P-Delta and

Minimum Base Shear

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Min. Base Shear

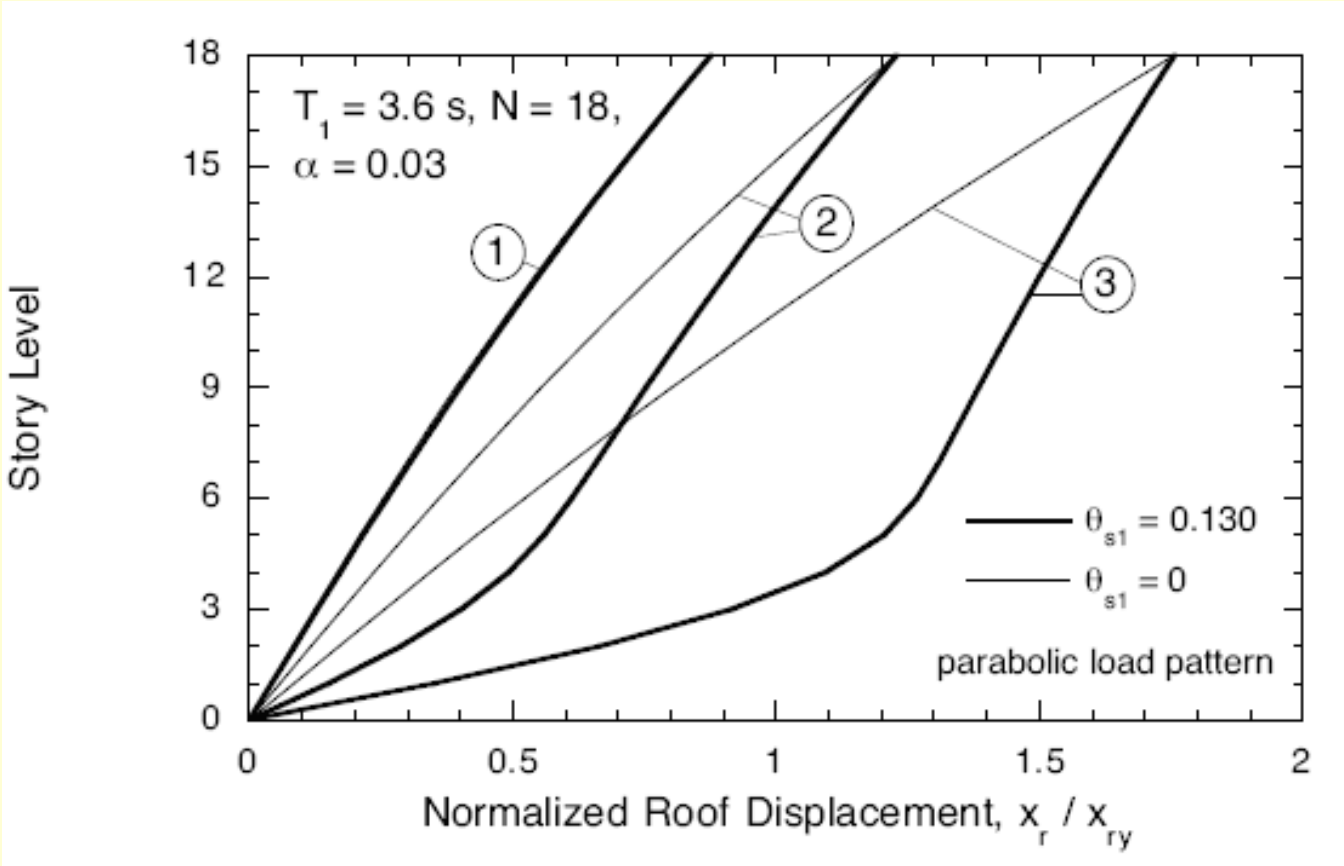
- **$V = (0.8ZN_vI/R)W$** for drift limitation?
- Is it for ground motion uncertainty or "modeling" uncertainty or both?
- Let's say explicitly what it is for!
- Should be the same "enforcement" as for code-conforming structures
- If for modeling uncertainties and alternative design, then it belongs to Level 3 – if for collapse safety?

Collapse Safety + Drift ≡ P-Delta

P-Delta is controlled by

- P (large in lower stories)
- Delta - but inelastic δ
- Collapse mechanism
- Length of post-yield “plateau”
- Effective post yield stiffness
- Deterioration
- Frame problem very diff. from wall problem

Pushover Deflection Profiles, without and with P-delta -- N =18, T = 3.6 -- Frame



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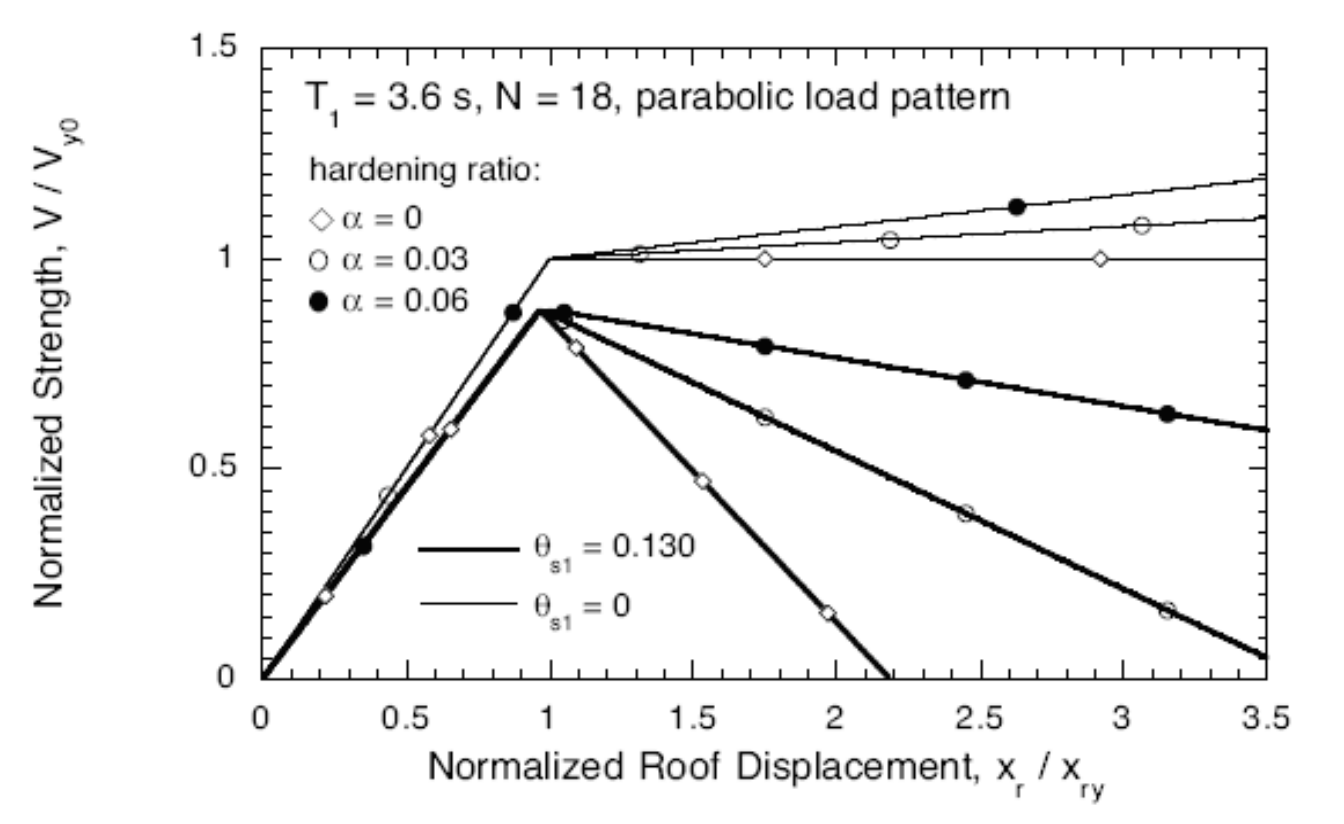
Global Pushover Curve, without and with P-Delta -- N =18, T = 3.6 -- Frame



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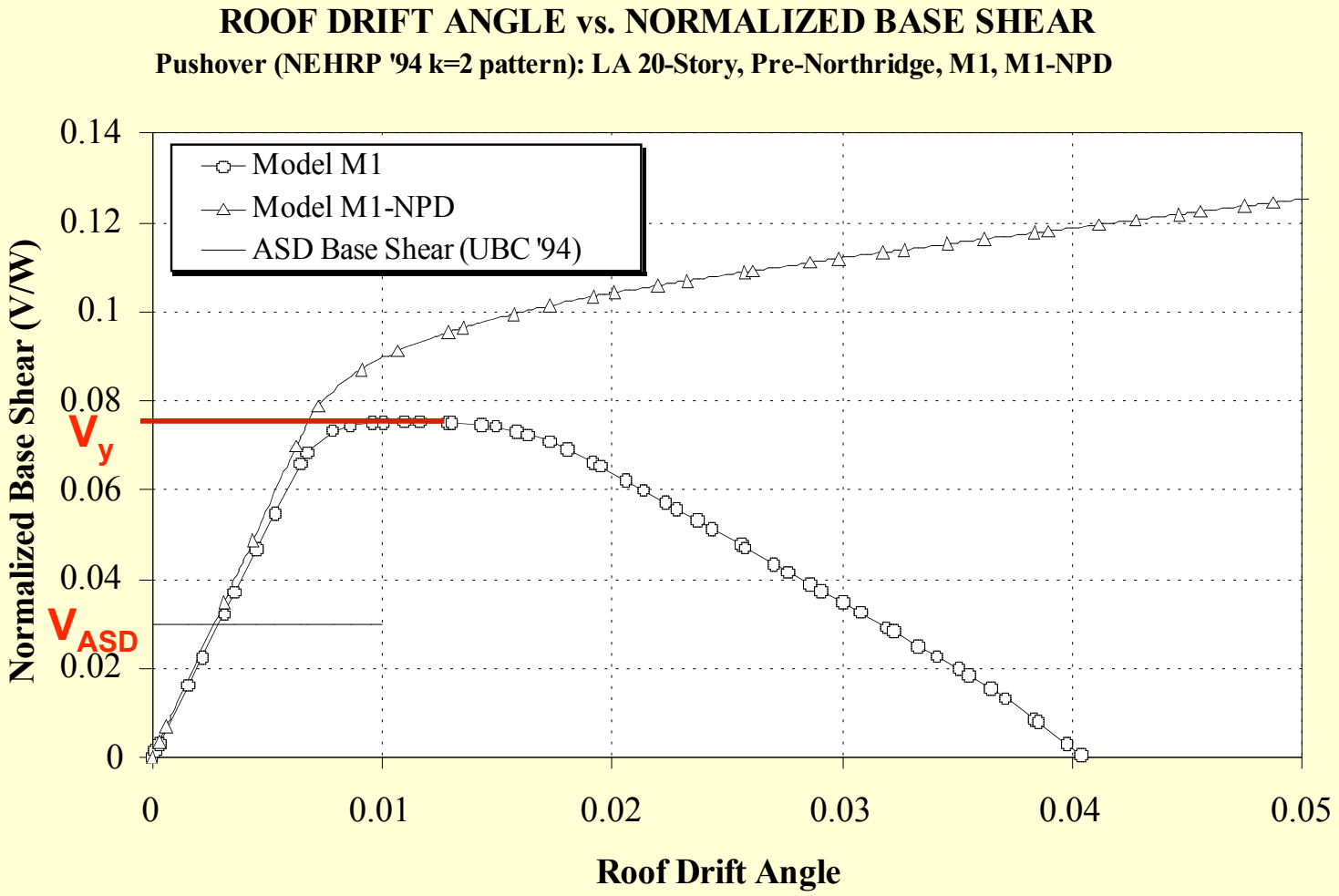
Global Pushover Curve, LA-20, without and with P-Δ



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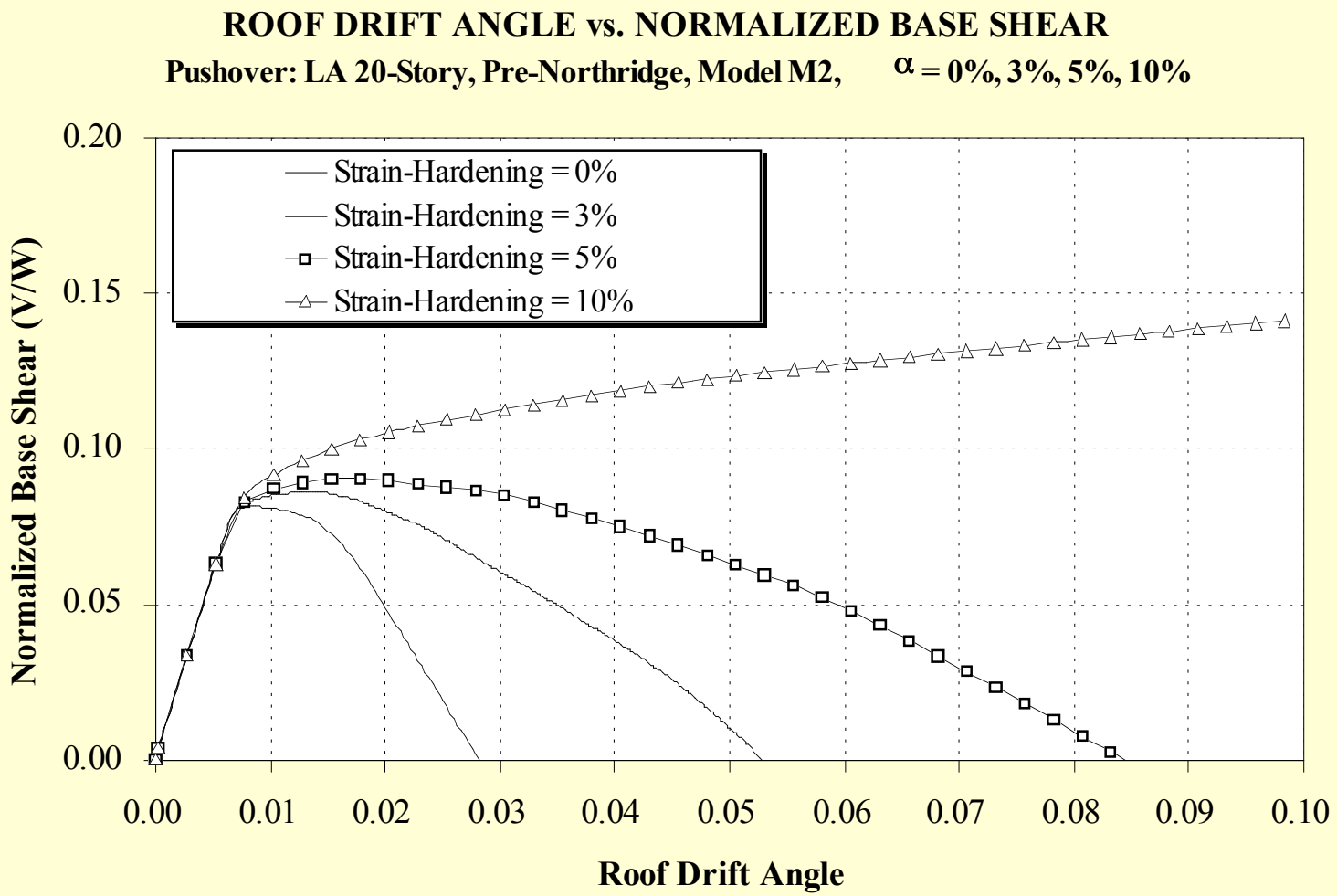
Sensitivity to Strain Hardening, Pushover, LA-20



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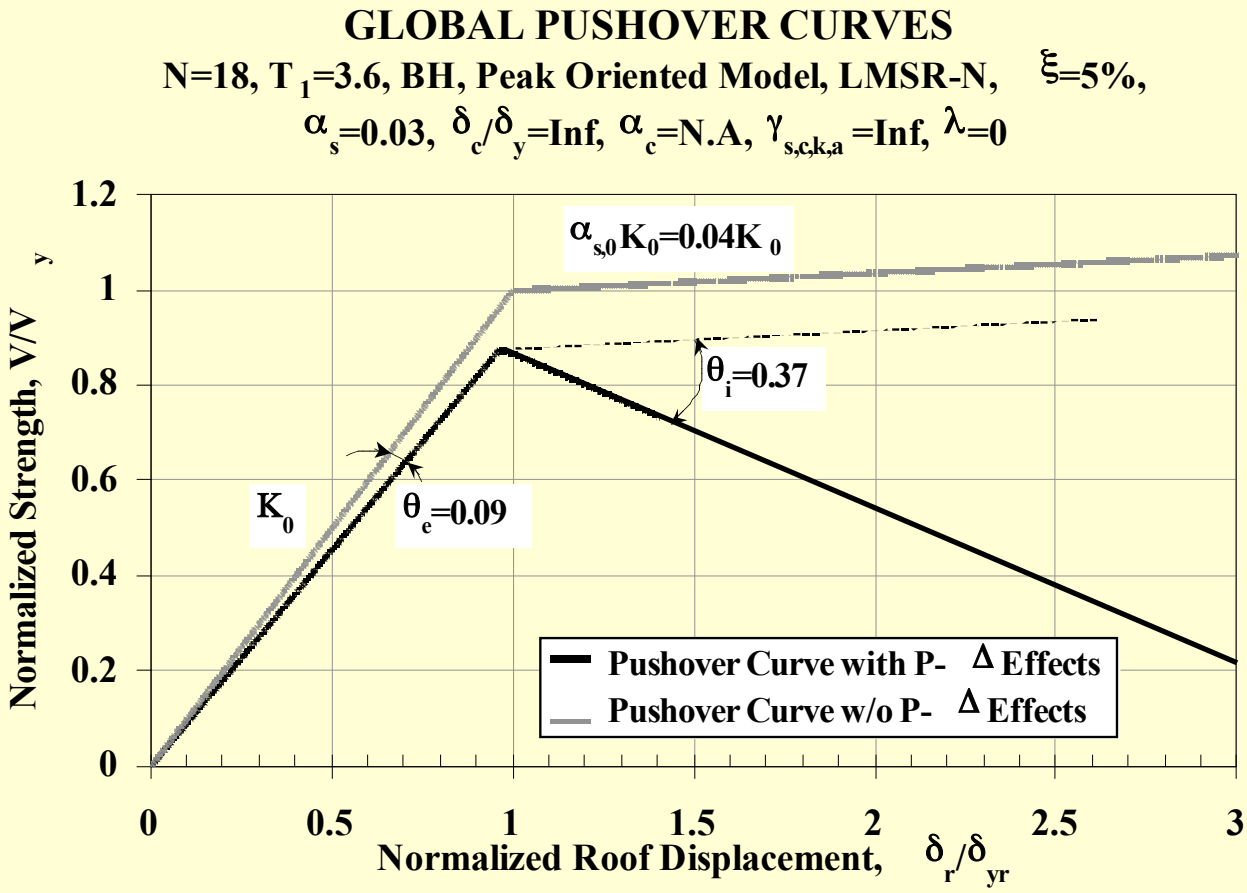
Elastic and Inelastic Stability Coefficient
N =18, T = 3.6 -- Frame



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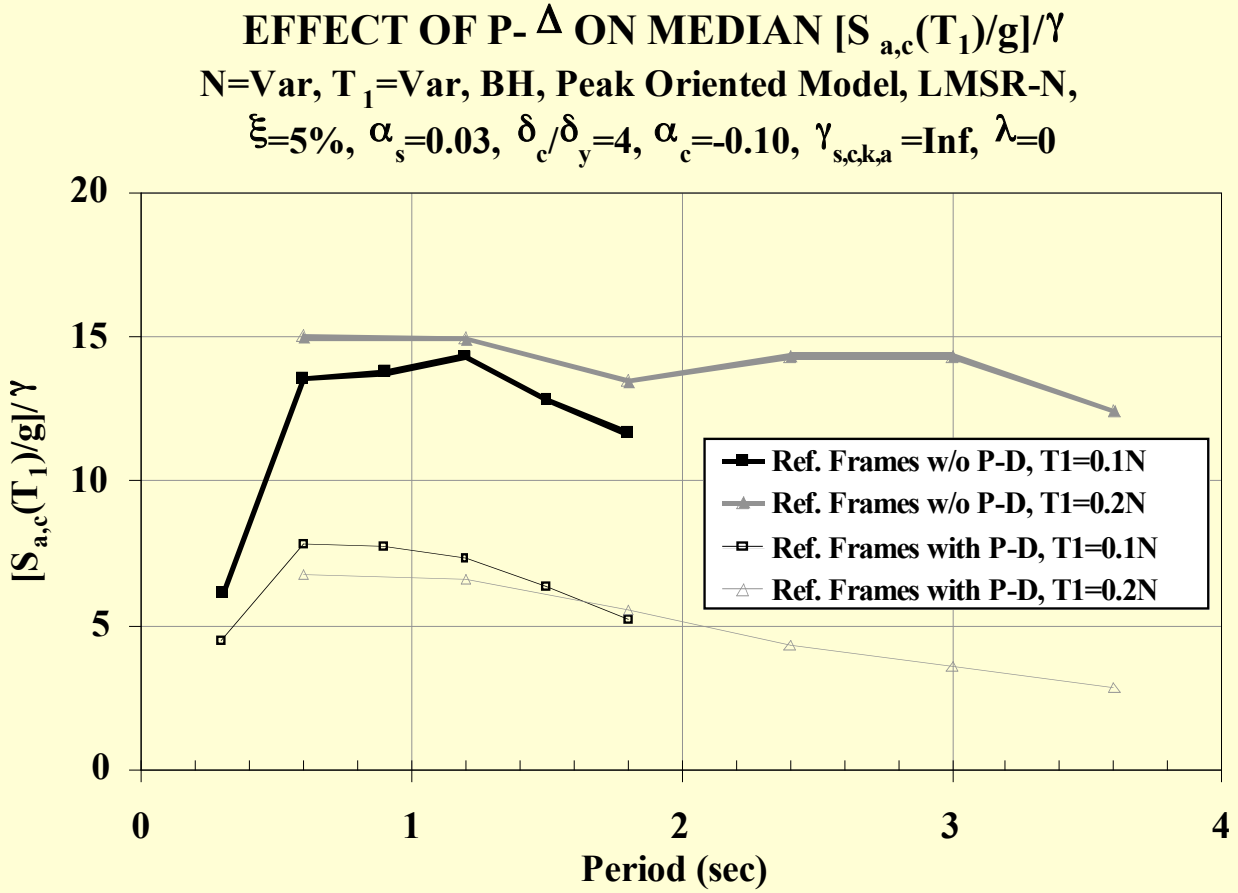
Effect of P-Delta on Median Collapse Capacity (Deteriorating Frame Systems)



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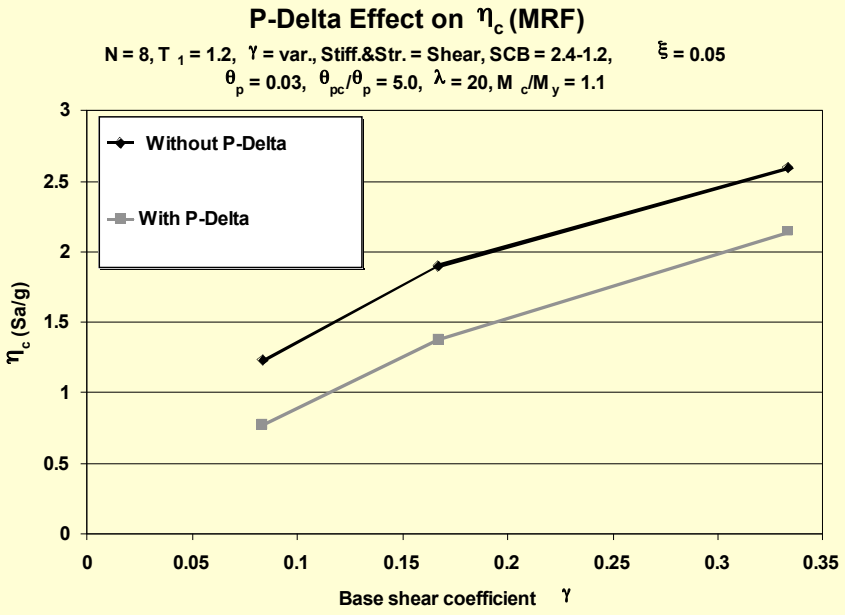
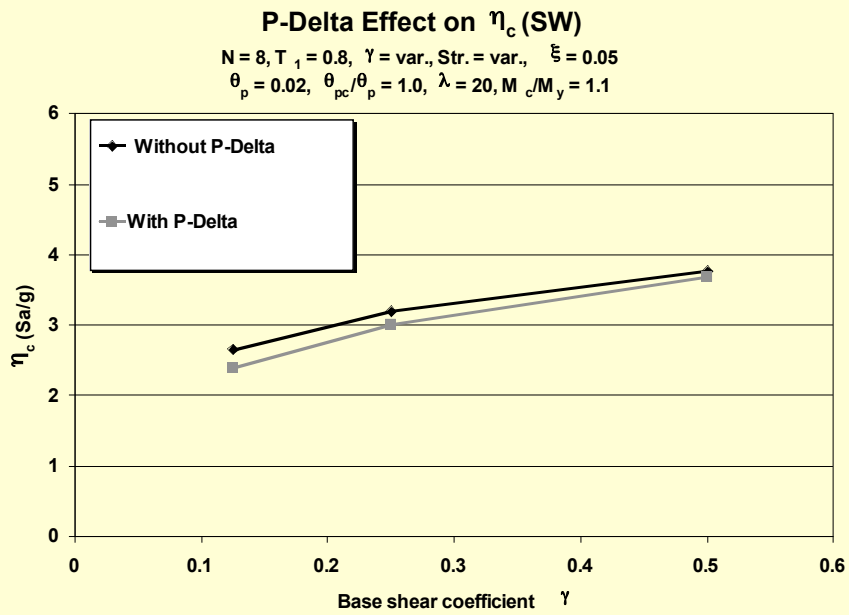
Effect of P-Delta on Median Collapse Capacity (as function of base shear yield coefficient) Frames versus Walls (8-story)





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So, what's the point?

- P-Delta, which is amplified by deterioration, causes collapse (not the only source)
- P-Delta effect is very sensitive and not straight forward to predict
- We should safeguard against prediction errors
- But min. base shear does not look like the right vehicle to do so
- In codes: establish a limit on $P\delta/(V_y h)$????