HFL Testing Briefing

- WSDOT ABC Meeting 08.04.2010 -

University of Washington

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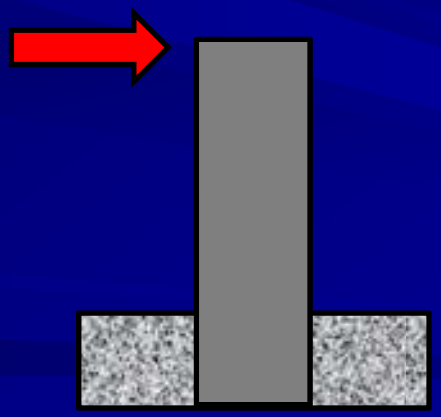
Overview

- Completed tests: results
- Planned tests

Specimens Tested: Overview

- Column-to-footing connection:
  - A precast column embedded in a cast-in-place foundation



Specimens Tested: Details

- Two 42 %-scale specimens constructed:
  - Specimen A: “Full Guide Spec”
  - Specimen B: Less conservative

Test Specimens

- Differences in footing details:
  - Flexural steel moved outside column.
  - Almost all shear friction steel removed.
  - Half of the footing ties removed.

Bars in slots

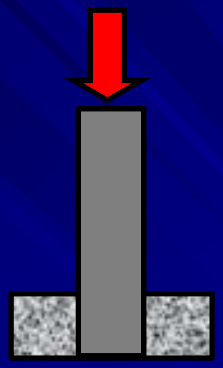
Specimen A

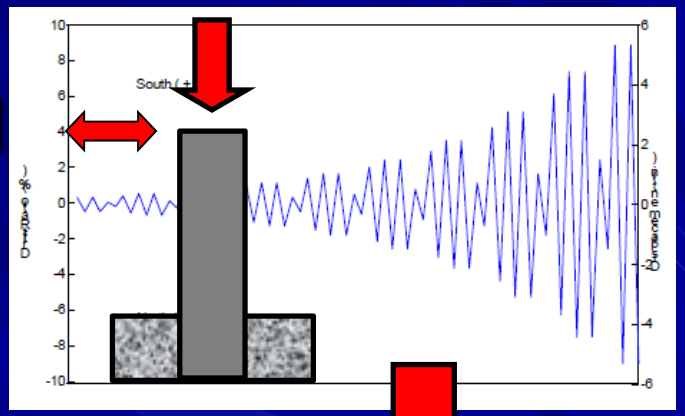
Reduced SF steel

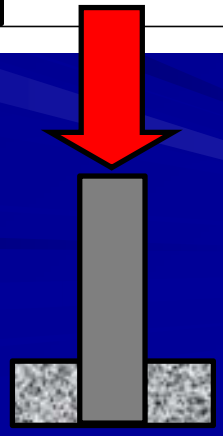
Specimen B

Testing

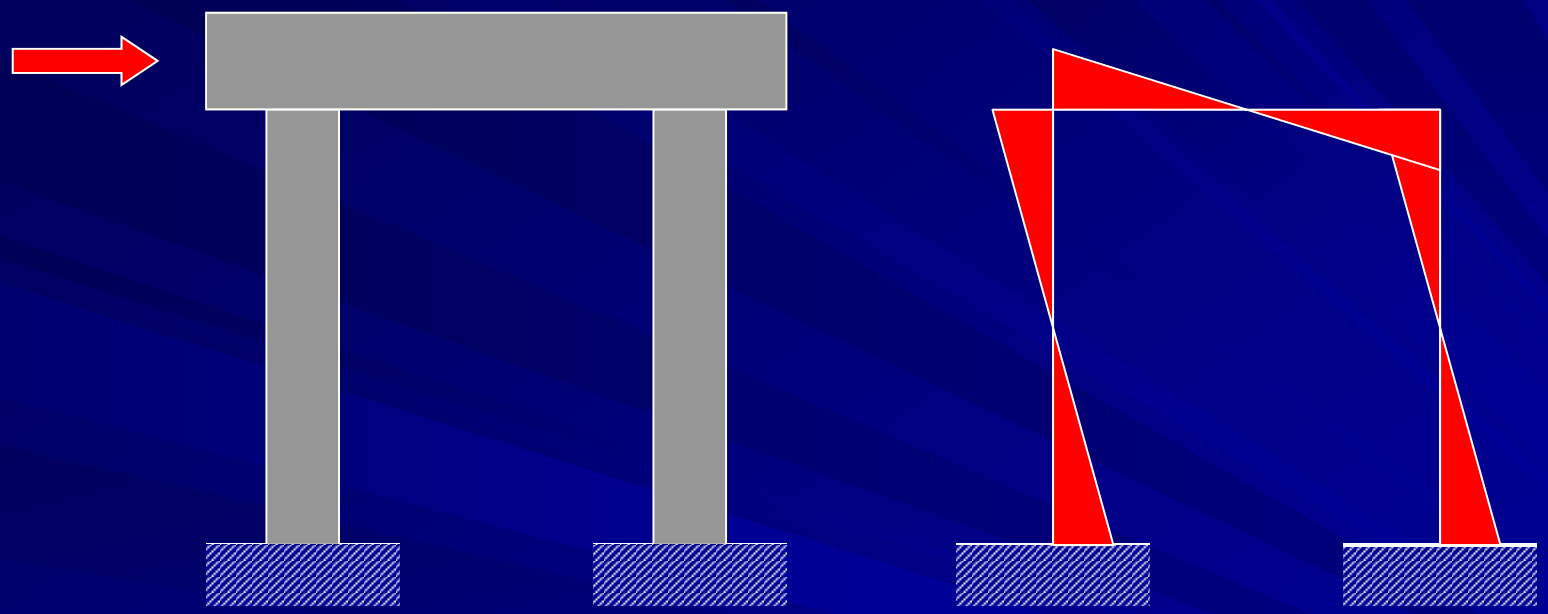
- 1. Pure axial load
  - Factored DL + LL = 240 kips
- 2. Axial load plus horizontal load:
  - Constant un-factored dead load 159 kips
  - Cyclic horiz. displacement. (Modified NEHRP).
- 3. Pure axial load to failure
  - Determine punching capacity







Seismic Performance

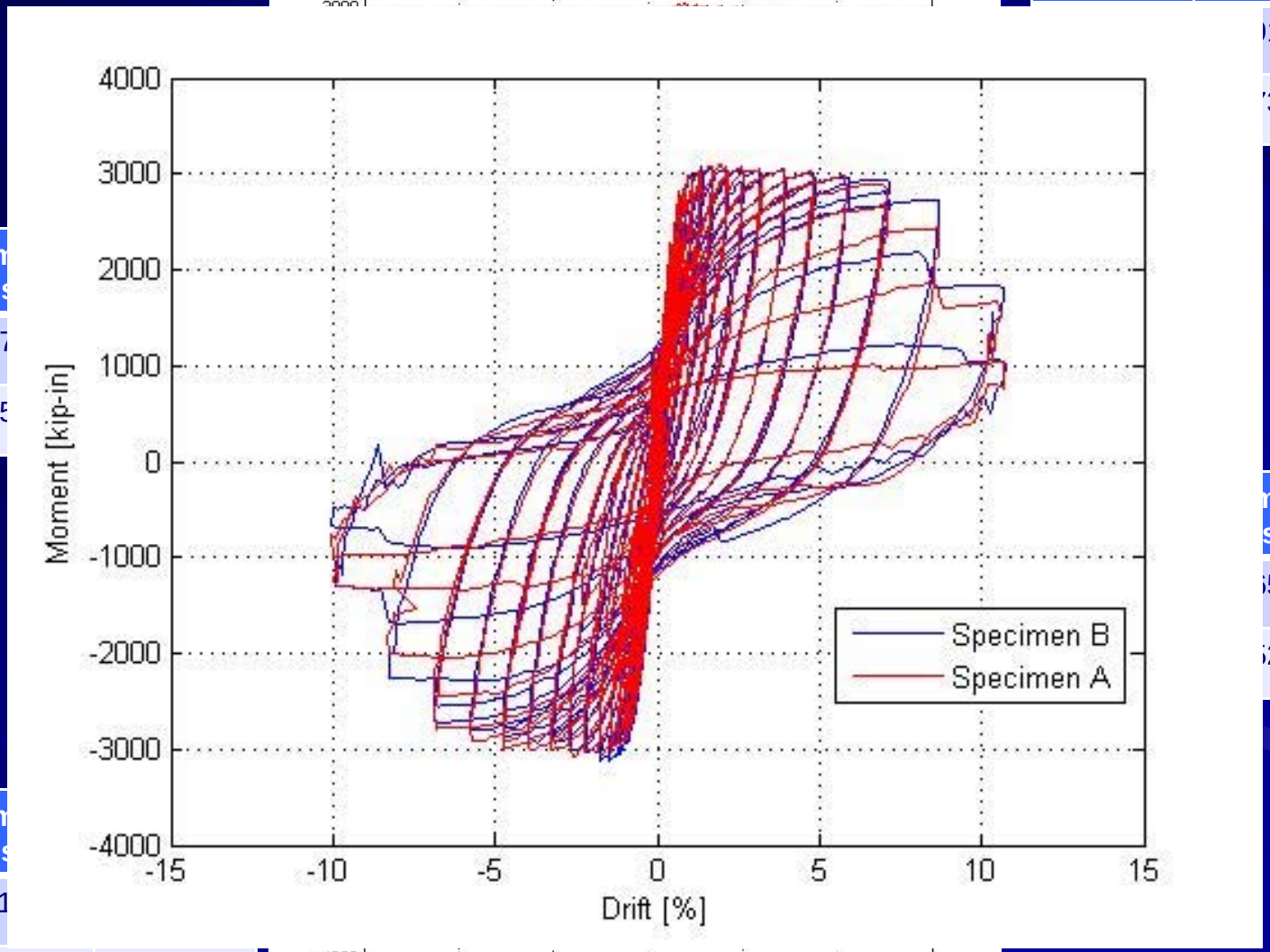


Maximum moments occur at intersections.

Seismic Performance

- Lab tests at 42% scale.

Moment vs. Drift



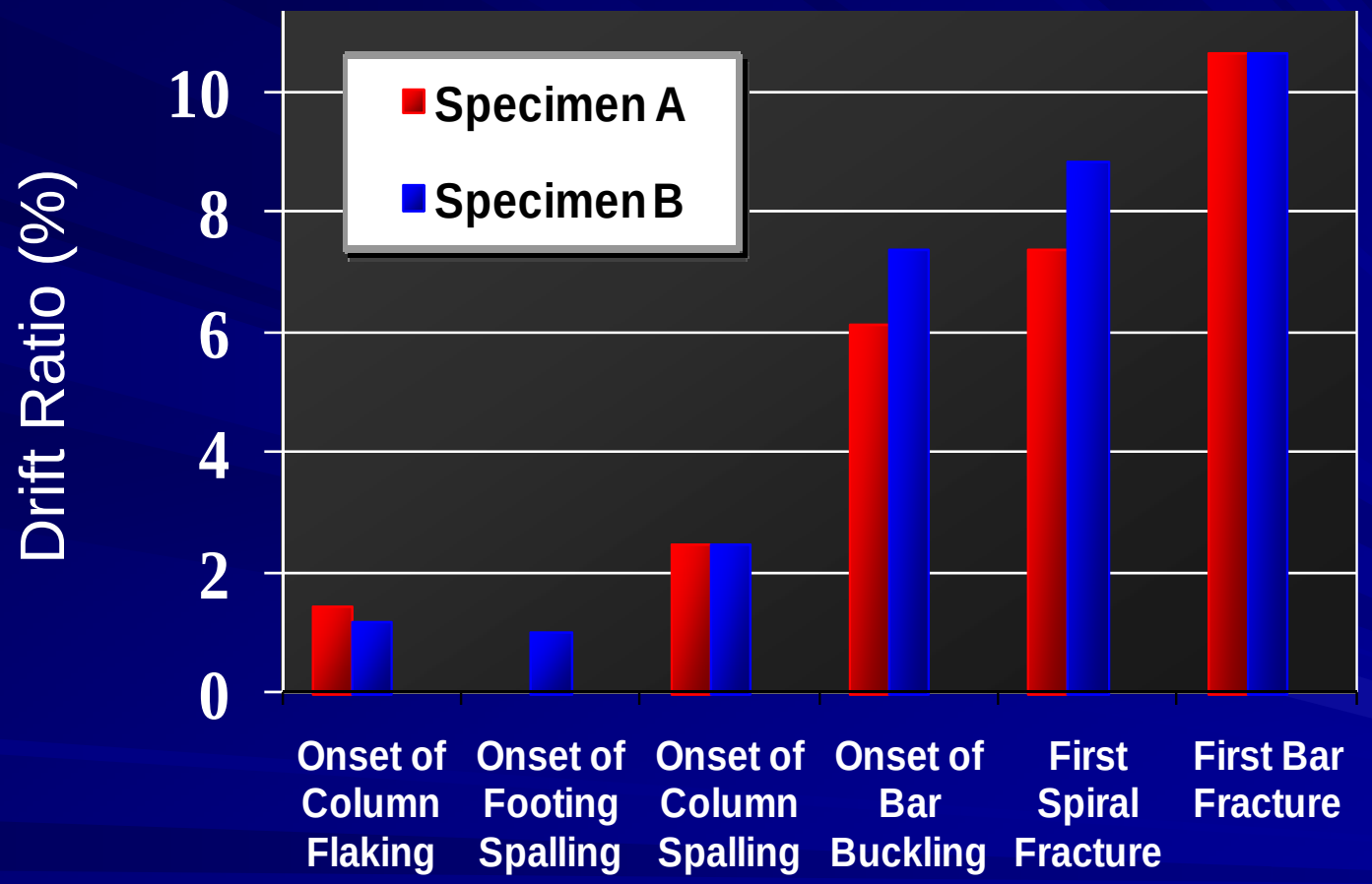
South	Moment [kips-in]	Drift [%]
	1	1.95
	3	7.1

North	Mom [kips
Max	-3,07
80% Max	-2,45

	ment s-in]	Drift [%]
	5	1.38
	2	8.69

North	Mom [kips	
Max	-3,11	
80% Max	-2,490	-6.85

Damage Progression



Damage Level

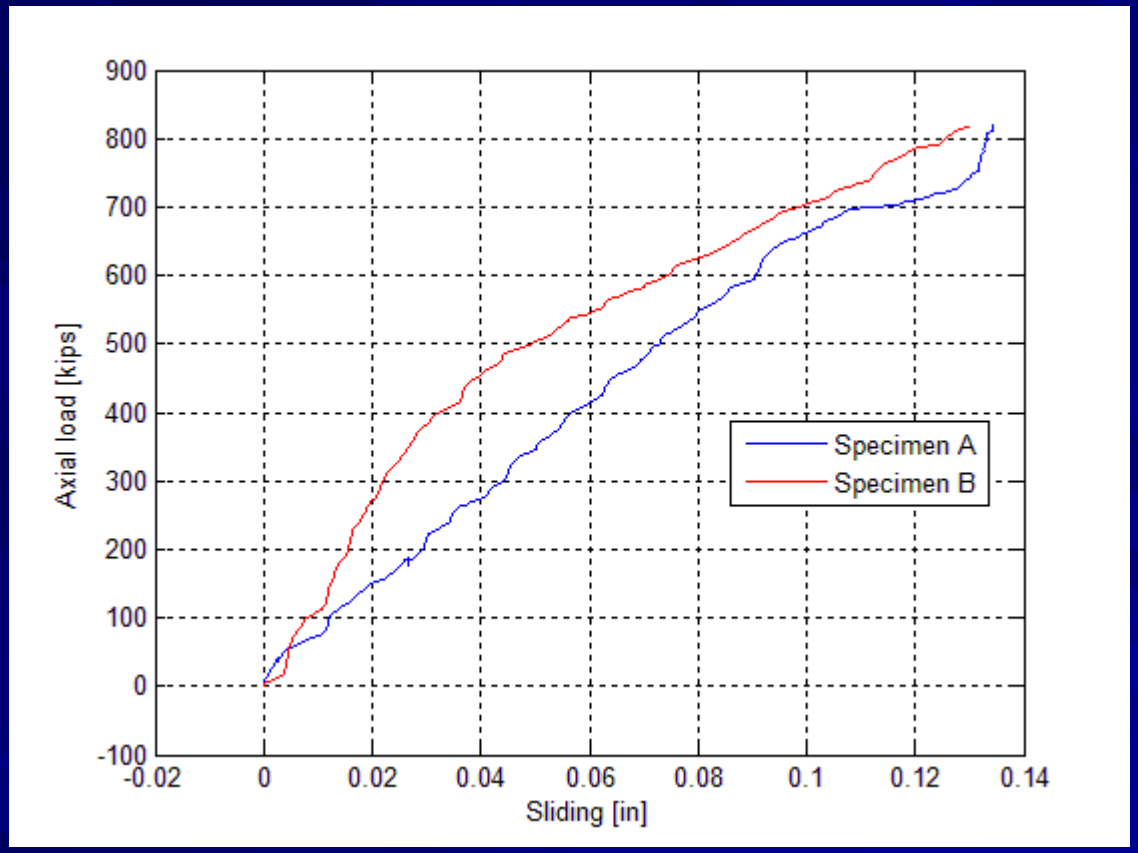
End of Cyclic Testing

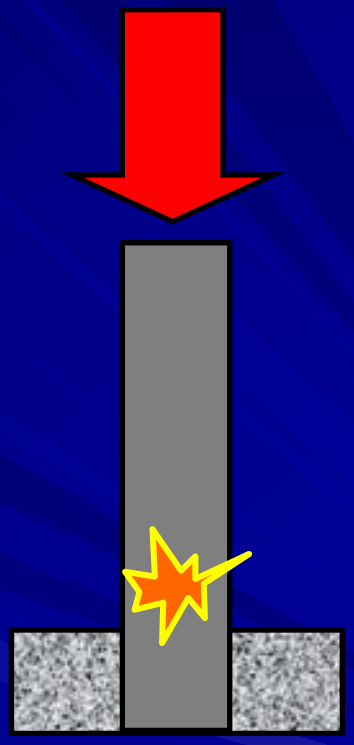
Specimen A

Specimen B

No cracks in footings.

Vertical Load Test to Failure





Failure by column crushing – not punching in the footing

After all Testing

Specimen A

Specimen B

No sign of punching failure

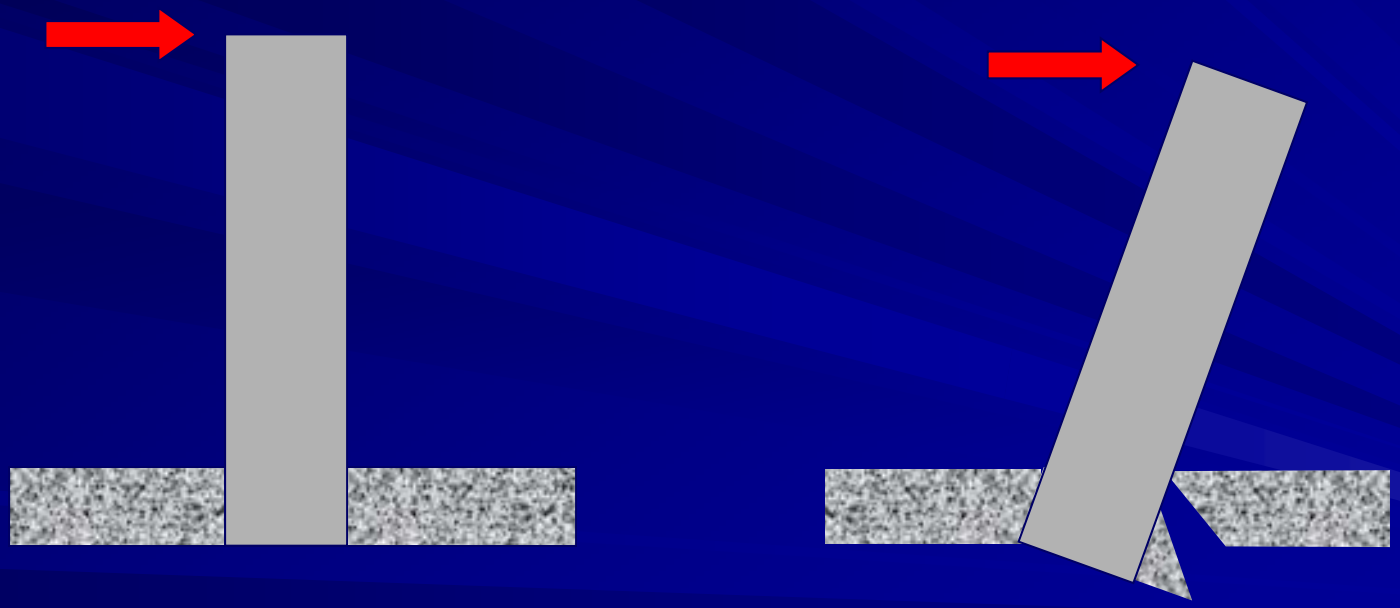
Observed Behavior

- Both specimens behaved like c.i.p.
- Both had 80% of full strength at 7% drift.
- No shear slip between column & footing.
- No damage to the footing.
- P.C. column splice remained elastic.

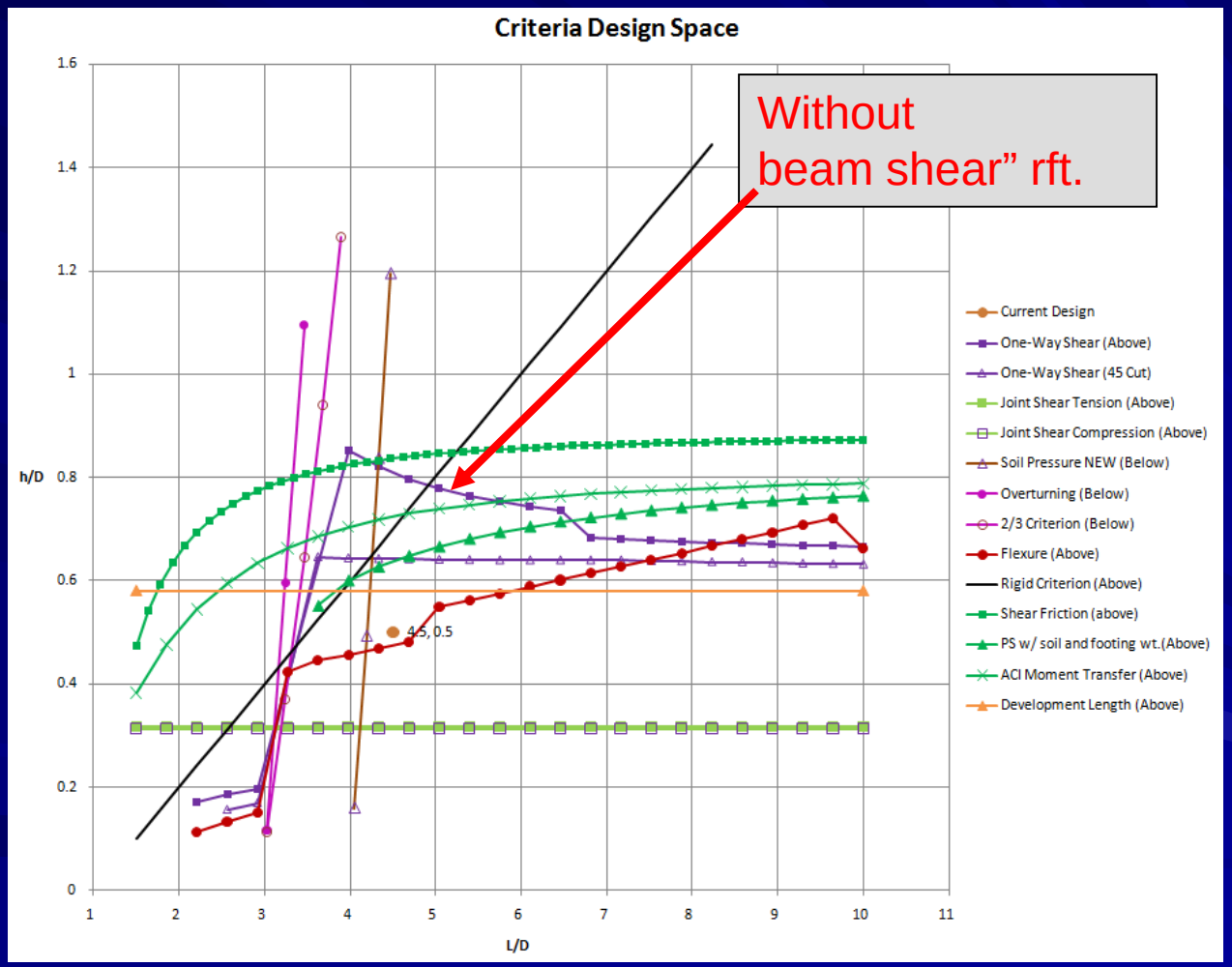
Planned Tests 1: Thinner Footing

- Footing thickness may be limited by heat of hydration.
- Footing thickness < column diameter.
- Investigate strength and failure mode if footing fails.
- Expected failure mode:
  - Punching shear + moment transfer

Planned Tests 1: Thinner Footing



Thin Footing Design Space



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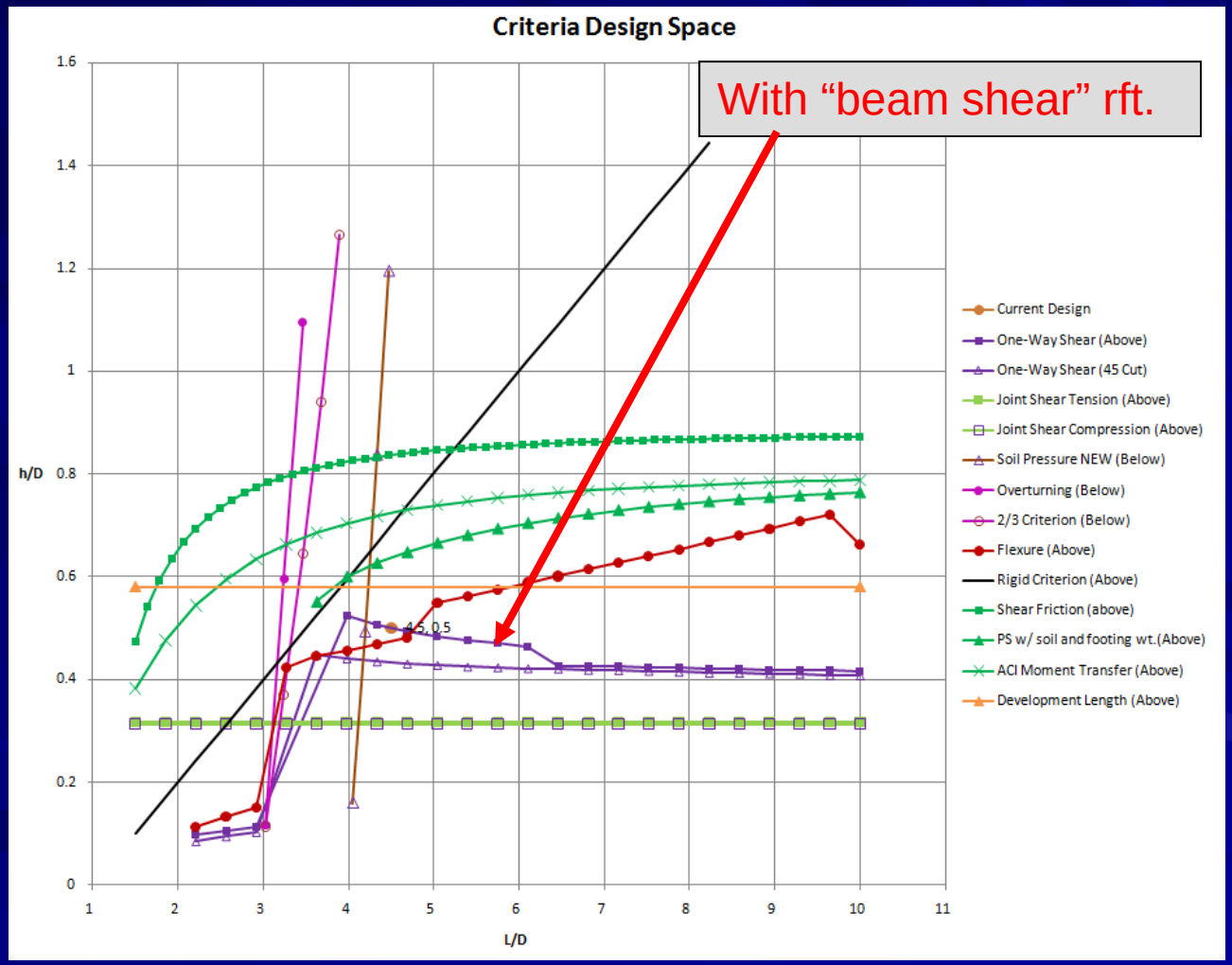
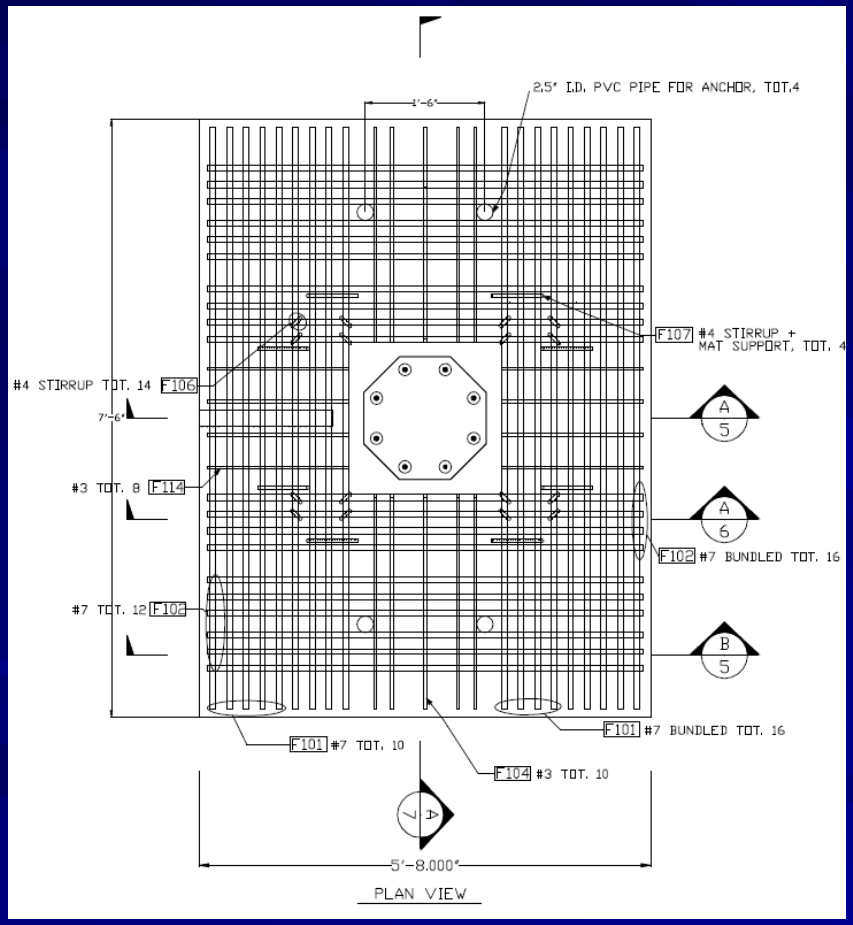
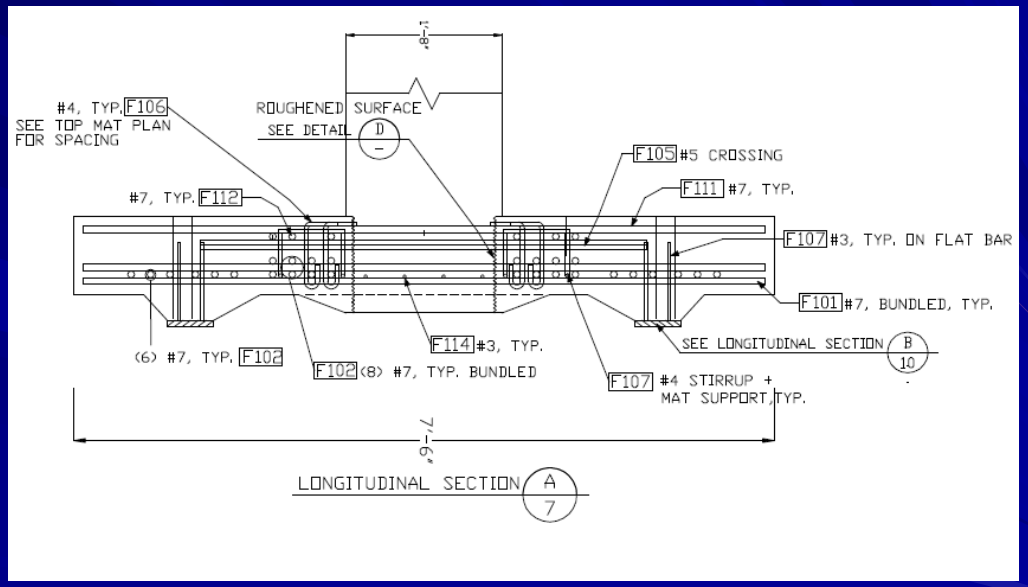


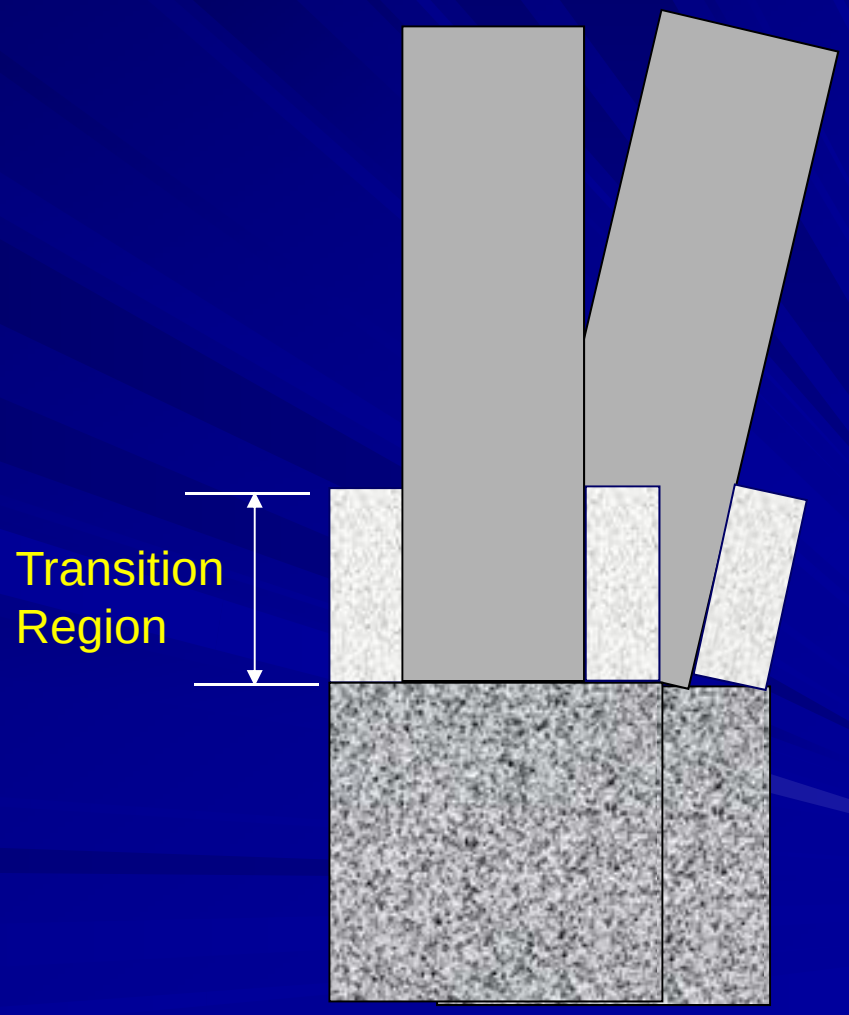
Thin Footing: Final Design





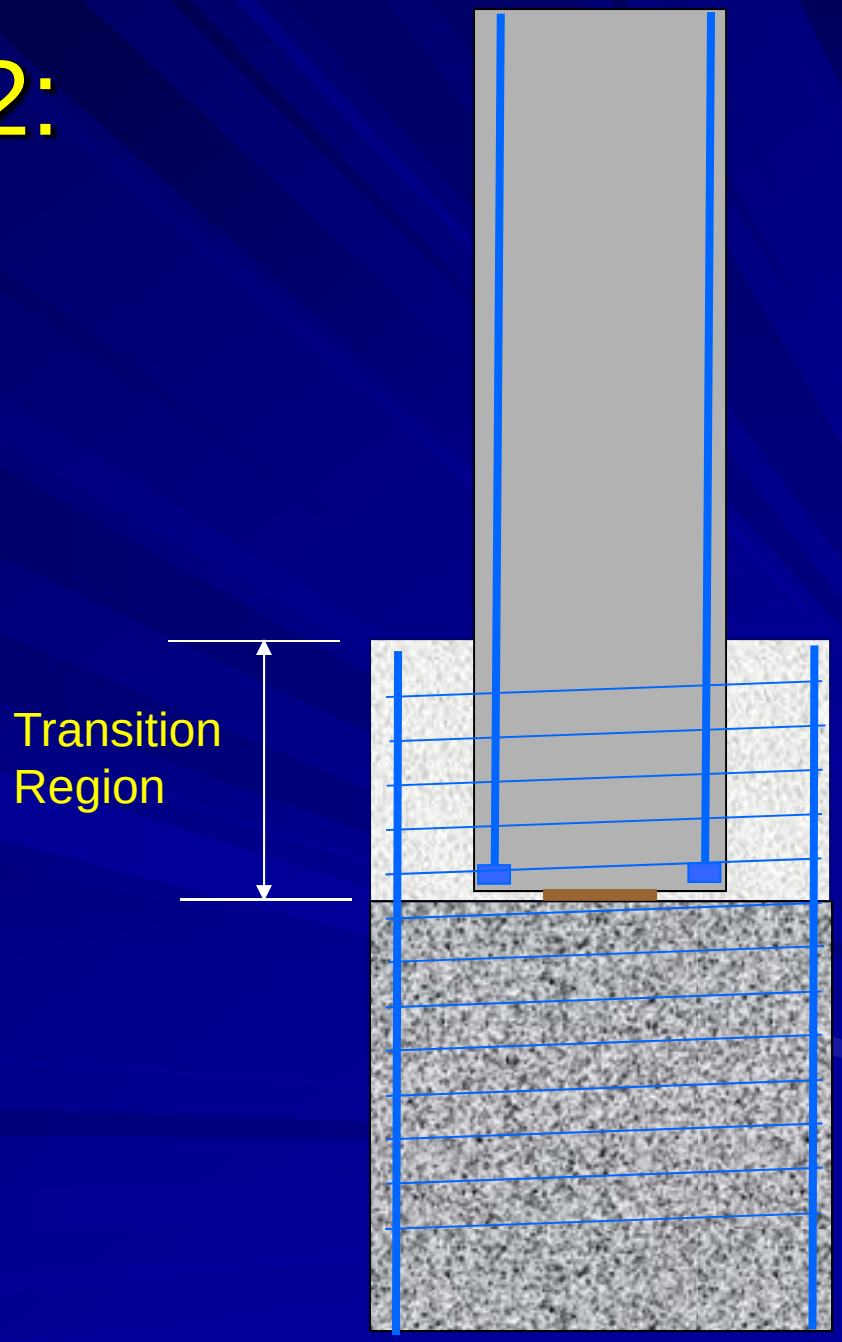
Planned Tests 2: Drilled Shaft.

- P.C column embedded in drilled shaft.
- Investigate potential for failure in transition region.



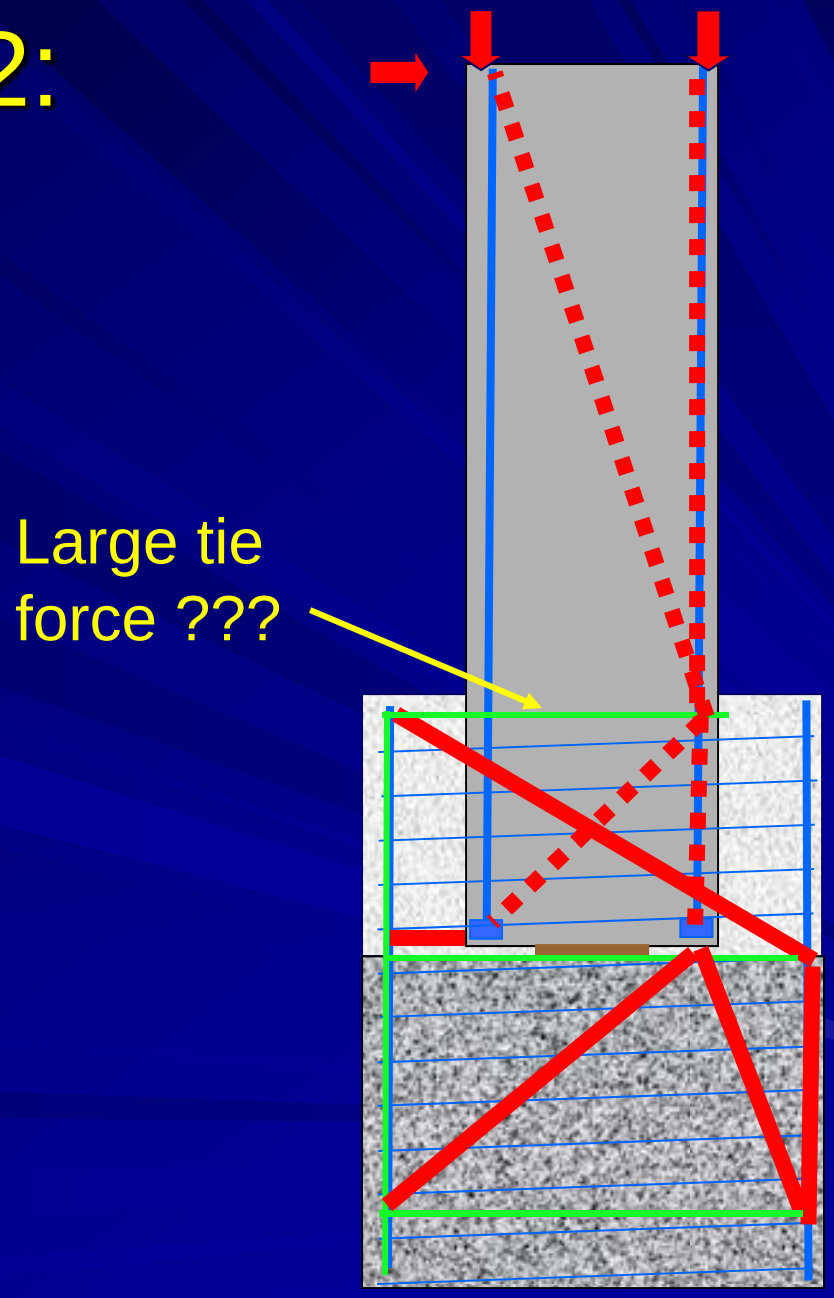
Planned Tests 2: Drilled Shaft.

- Specimen A: per WSDOT BDM and AASHTO Seismic Guide Spec.
- Specimen B: Less conservative design of transition region.
  - Need to ensure that shaft fails.



Planned Tests 2: Drilled Shaft.

- Strut-&-Tie models suggest force patterns.
- Pattern depends strongly on assumptions about shear transfer between pc column and cip shaft.



And if that does not work.....