Application of Mesh Reinforced Mortar for Performance Enhancement of Infill Walls

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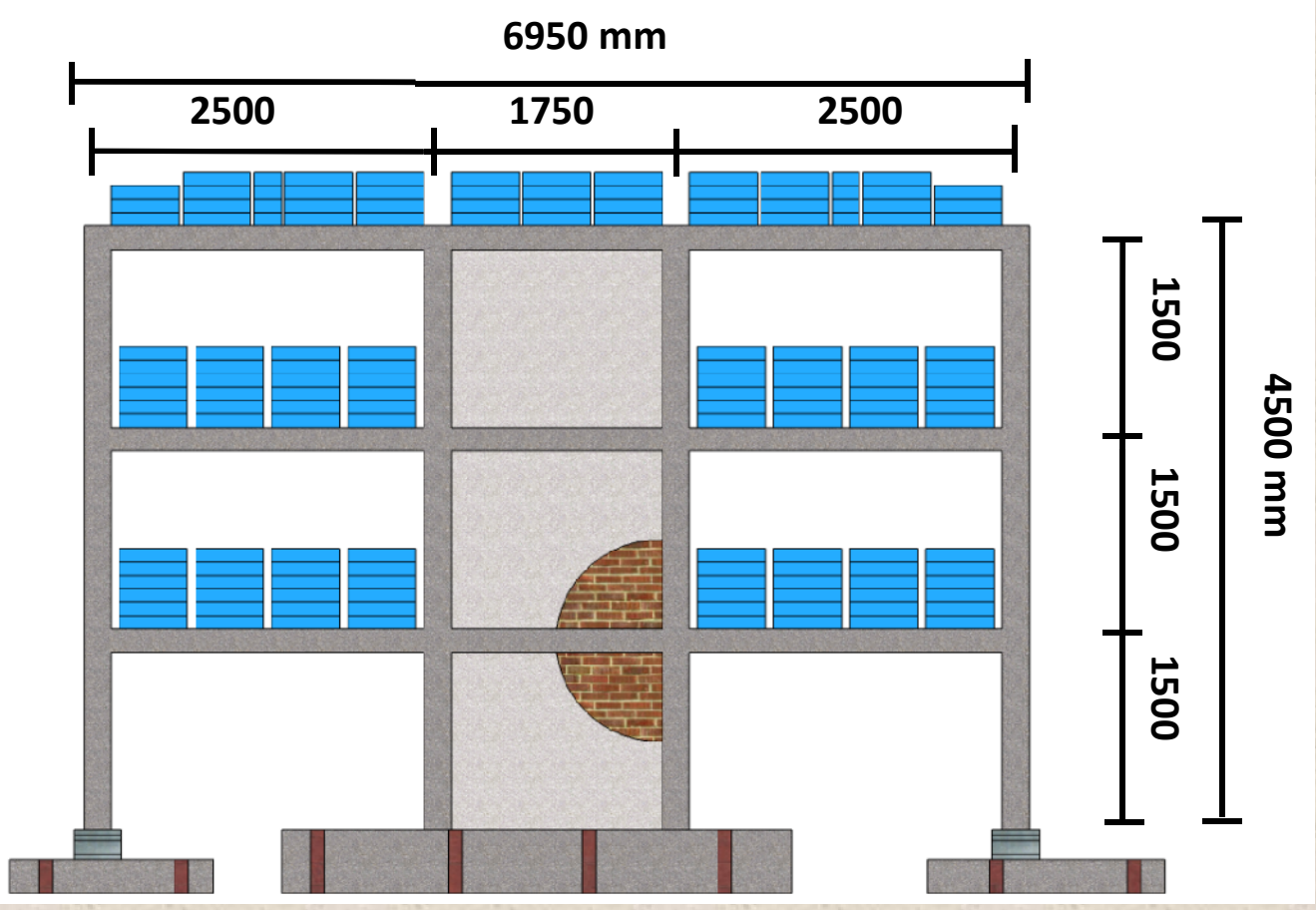
Brief

- Mesh Reinforcement with Mortar (MRM) is a recommended seismic strengthening procedure in the Turkish Seismic Resistant Design Code (2007).
- Benefits:
  - ease of application,
  - eliminating the out of plane failure of existing infill walls.
- The efficiency of the method was tested on single bay frame specimens using quasi-static loading.
- The performance of MRM application is investigated by pseudo-dynamic and cyclic tests.

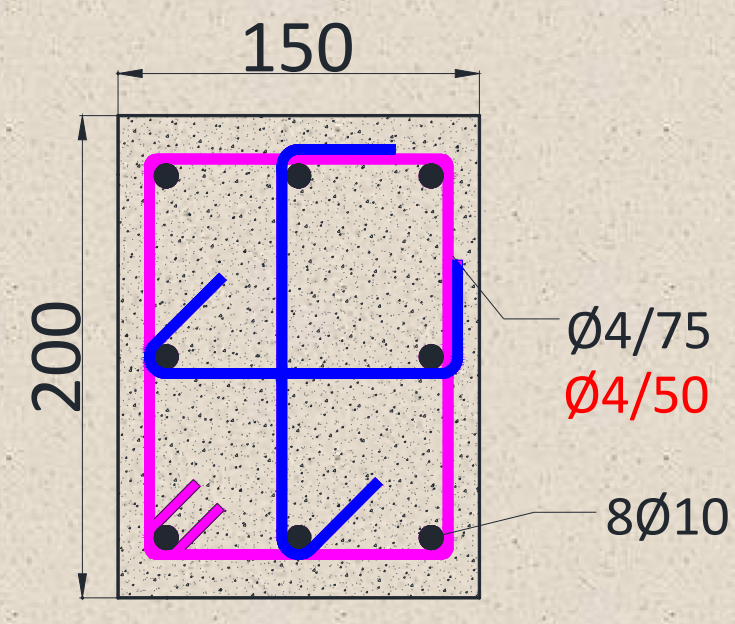
Test Frames

½ scale
Three story
Three bay
Code compliant (TEC 2007)
f_c= 20.5 MPa
Deformed bars
Confinement
Hollow clay brick infill wall
Gravity loads by dead weights

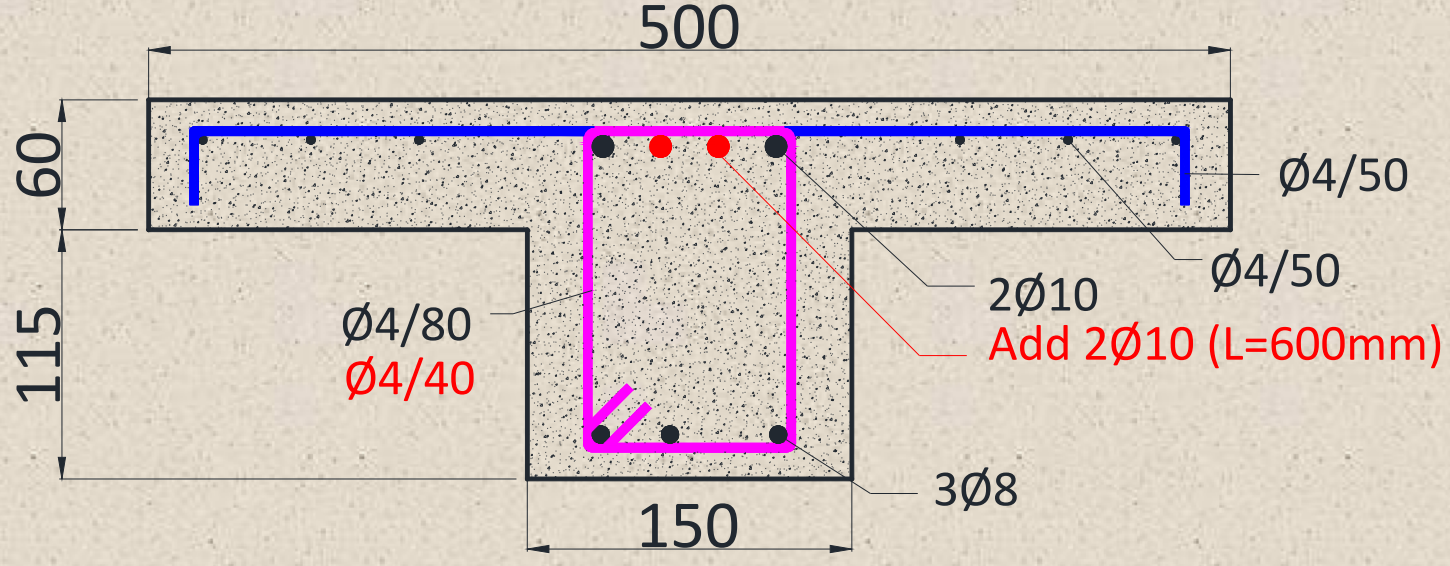


Section Details

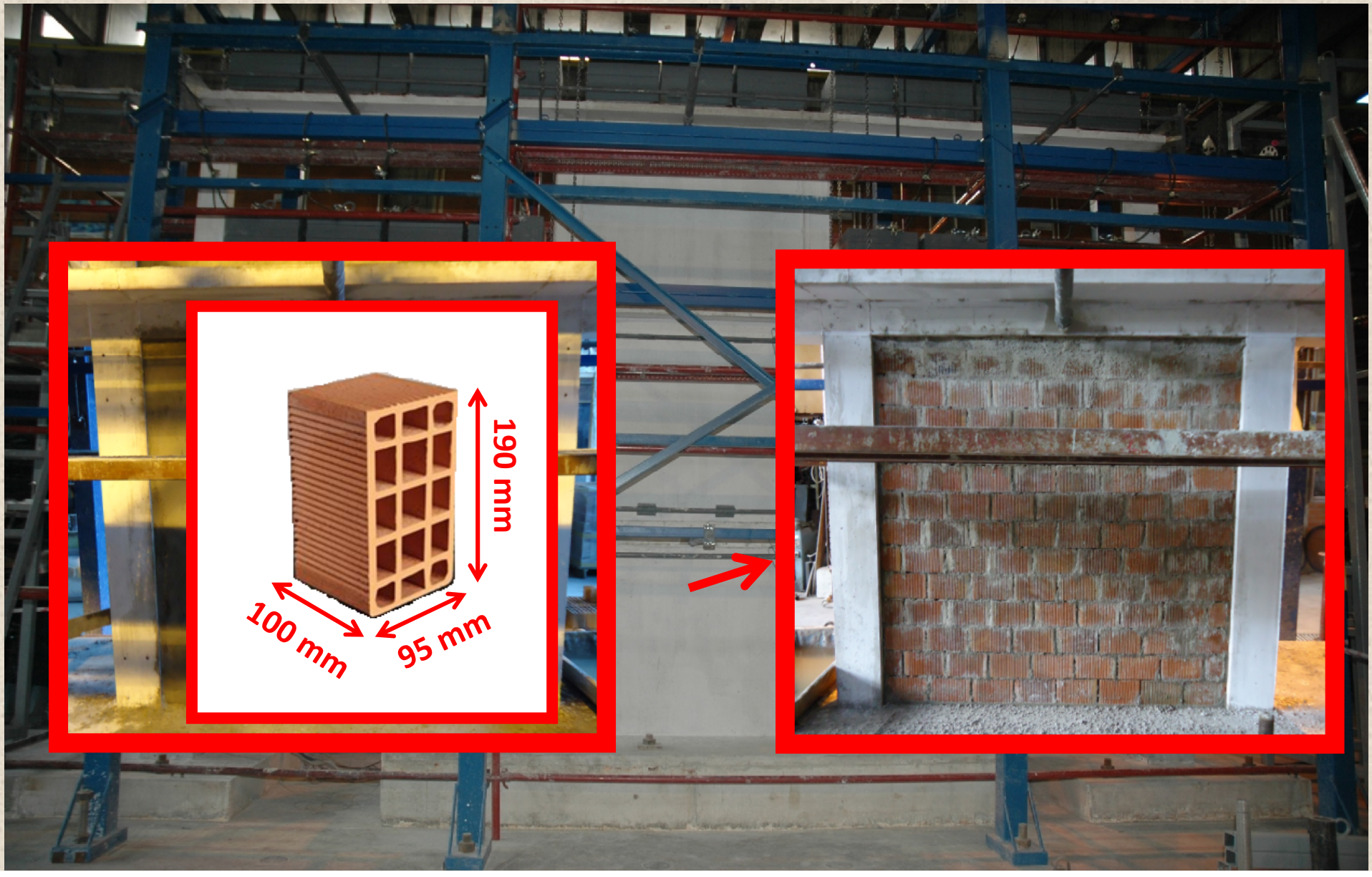
Columns



Beams

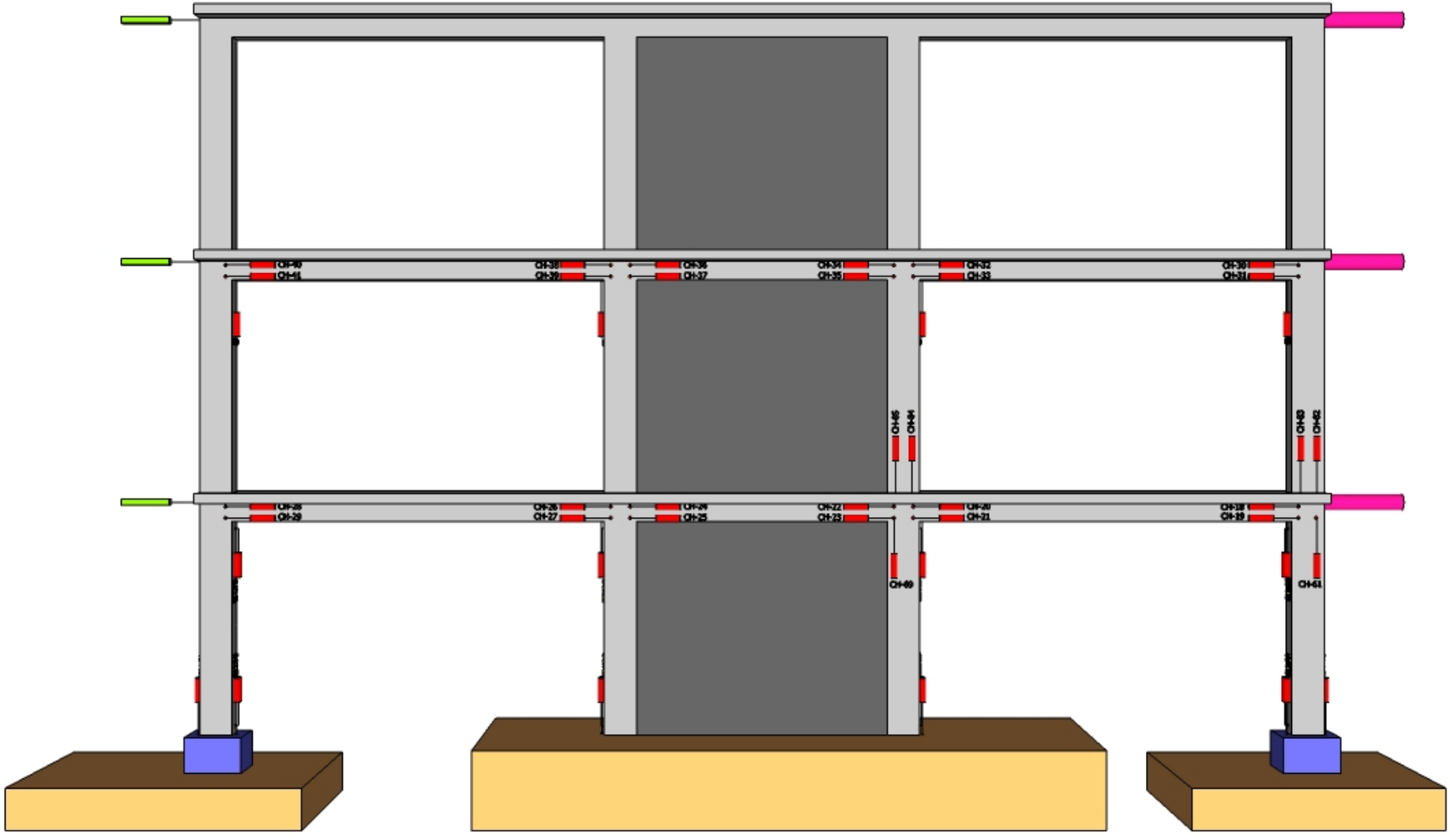


Test Frame-Reference



Experimental Setup

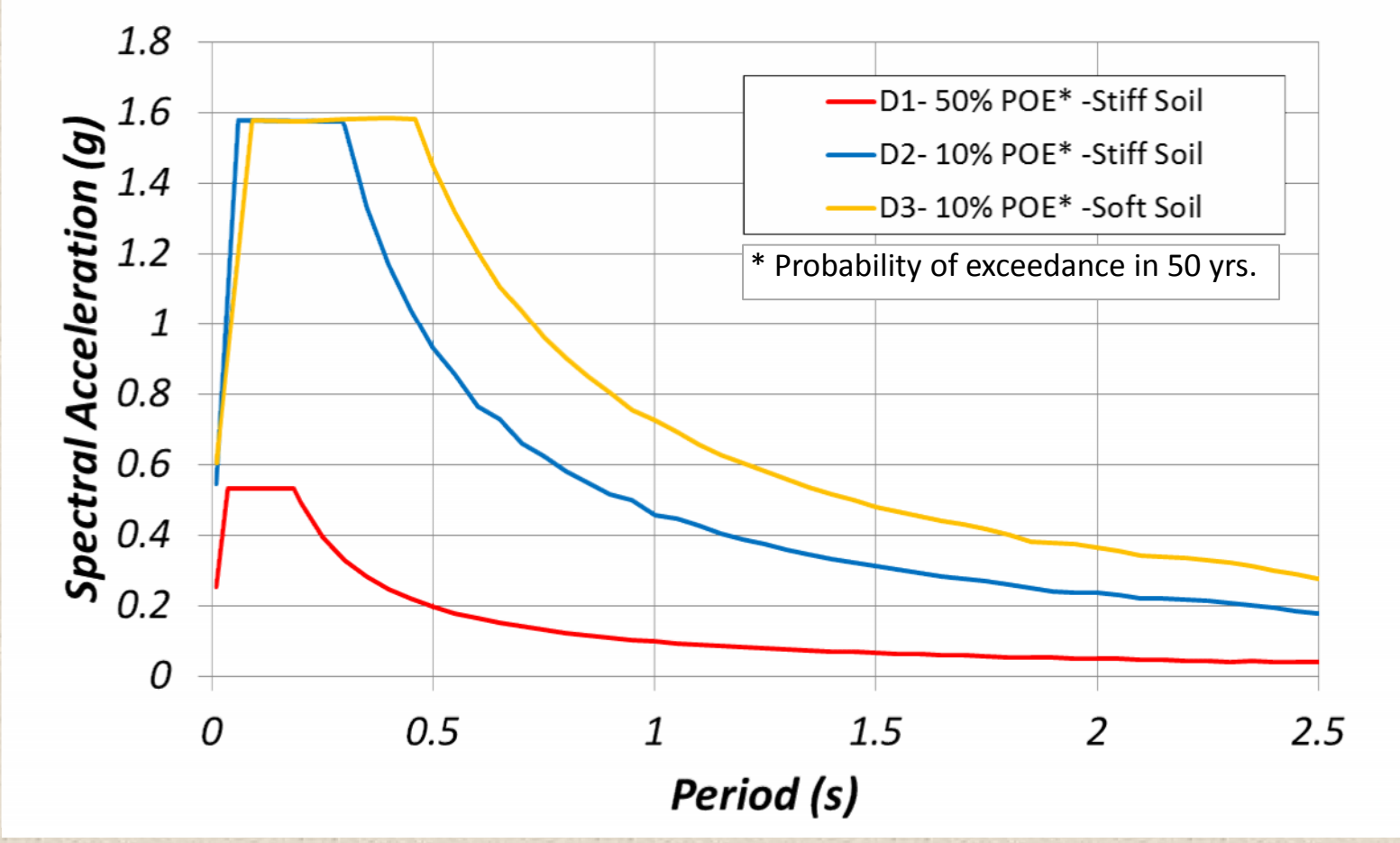
Gage Locations



Back View

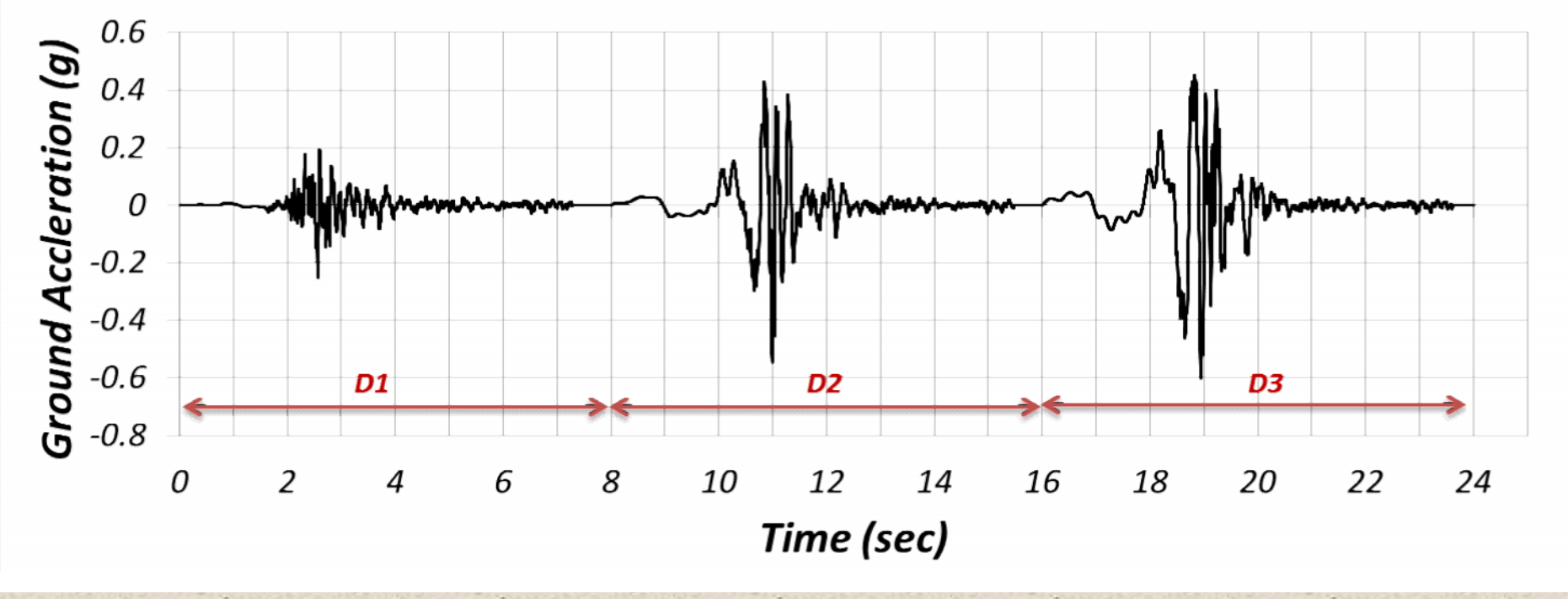
Site Specific Acceleration Spectra

Düzce site spectrum

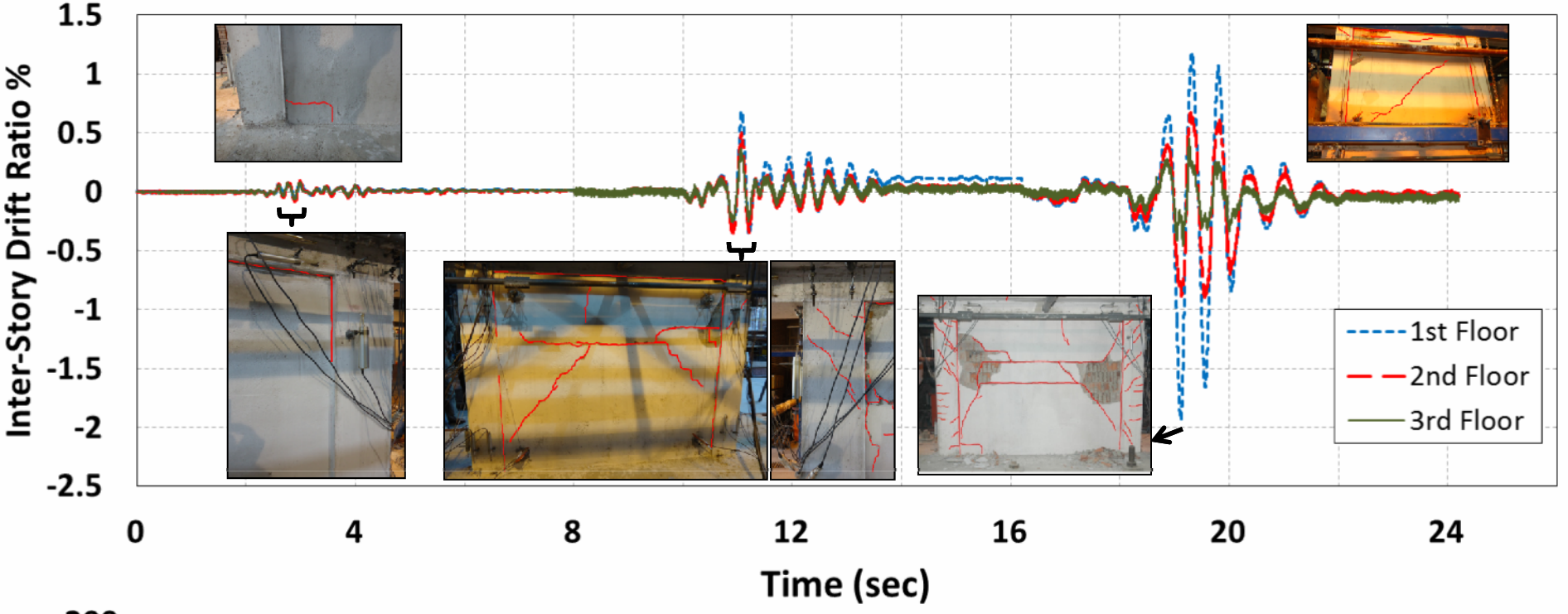


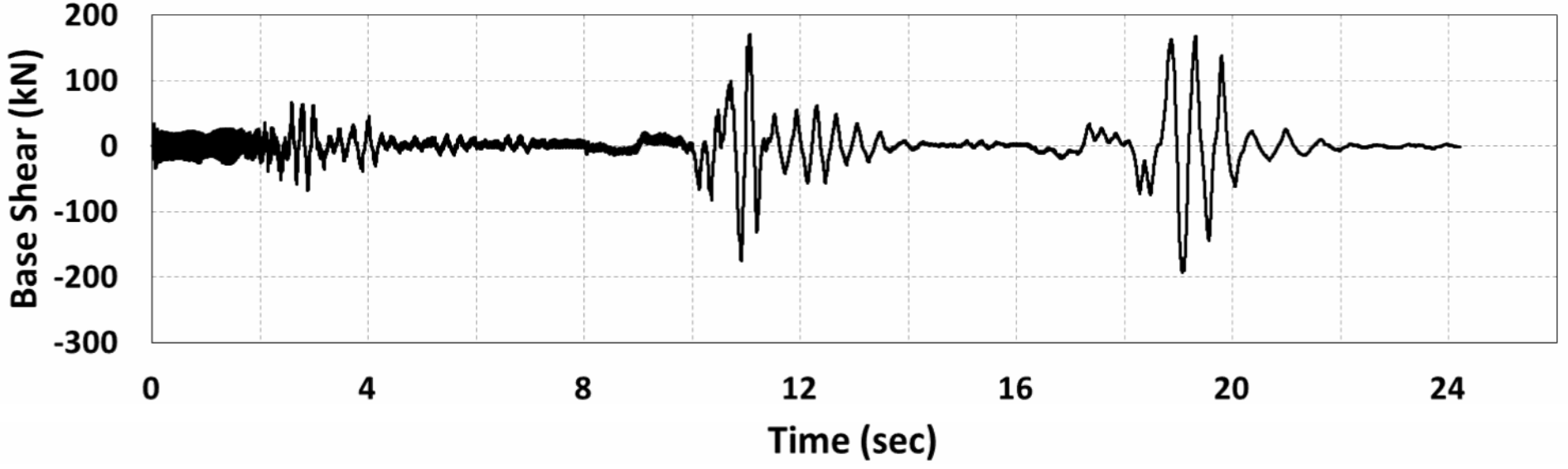
PsD Testing

Synthetic ground motions compatible with Düzce acceleration spectra



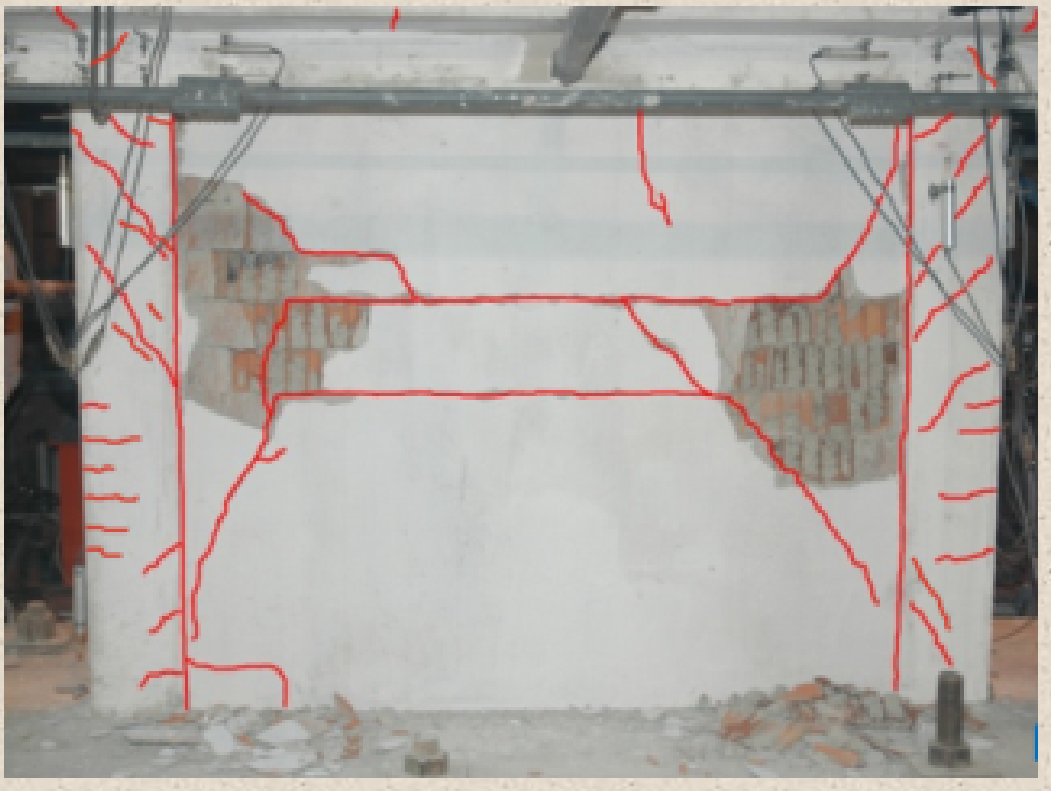
Reference Frame





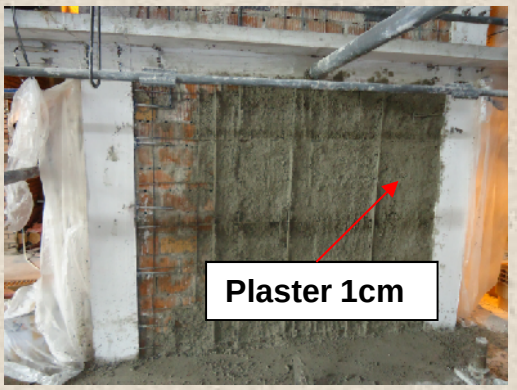
Infill's Damage state

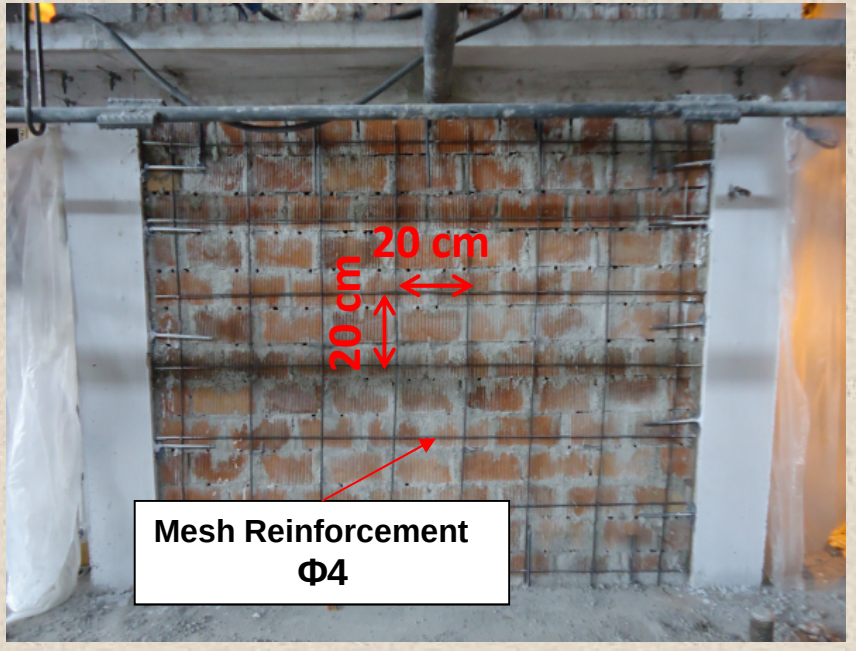
- After testing the specimen under D1, D2 and D3 ground motions respectively, extensive damages observed in the infill wall of the first story.



Mesh Reinforcement Mortar Application

- All Infill walls of the reference frame were replaced with new ones and repaired with MRM and retested as “Retrofitted Frame”.





PsD Testing

Aim:

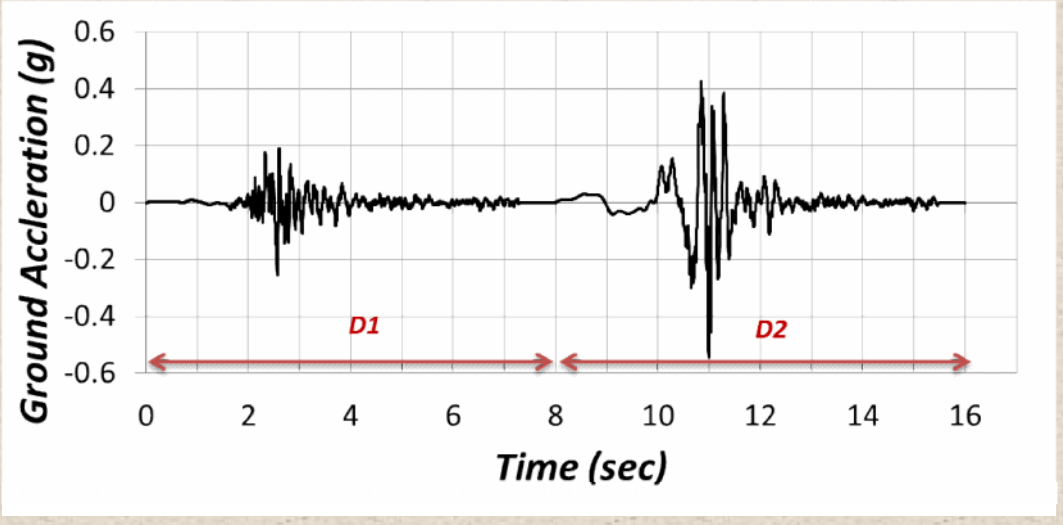
PsD test on retrofitted frame using D1, D2, D3 ground motions

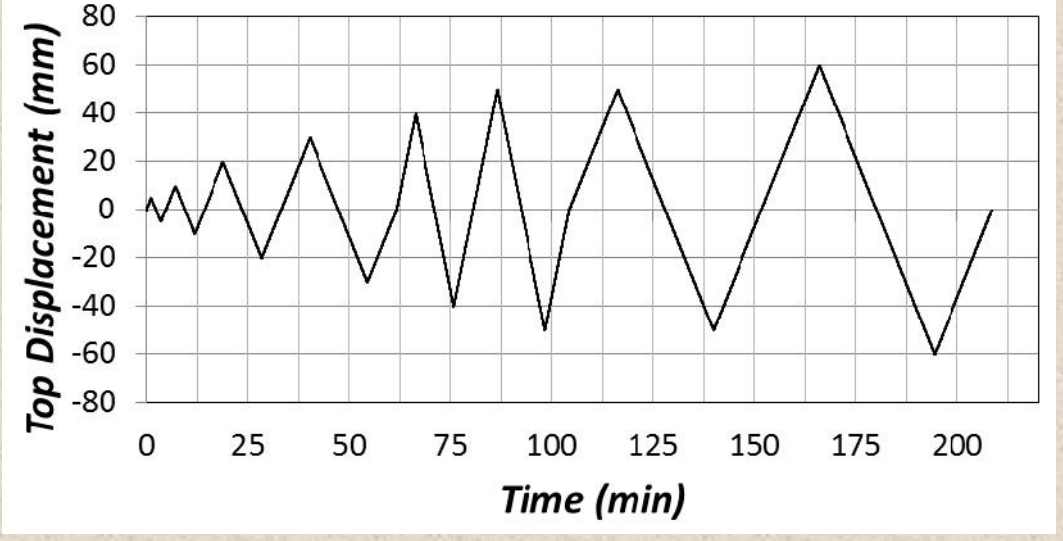
Problem:

Mechanical problems in servo-controlled actuators during D2

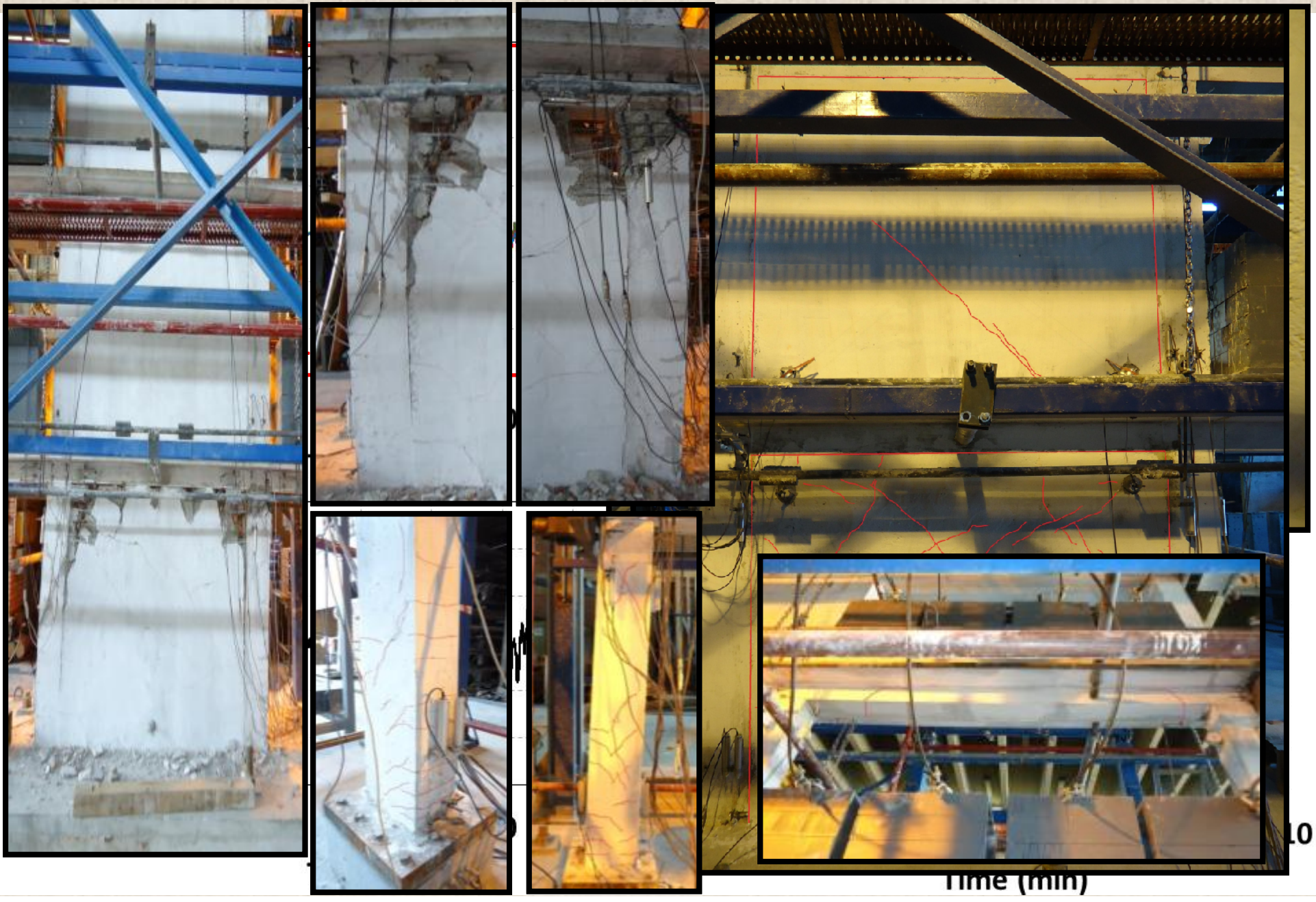
Solution:

Continued with displacement controled cyclic test.

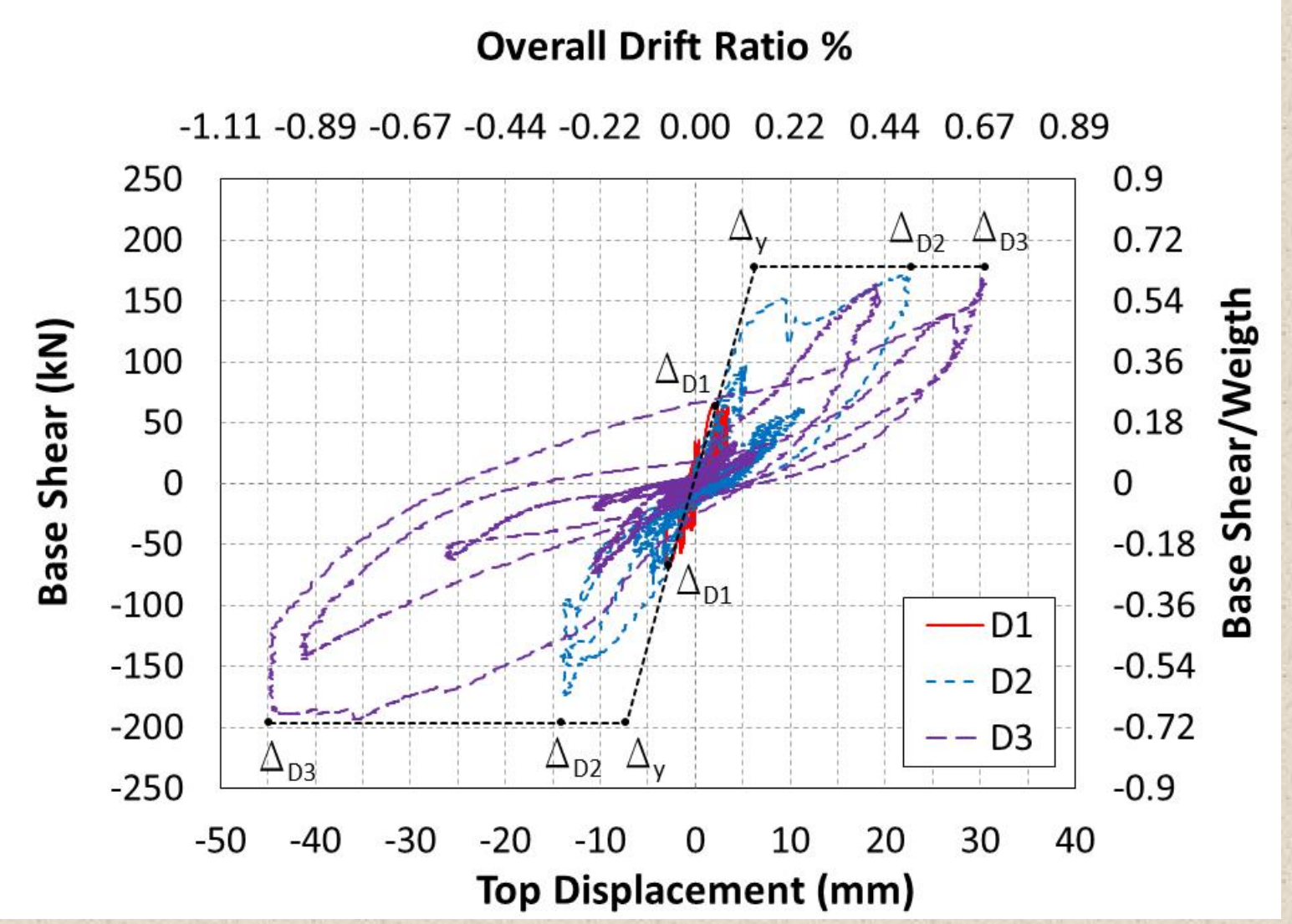




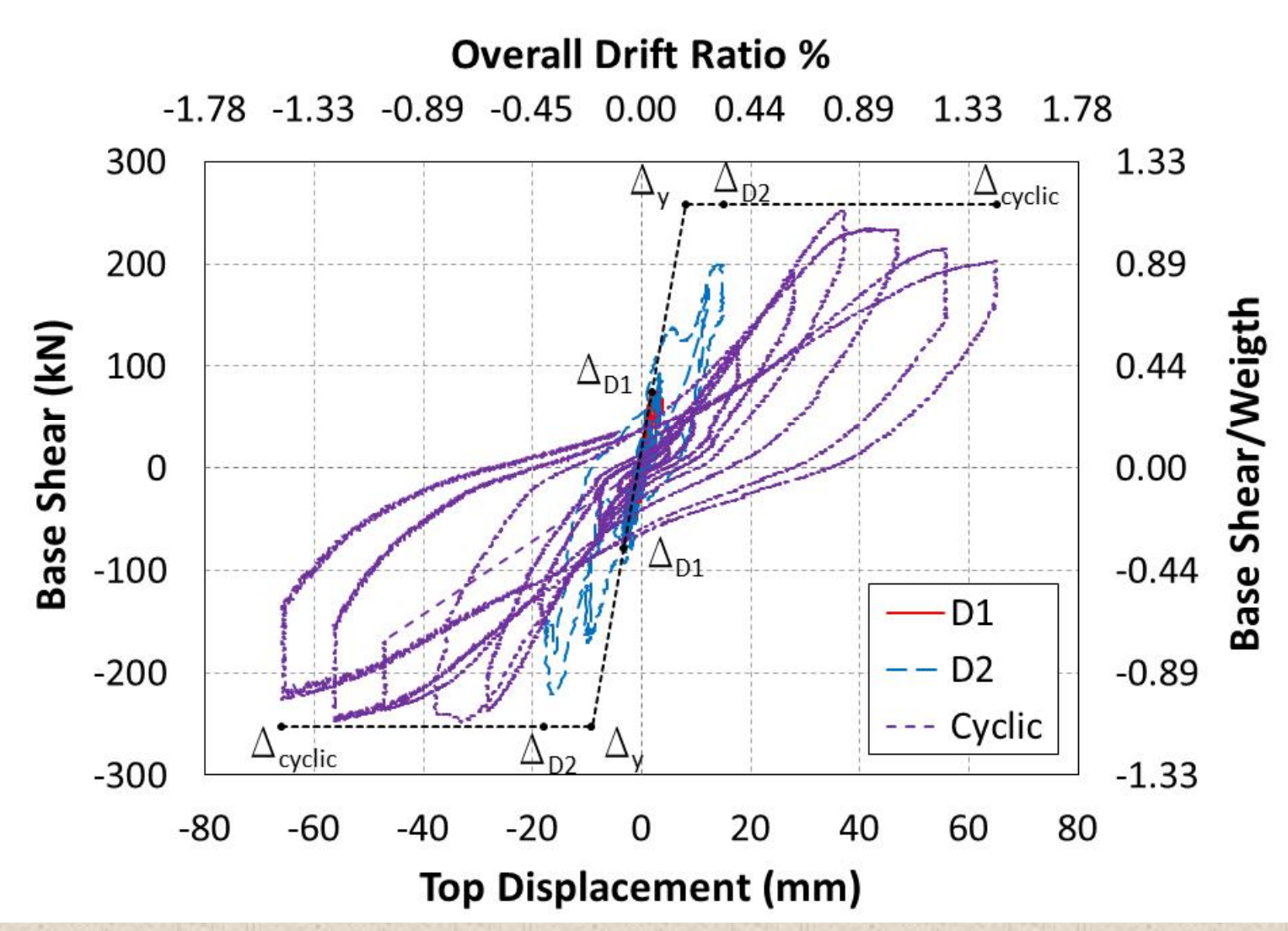
MRM Retrofitted Frame



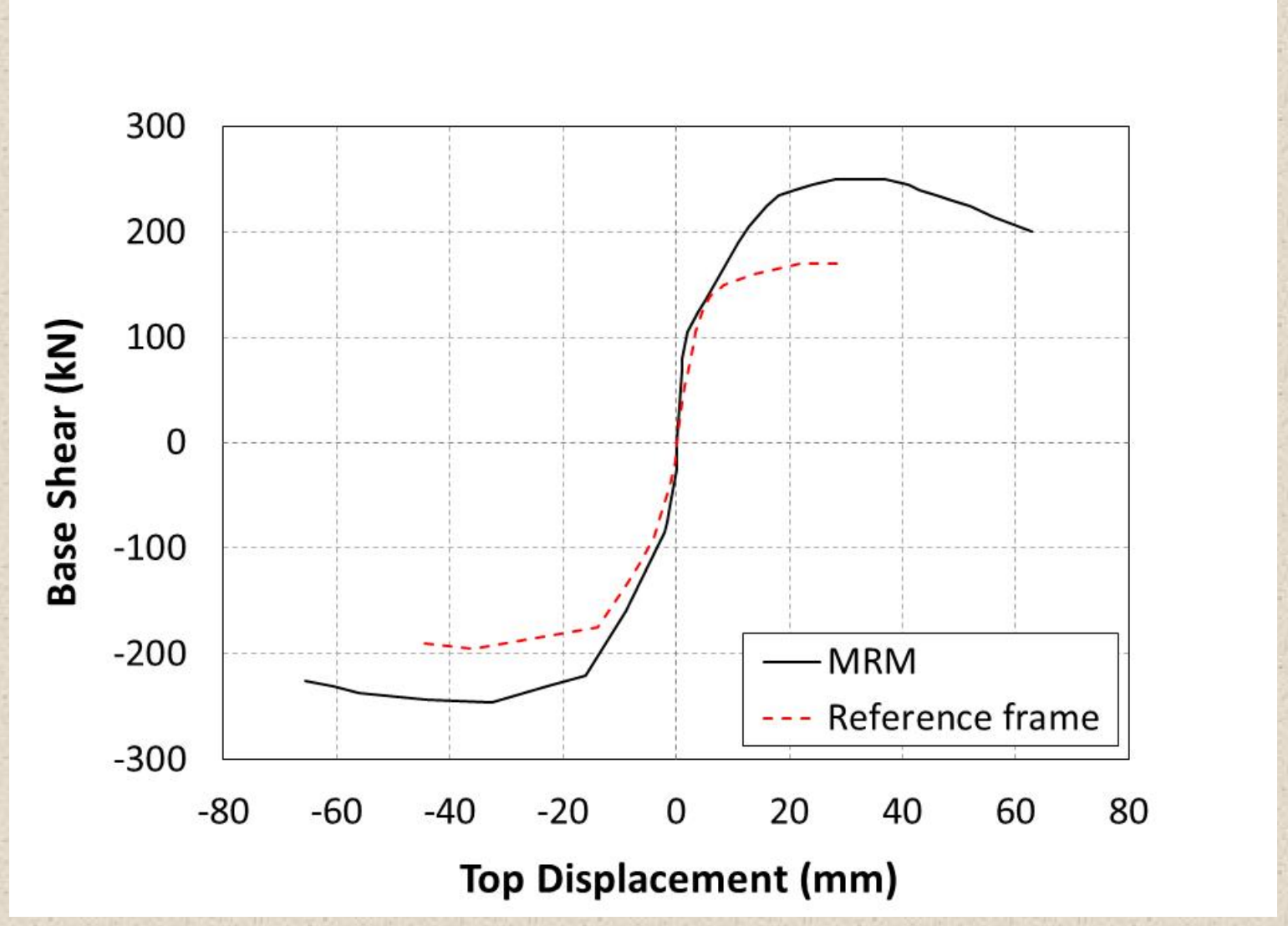
Reference Frame



MRM Retrofitted Frame

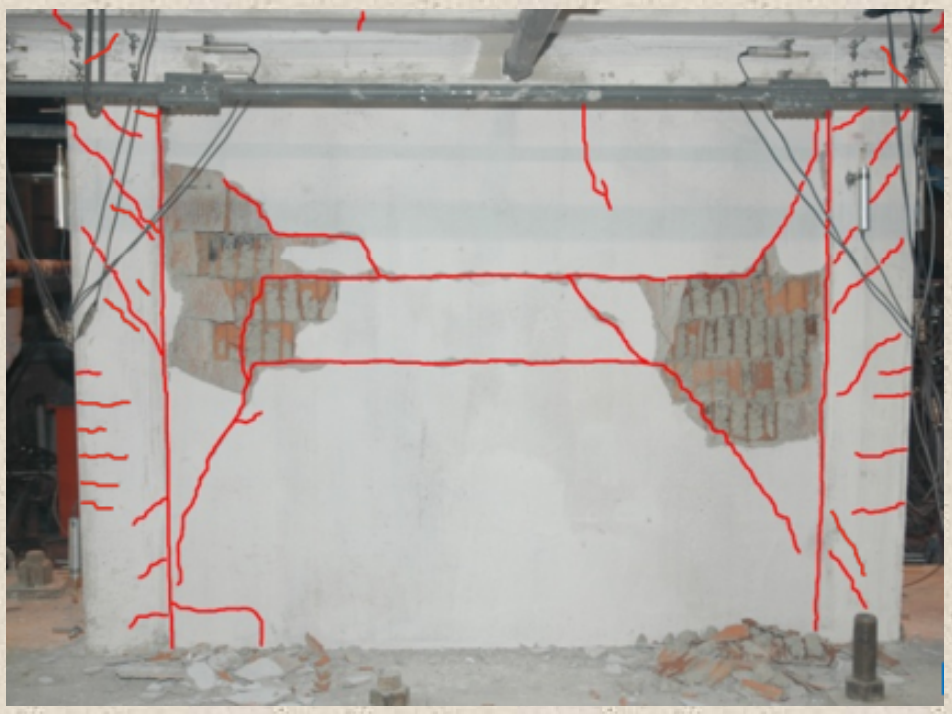


Envelope Comparisons



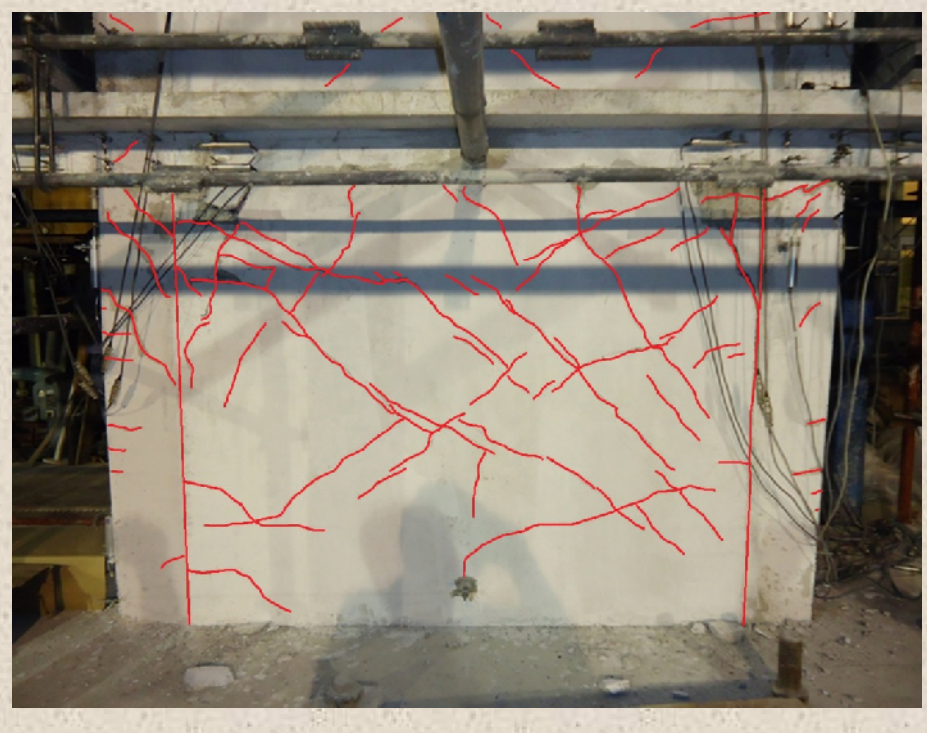
Comparison of Damage

Reference Frame



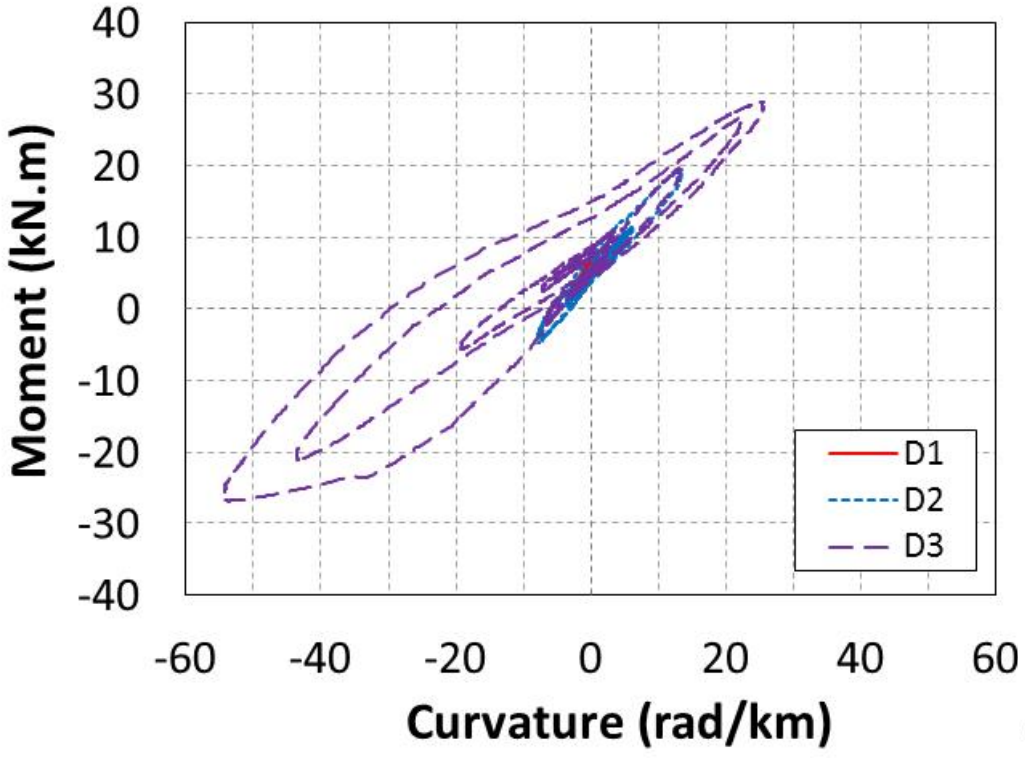
Inter-story drift ratio = 2%
Base-Shear= 193 kN

Retrofitted Frame

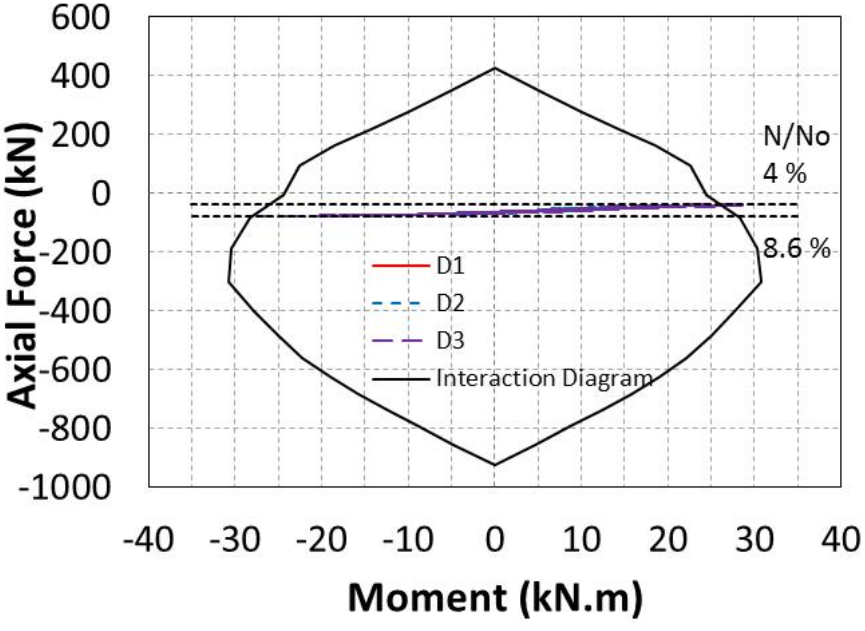


Inter-story drift ratio = 2%
Base-Shear= 233 kN

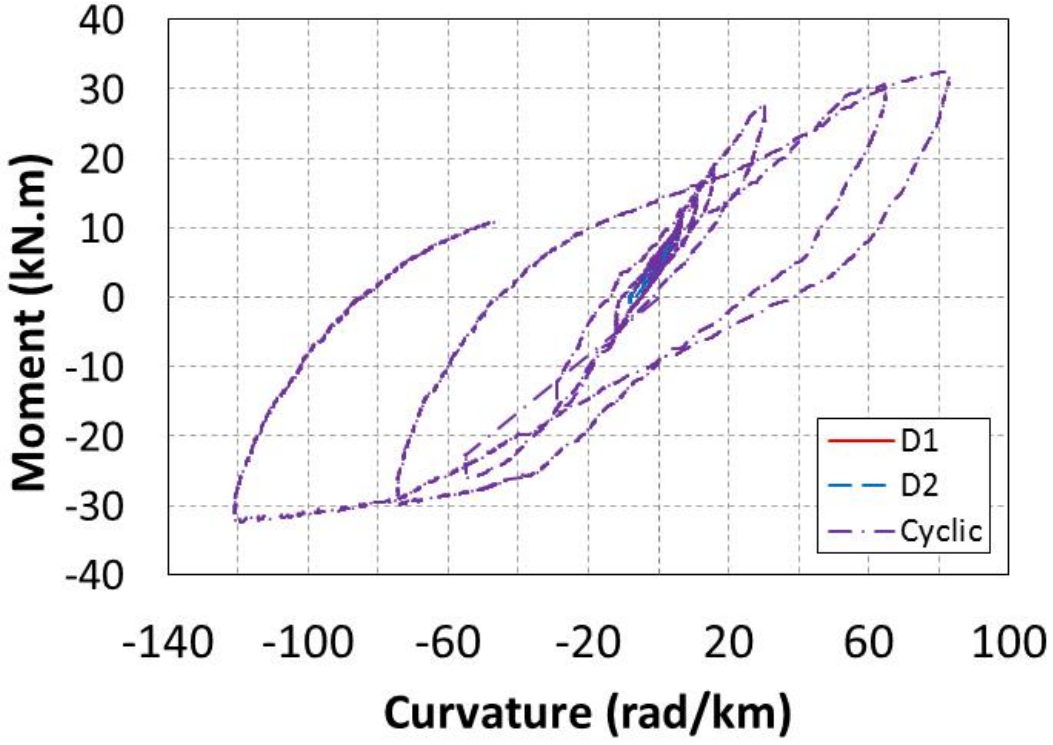
Column Response-Reference Frame



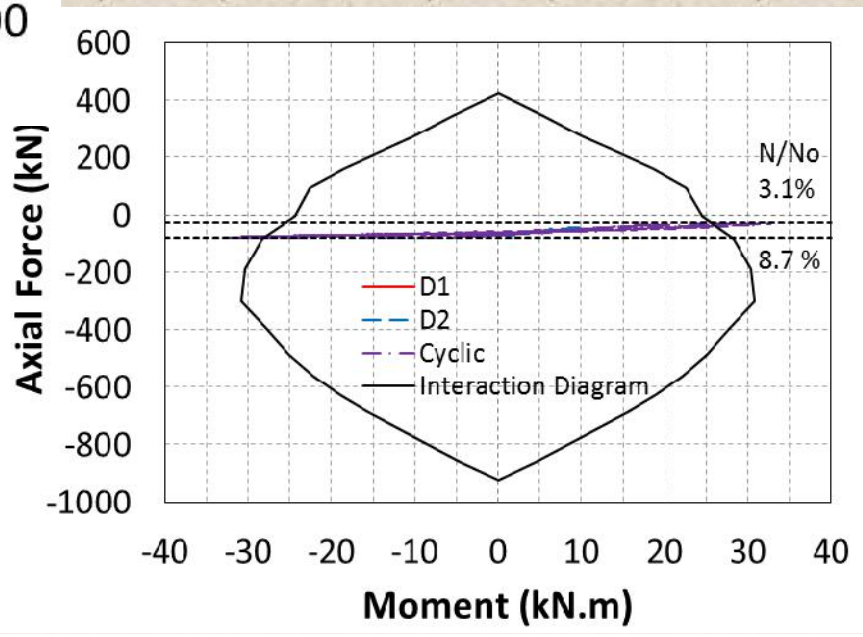
Column 4



Column Response-MRM Retrofit



Column 4



Summary of Test Results

Test Frame	Ground Motion	Max. Interstory Drift % (Story 1)	Max. Interstory Drift % (Story 2)	Max. Interstory Drift % (Story 3)	Max. Base Shear (kN)	Max. Disp. Ductility Demand
Ref.	D1	0.073	0.095	0.082	67	1
	D2	0.68	0.5	0.36	175	3.9
	D3	1.93	0.89	0.46	193	6.1
MRM	D1	0.056	0.1	0.1	80	1
	D2	0.41	0.5	0.45	221	3.6
	Cyclic	3.5	1	0.85	248	-

Conclusion

- MRM Application provided 25% decrease in first story drift ratio and 20% increase in base shear demand under D1 ground motion which resulted in approximately minimum damage.
- This method also provided 40% decrease in first story drift ratio and 26% increase in base shear demand under D2 ground motion which resulted in moderate damage.
- More importantly, the main advantage of MRM is to provide out of plane support to the brick wall.
- During the cyclic test it is observed that MRM method kept the frame's integrity and enabled the frame to carry lateral load at higher level of drift without significant strength degradation.

Thanks for your kind attention