Thoughts on minimum strength & stiffness requirements for seismic design

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PEER/SF-AB Tall Building Discussion

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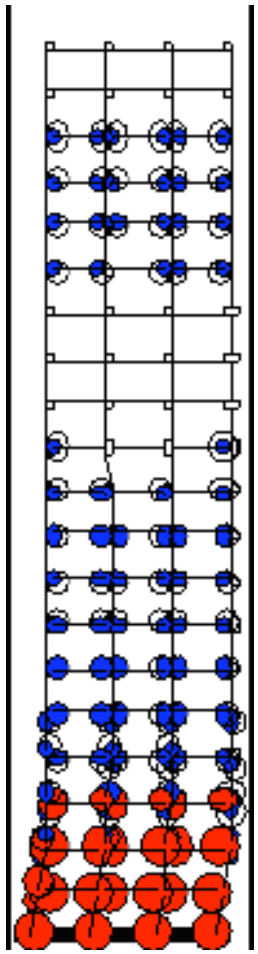
20 Story RC SMF Perimeter Frame (Haselton et al., 2006)



IDA collapse mechanism

Design Information (ASCE 7-02)

$V_d/W = 0.044$

$V_u/W = 0.086$ (pushover)

T = 2.6 sec

IDA Collapse (median quantities)

$Sa(T_1) = 0.48g$ (median intensity at collapse)

$IDR_{max} = 0.051$ (about = ¾ x $V_u/W = 0.057$)

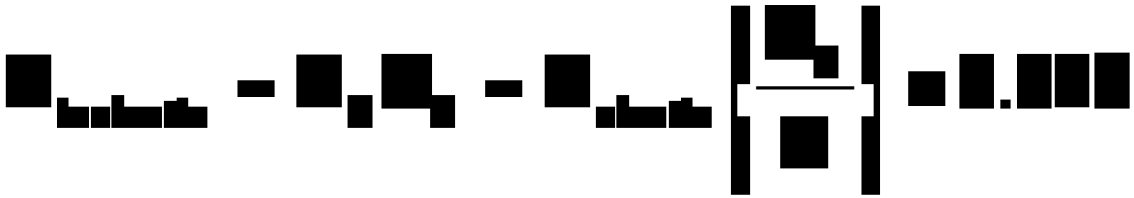
$RDR_{max} = 0.013$

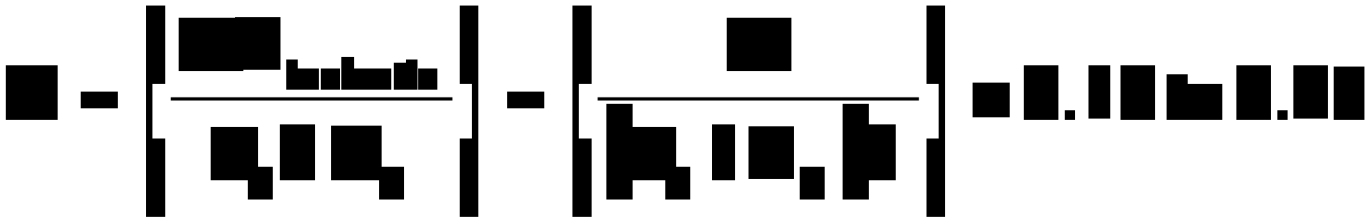
Observations:

1. $IDR_{max} = 0.051$ = about ¾ x Vu/W = 0.057
2. $Sd(T_1) = (T/2pi)^2\, Sa(T_1) = 32$ in.
3. System Collapse Drift = 0.051 x 4 stories = 32 in.
4. Additional Study: ASCE 7-05 design with $V_d/W = 0.022$ has about one-half the collapse margin of ASCE 7-02.

Building Code Criteria (SEI/ASCE 7-02)

- **Minimum Strength:** $V_d = C_s W$
- **Minimum Stiffness:**

Drift: 

Stability: 

- **Mechanism Controls:** SCWB, capacity design, …
- **Toughness:** component detailing, …

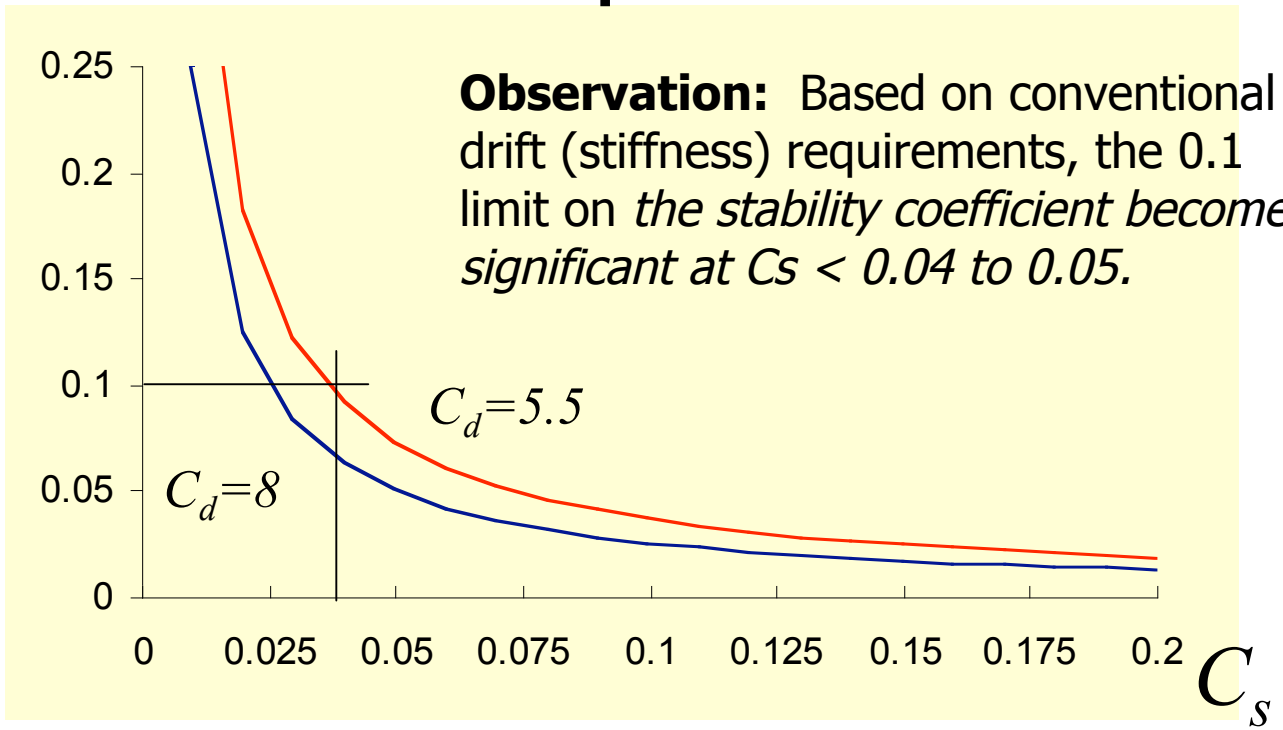
Minimum Stiffness & Stability

Strength: $V_d = C_s W$ **Stiffness:** [illegible]

Identities: [illegible] **&** [illegible]

Combine & Rearrange: [illegible]

[illegible]



Observation: Based on conventional drift (stiffness) requirements, the 0.1 limit on *the stability coefficient becomes significant at Cs < 0.04 to 0.05.*