Advanced Precast Concrete Dual-Shell Steel Columns

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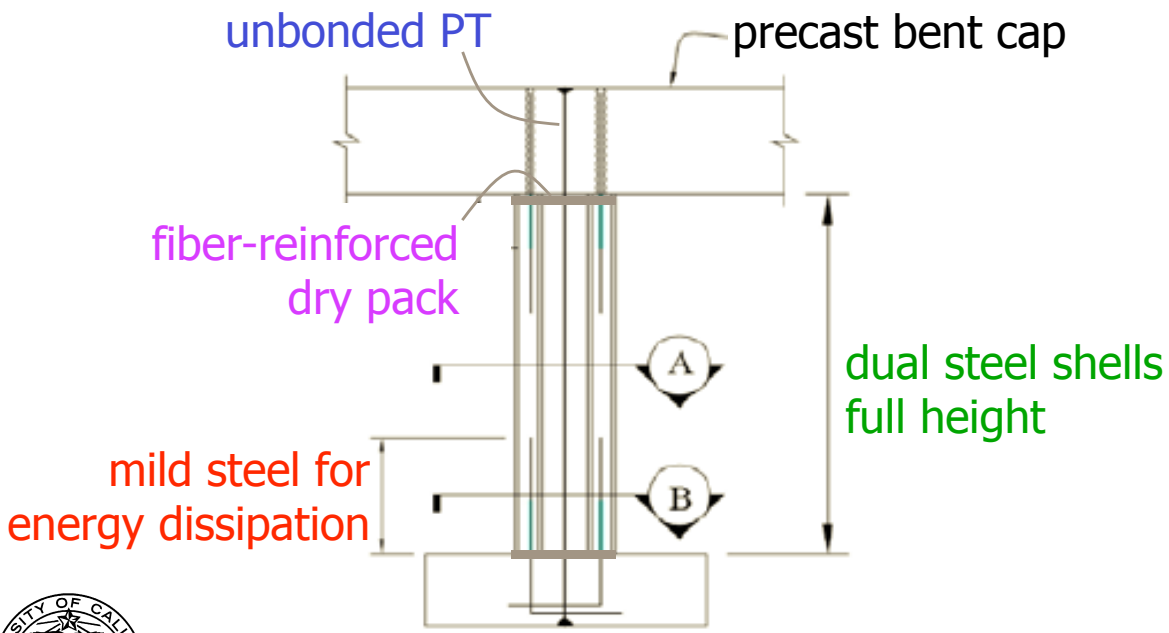
Project Description

Goals

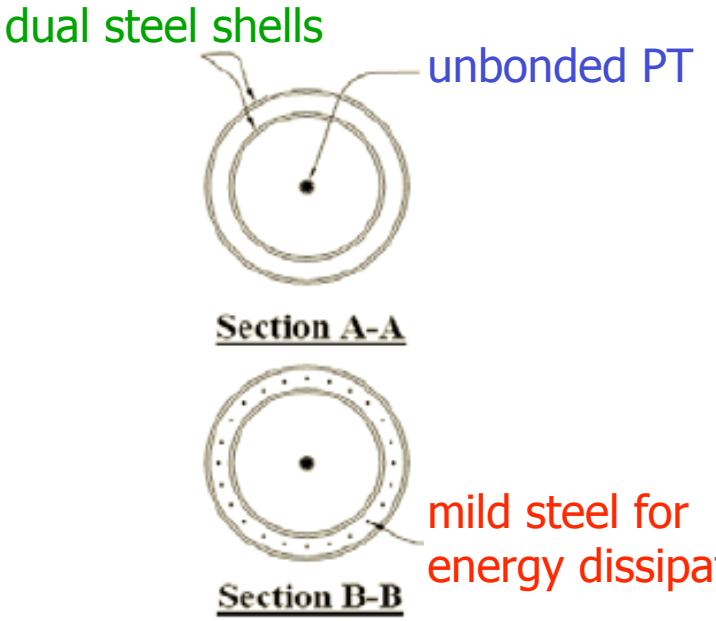
- Accelerated bridge construction (ABC - Caltrans)
- Improved bridge seismic performance

Main features

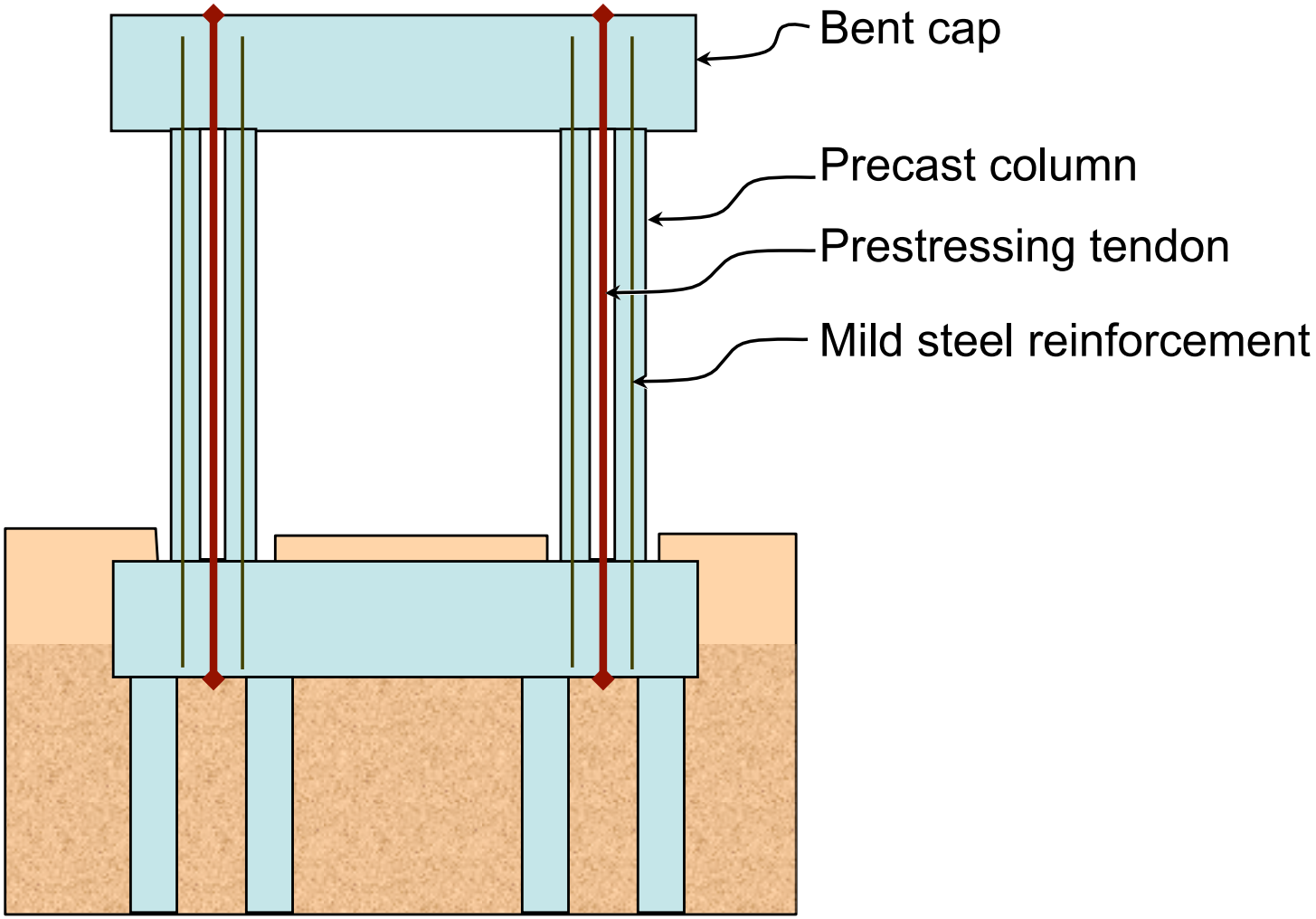
- Dual steel shells
- Postensioning / recentering
- Energy dissipation
- Fiber-reinforced dry pack



NCHRP 12-74



Hybrid connection concept



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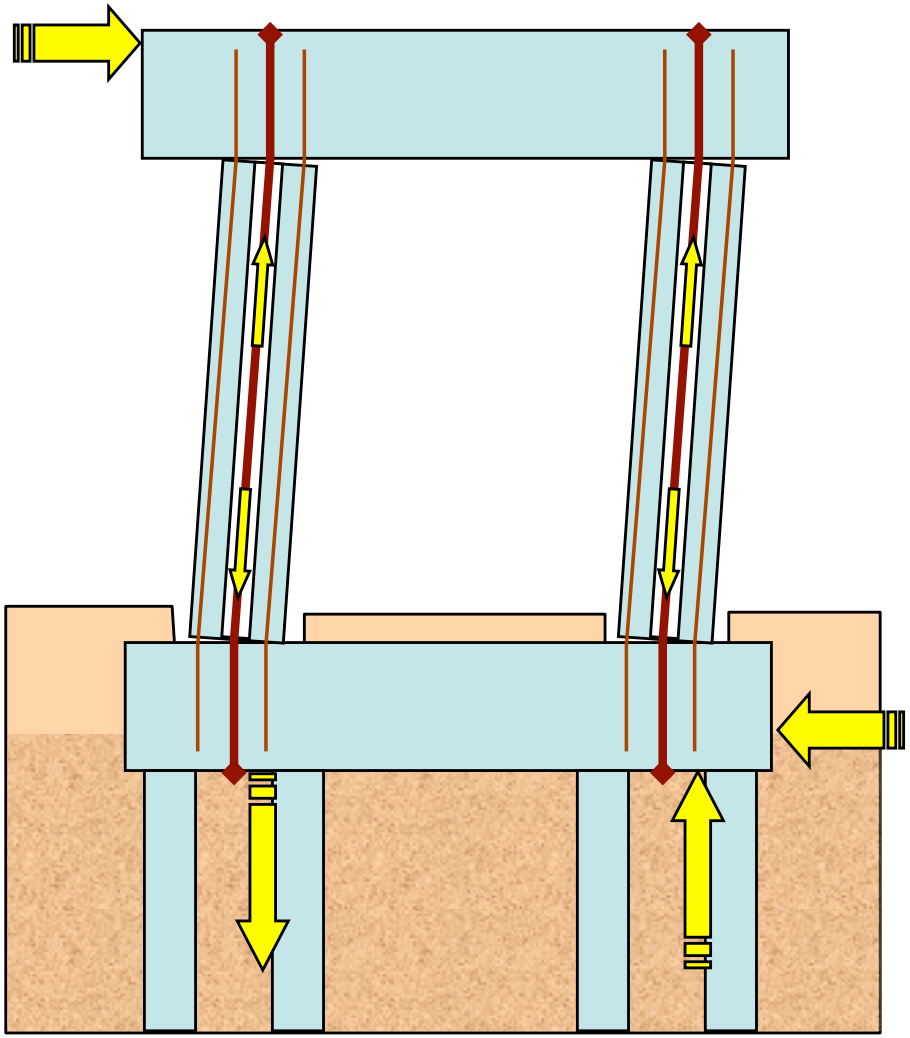

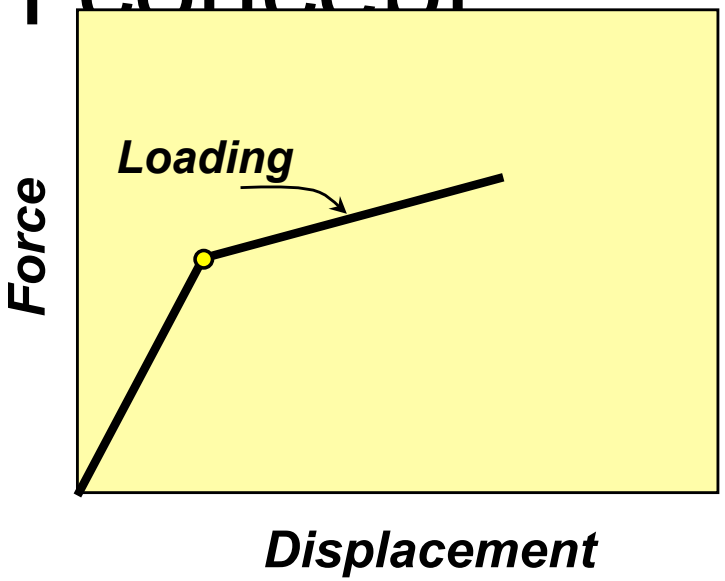

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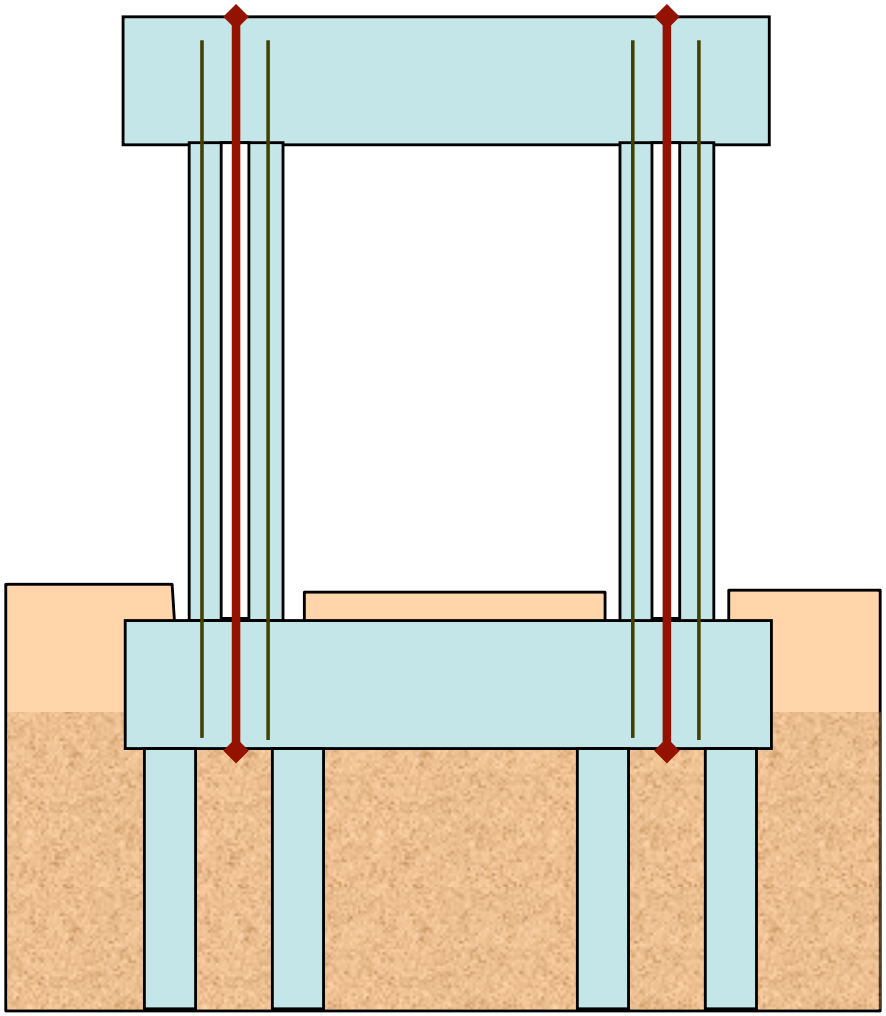
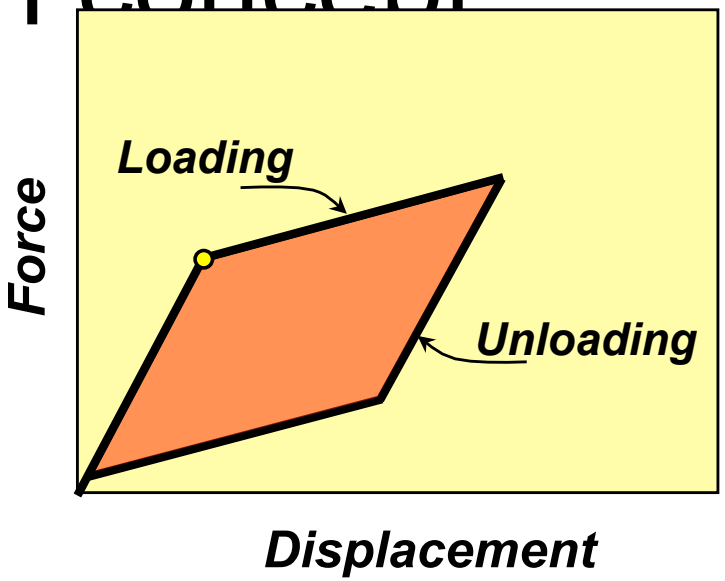
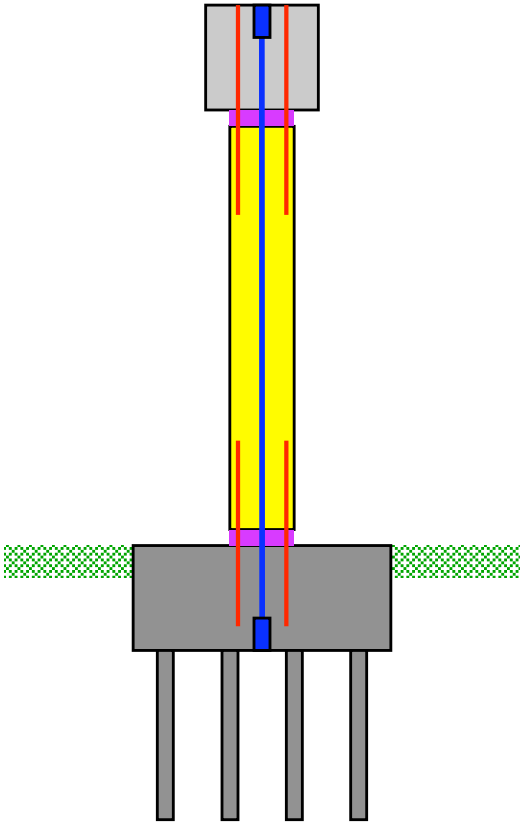


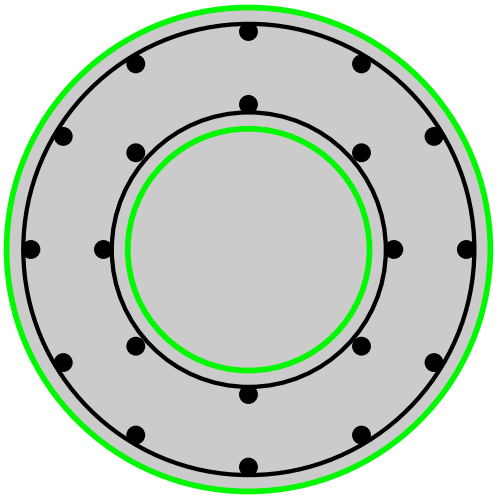


Dual-Shell Technology

Advantages

- Precast construction w/ permanent formwork
- Reduced column weight (hollow section)
- No reinforcing cage
- Reduced construction time



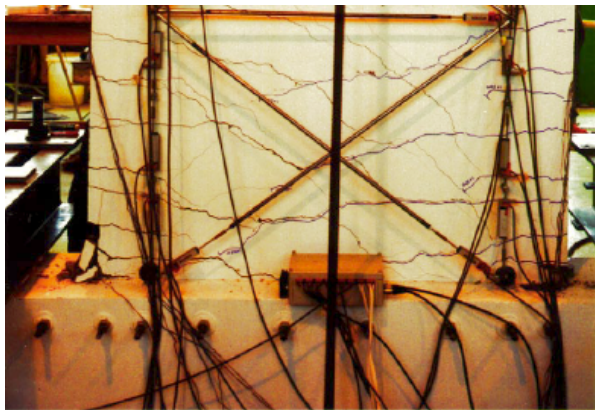


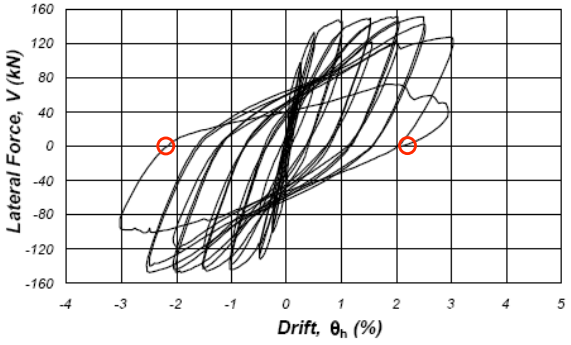
Self-Centering Behavior

Advantages

- Limited structural damage
- Small residual displacements
- Energy dissipation by specific devices
- Operability right after strong shakes

Monolithic system

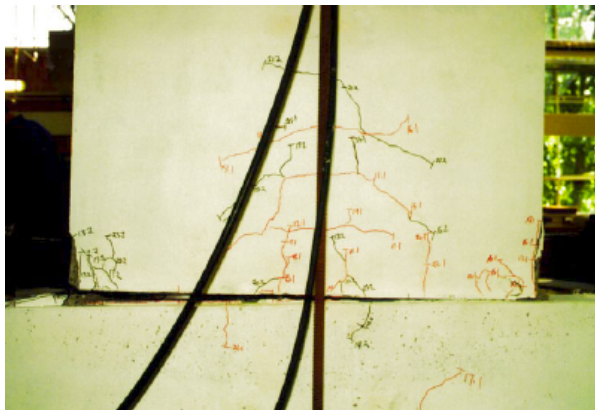


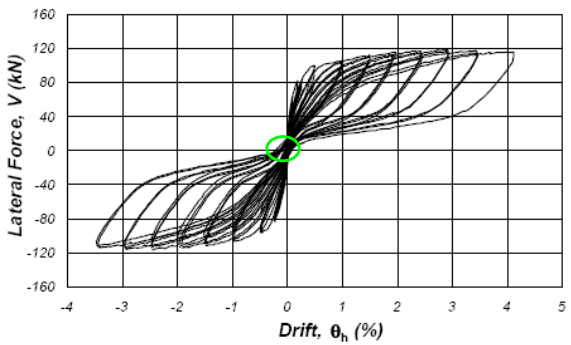


Shear-wall test results

(Restrepo, Mander, Holden)

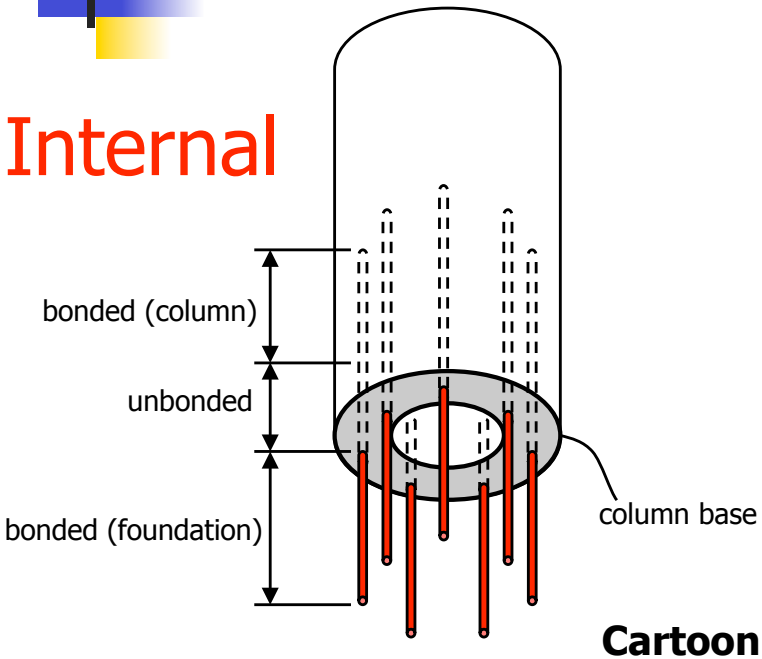
Self-centering system



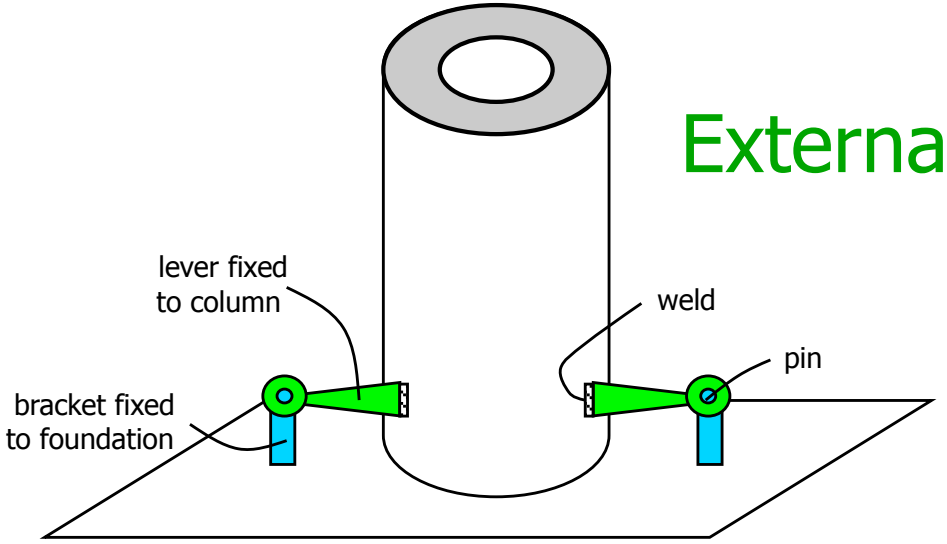


Energy Dissipation

Internal



External



Cartoon portraying concept

Aesthetically ok

Advantages

Easy to repair/replace

Hard to repair/replace

Drawbacks

Aesthetic mitigation needed


45

Project Tasks

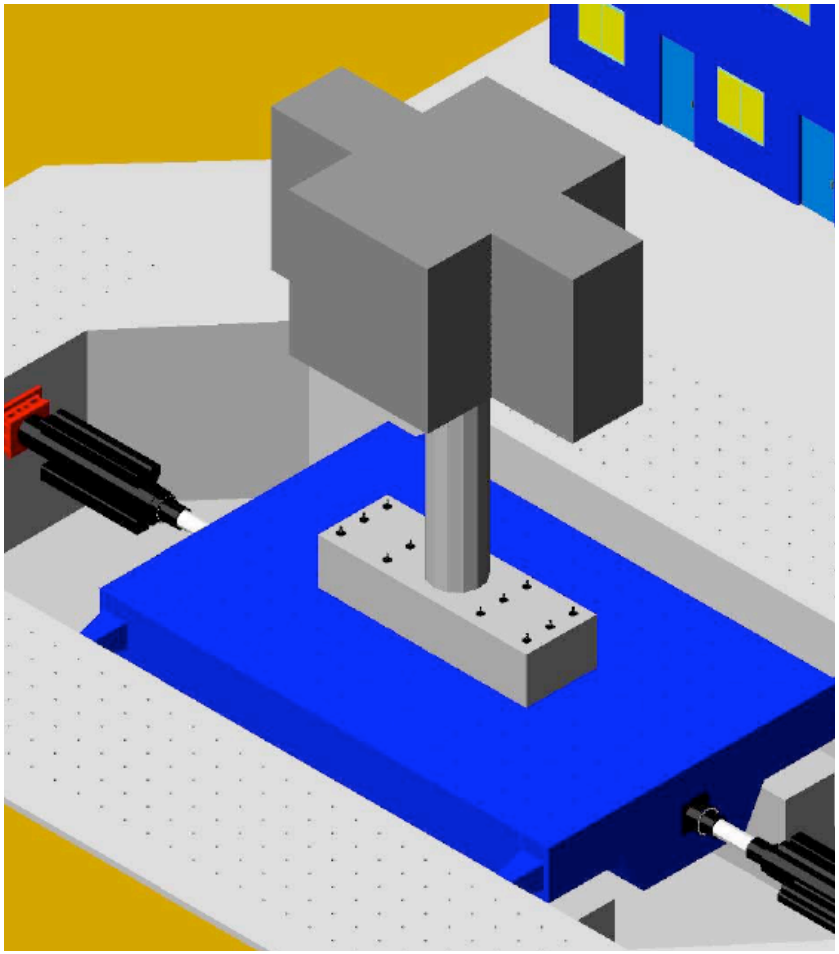
1. Prototype bridge **0%**
   - 2-span ordinary skew bridge
   - Opportunity for Collaboration: Bridge Testbed Group: Taciroglu, Stojaddinovic
2. Analytical modeling **60%**
   - TH analyses (Opensees) with 7 scaled records
   - Selection of bi-directional test protocol
   - FE analyses of external energy dissipators
   - Opportunity for Collaboration: J. Baker **80%**
3. Experimental tests
   - Design of two units: internal vs. external energy dissipators
   - Hysteretic characterization of external energy dissipators
   - Construction and test of the two units
   - Opportunity for Collaboration: Oestertag
4. Final report

Progress Forecast

- Expect to complete FEA and design of dissipators by November 2010
- Test two column specimens in February 2011
- Complete Opensees model in April 2011
- Complete nonlinear analyses in June 2011
- Final report due September 2011

- No additional costs are anticipated

Large Column Test Update



- Shake table testing of a full scale column designed per Caltrans SDC
- 1.2 m diameter by 7.2 m tall column
- 250 Ton of Inertial mass
- Densely instrumented (280 sensors)
- Objective to compare with tests done at E-Defense in Japan where significant flow of the concrete core was observed upon yielding of transverse hoops
- Provides an opporunutiy for the community to calibrate models and improve understanding on model uncertainty
- Blind prediction is being launched
- Testing to take place during second week of September
- Report due June 30 2011

Large Column Test Update

- Main funding from PEER transportation and lifelines (Caltrans) and FHWA through several DOTs, and NEEScomm
- Industry partners: Skanska, CRSI

THANK YOU

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