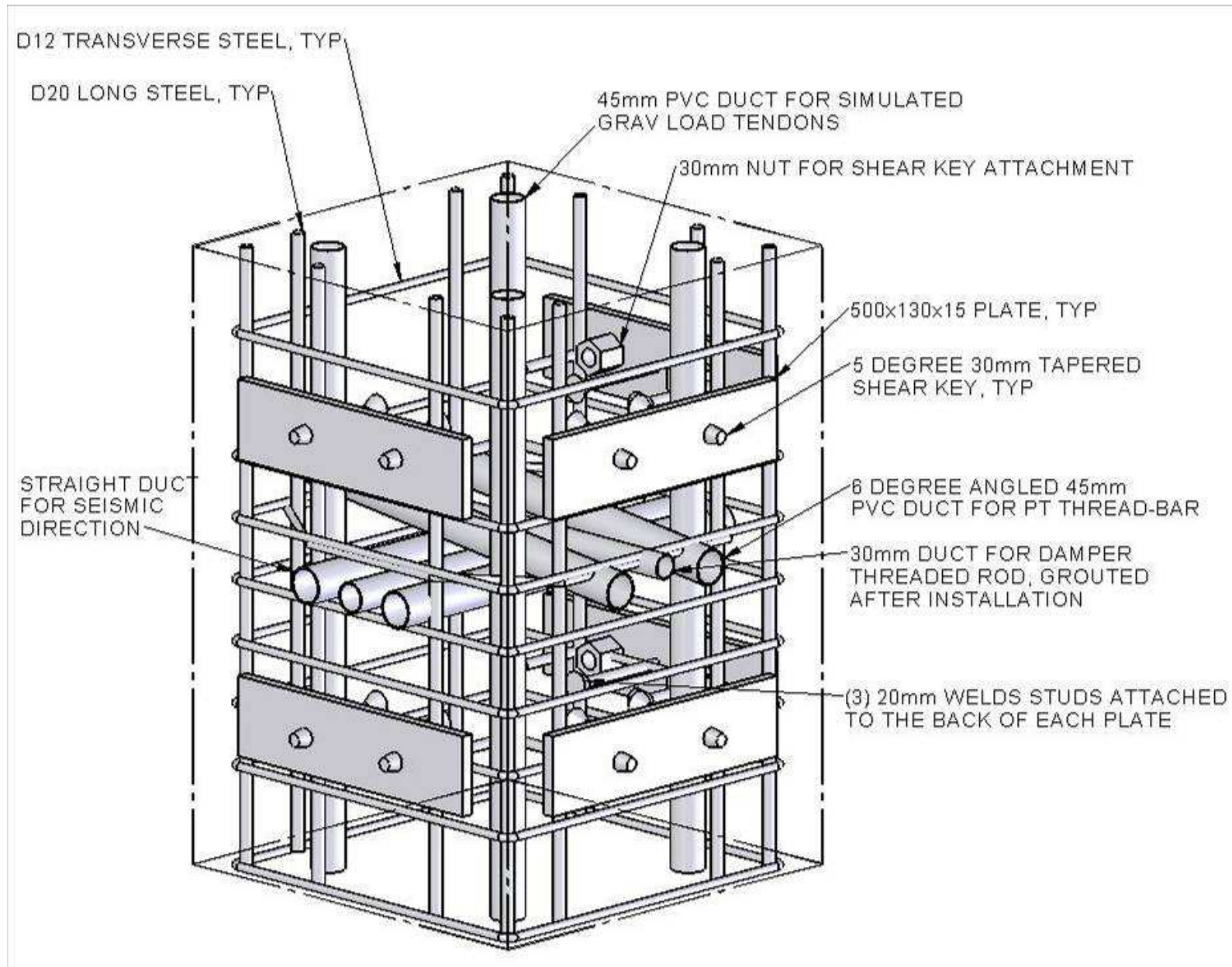
Beam-end region showing closure pour details and a LED device



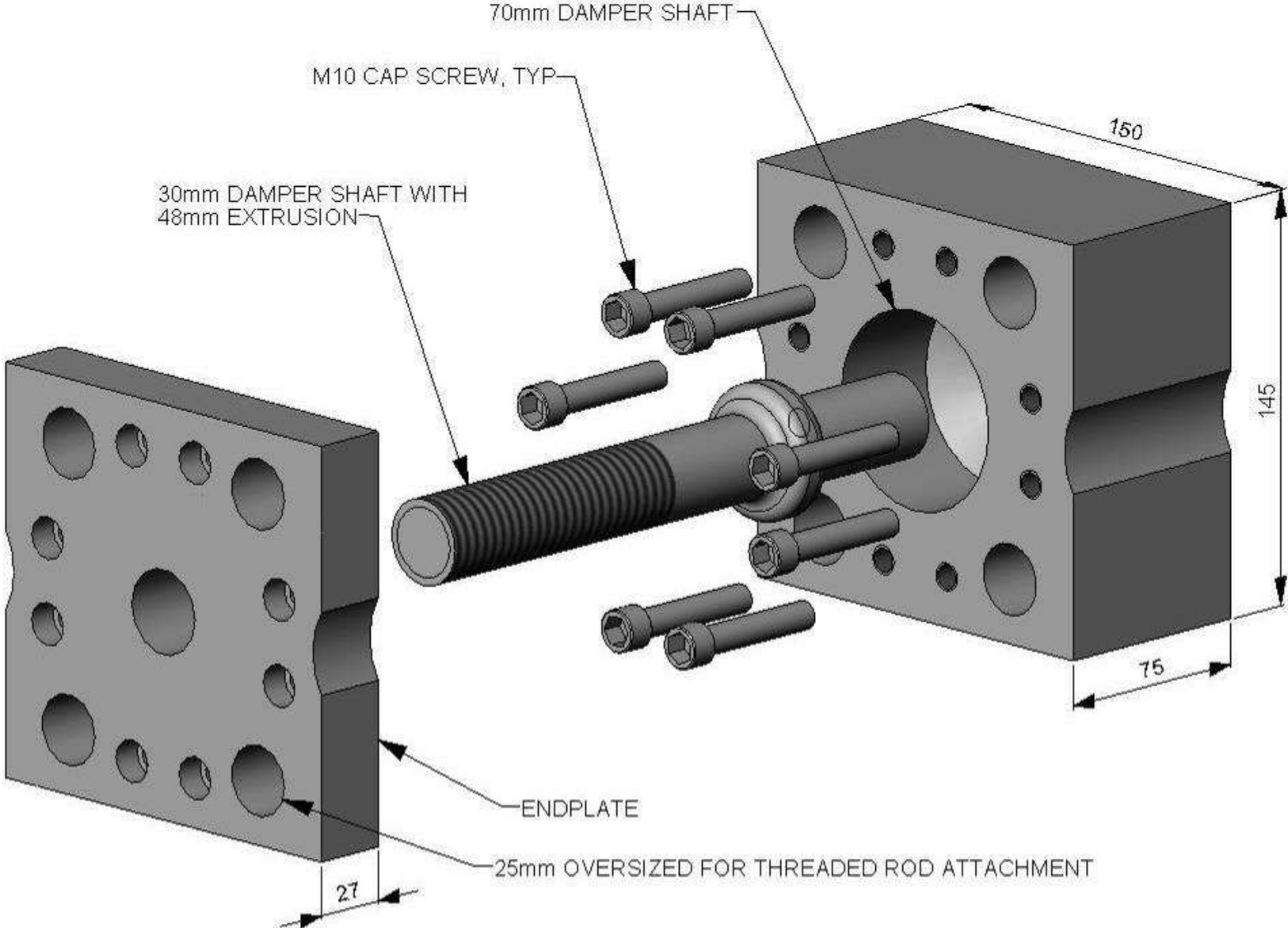
Reinforcing Details



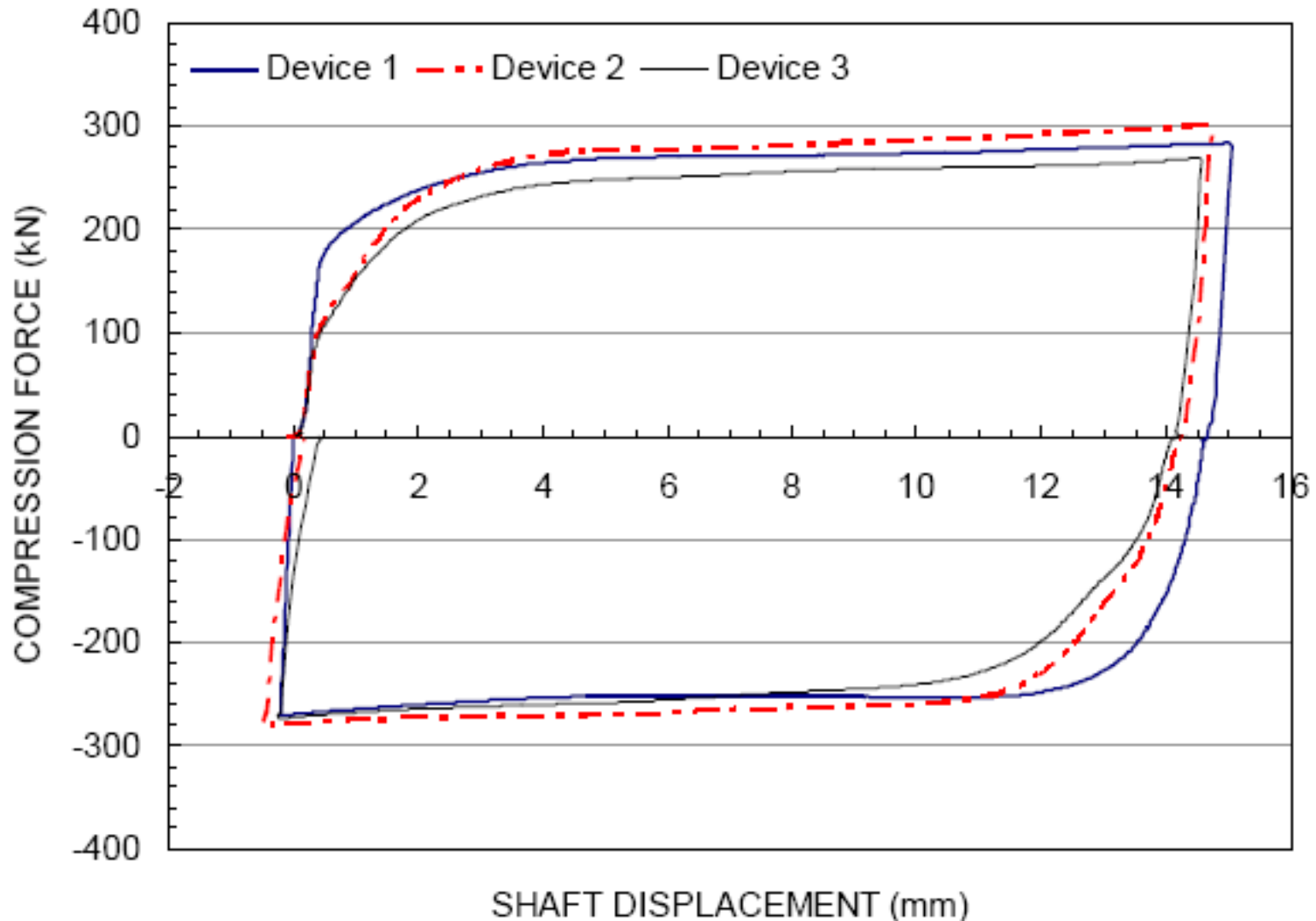
Column Connection



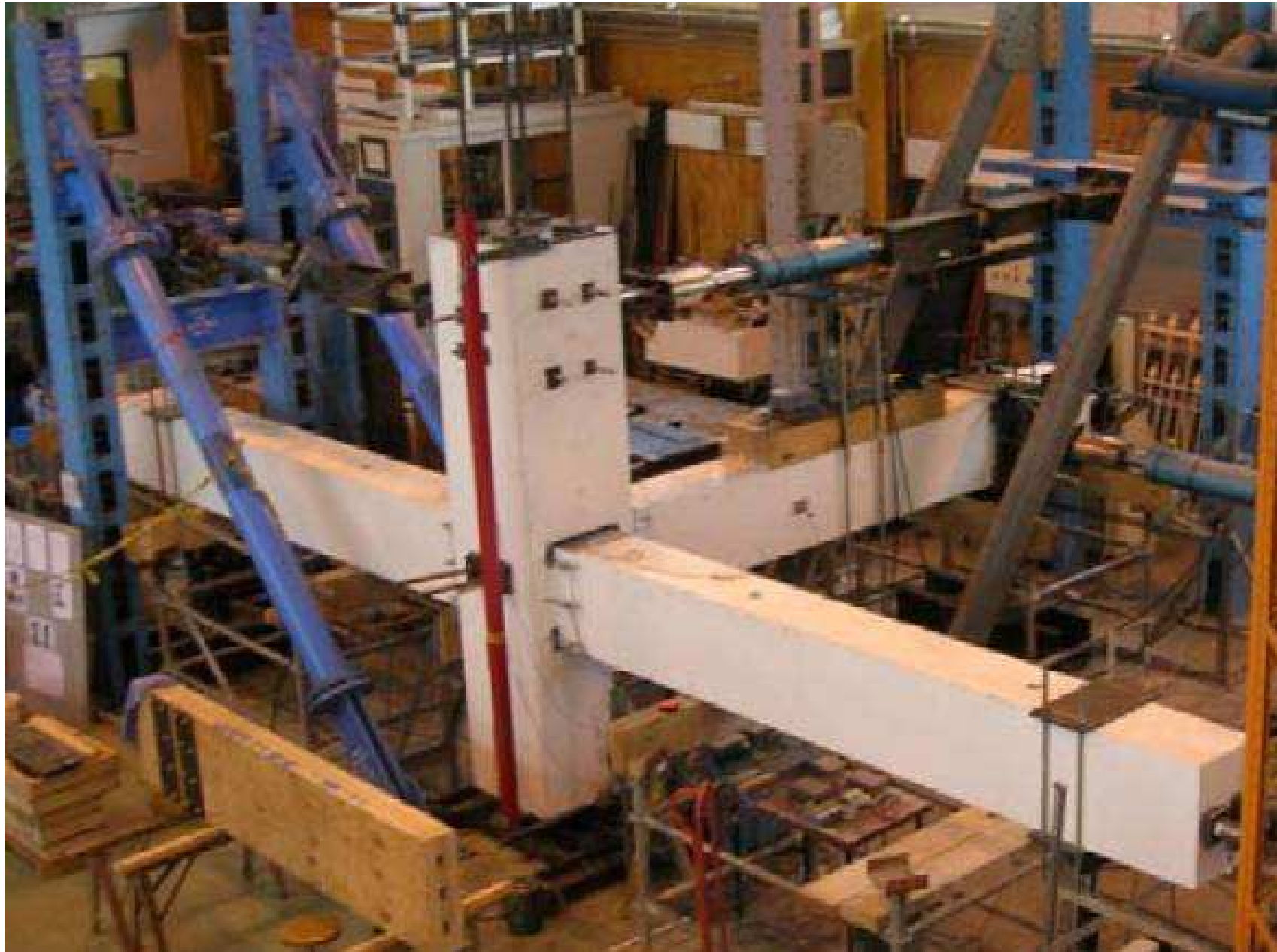
LED Device



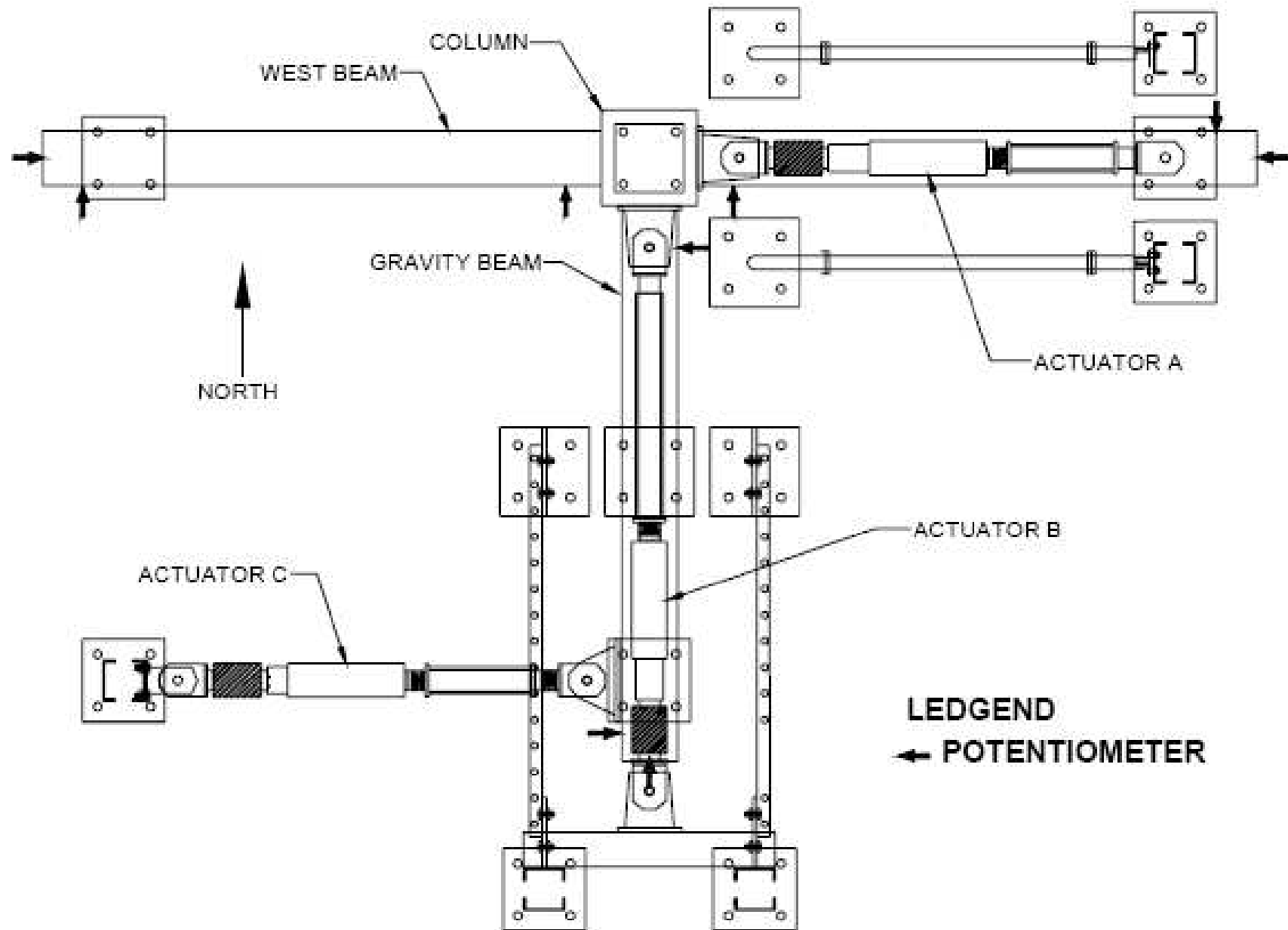
LED Device Performance



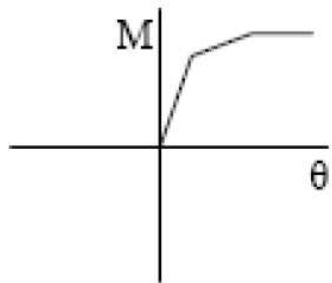
Experimental Setup



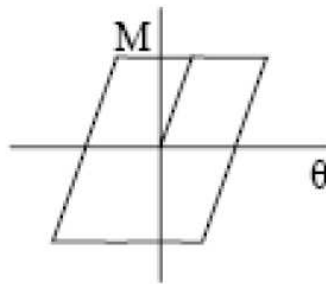
Plan view of experimental setup



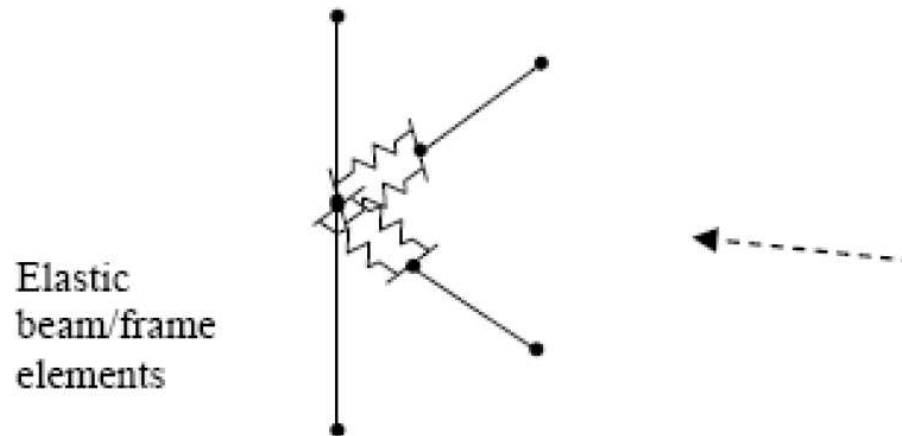
QED: modeling



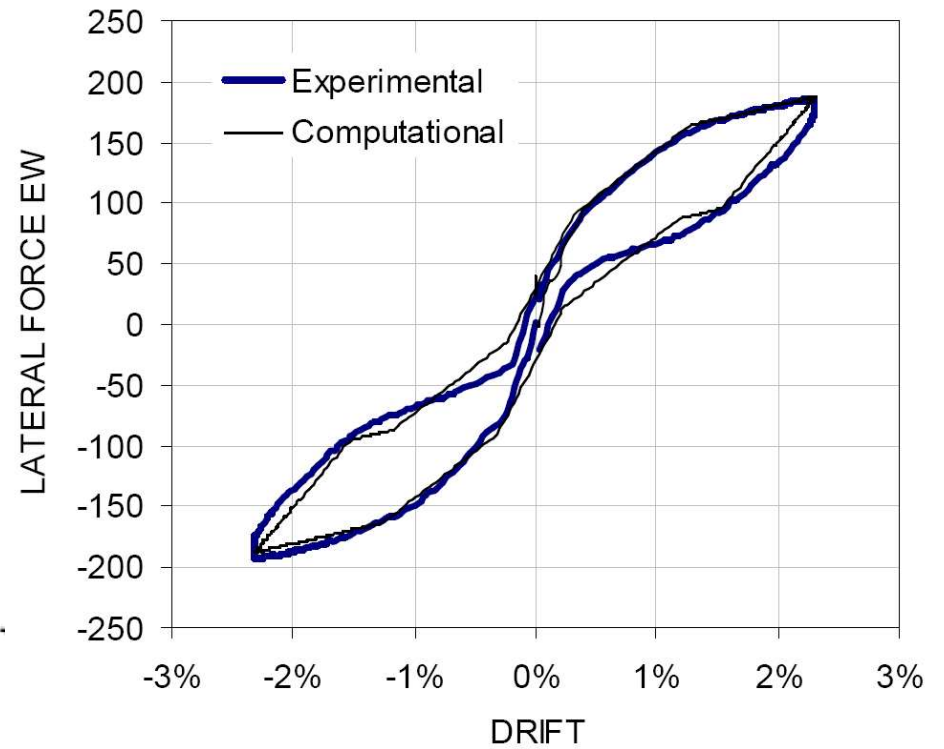
Tri-linear elastic spring



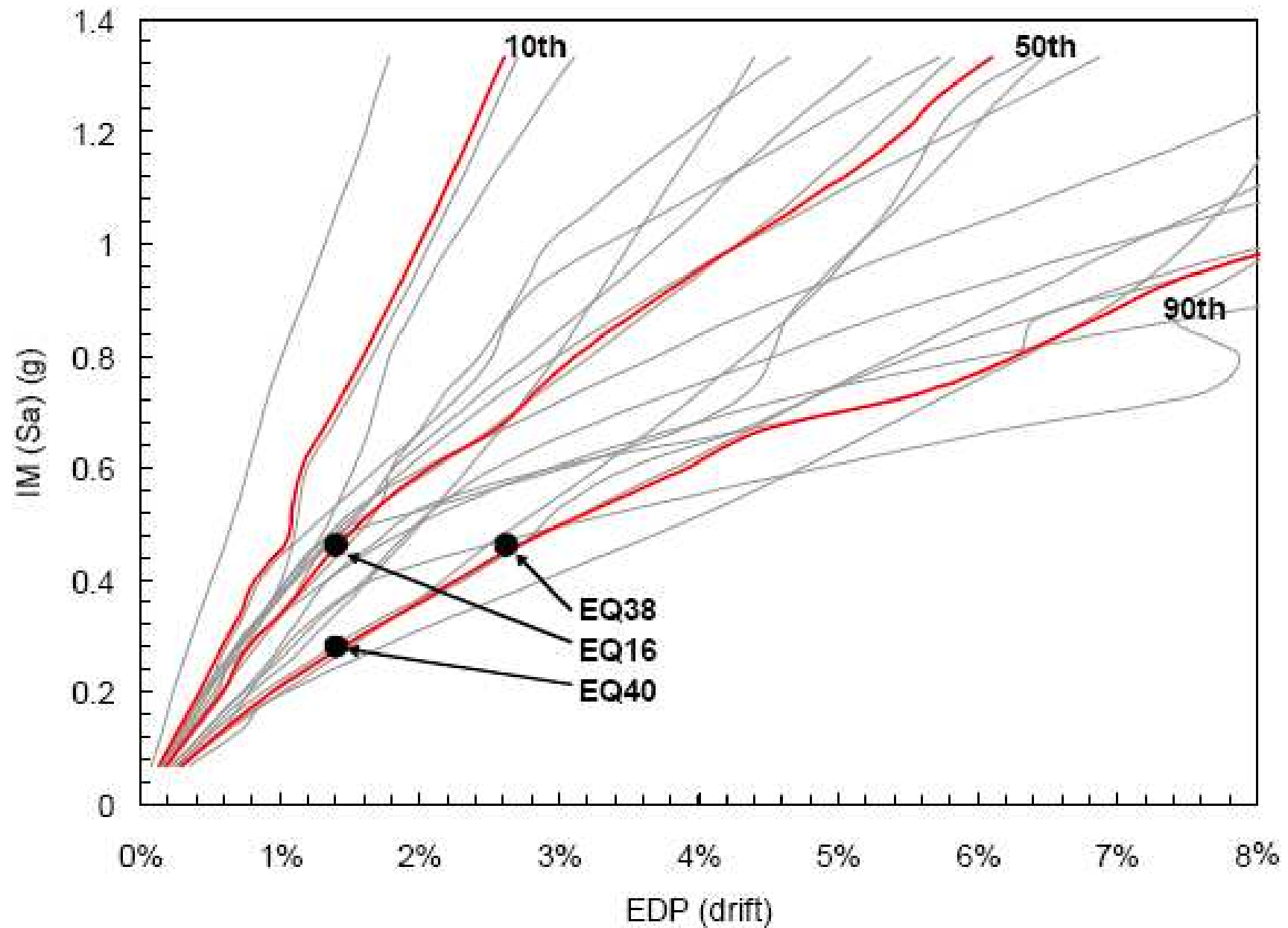
Elasto-plastic spring



Elastic beam/frame elements

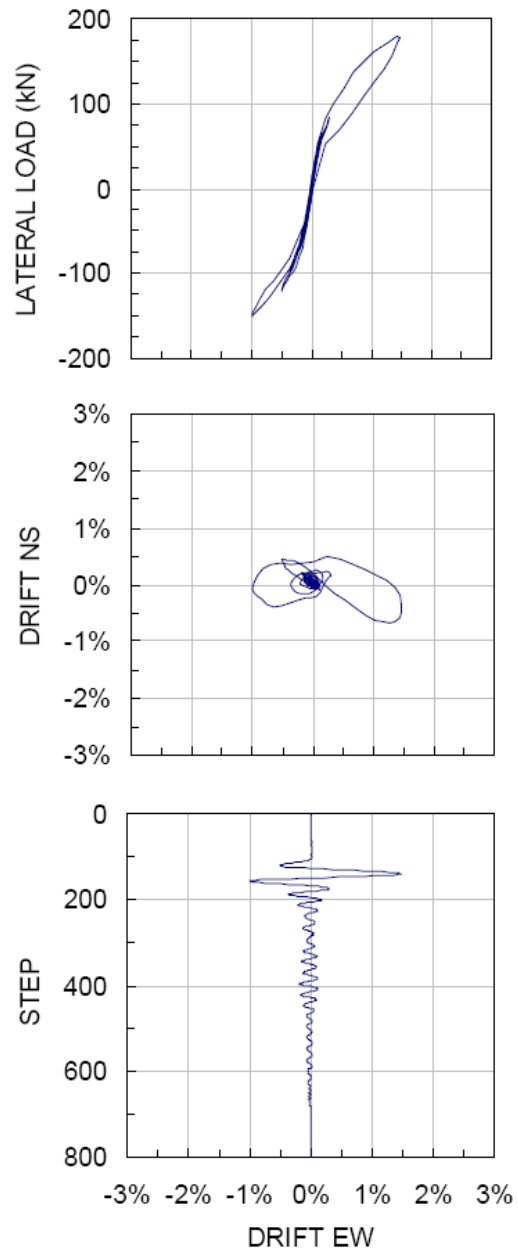


IDA results

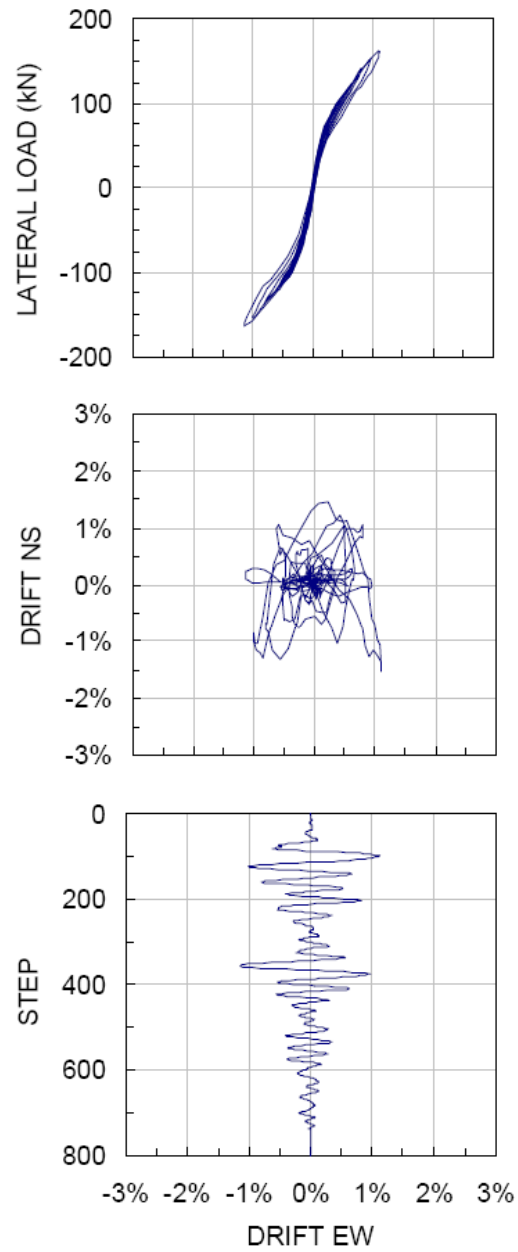


QED: results

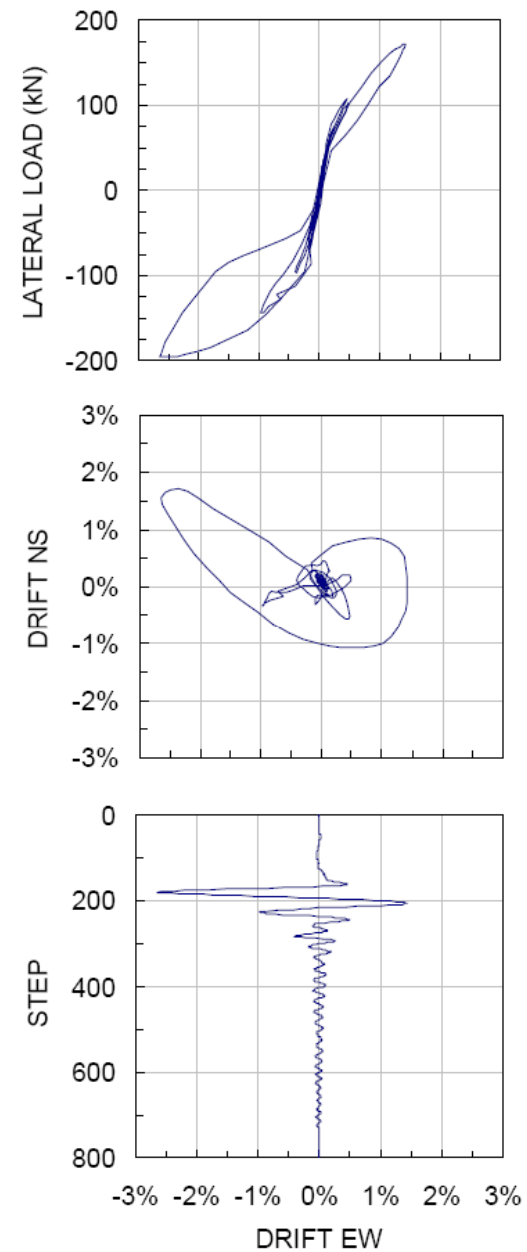
90% DBE



50% MCE



90% MCE



Key Findings:

- The specimen performed well through the most arduous earthquake event with NO damage. Moreover, re-centering was maintained at all times
- For successful DAD implementation small compact dampers should be installed within the connection region. Such devices should require no post-earthquake maintenance.
- The LED devices performed well in this regard.

Conclusion

- DAD precast systems are an attractive alternative to monolithic conventional systems designed for ductility. DAD systems can eliminate damage to the structural elements over a broad range of extreme seismic performance. Thus post-earthquake serviceability (I.O.) can be maintained even for very rare (MCE++) events.

Future Work

- The next step is to investigate the potential for eliminating damage beyond the frame and wall systems. Particular emphasis should be directed to the articulations of floor systems within DAD frames