National Institute of BUILDING SCIENCES

An Authoritative Source of Innovative Solutions for the Built Environment

Building Seismic Safety Council

PUC Chair: David Bonneville

PUC Meeting
IT III Update

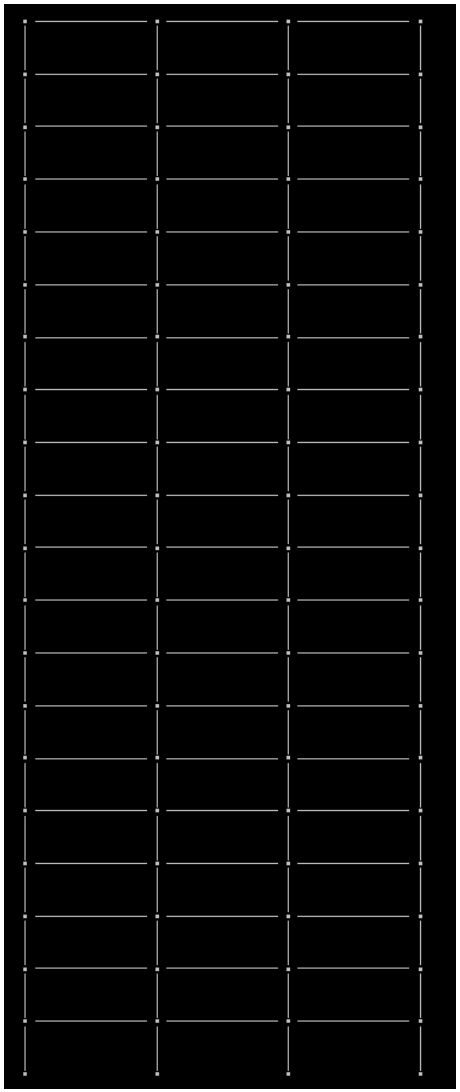
San Francisco, CA
April 4-5, 2018

nehrp FEMA

Topics 2,3,4,6

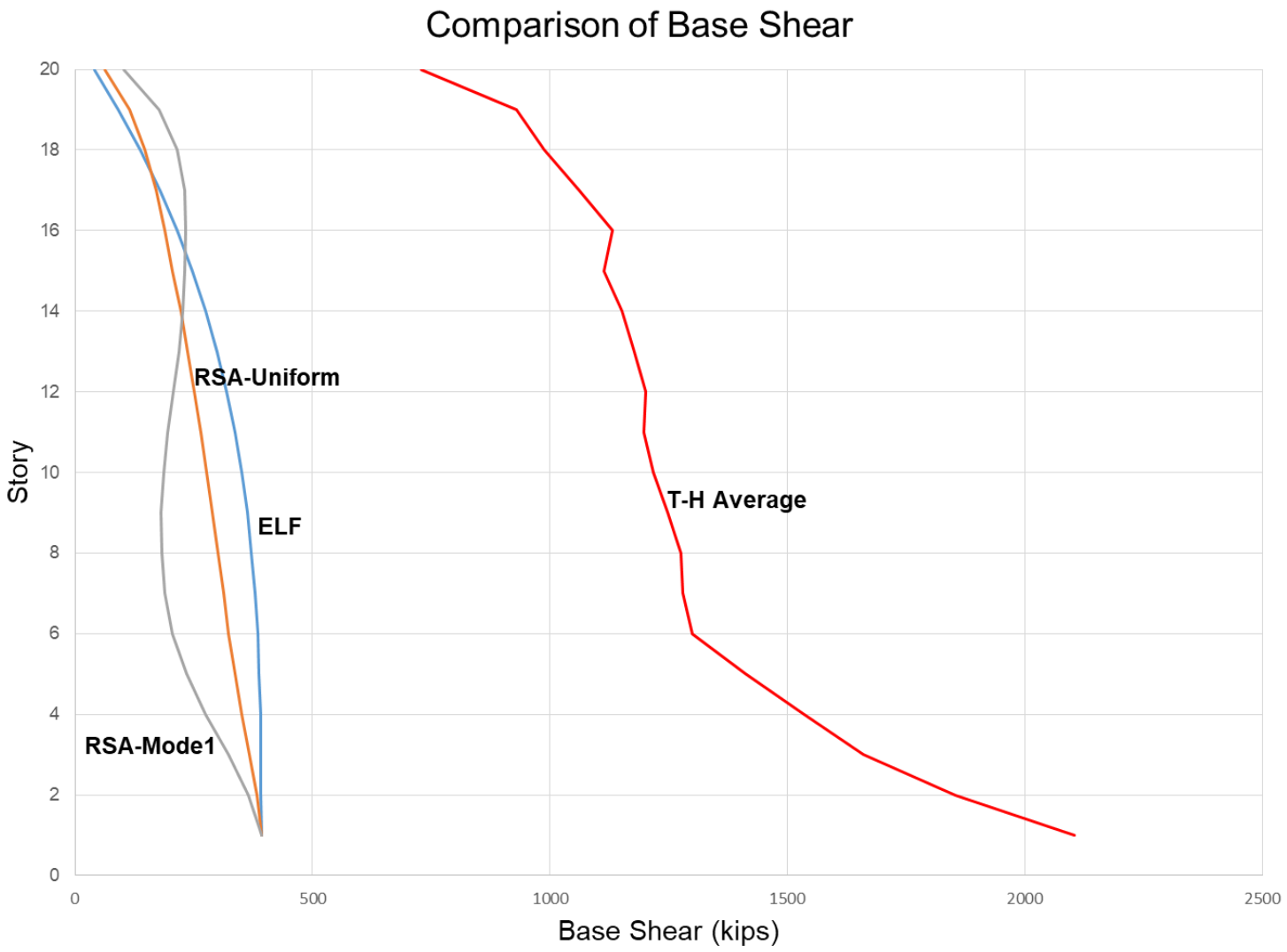
- Topic 2: Reduction by *R* only in the first mode (assuming higher modes are elastic)
- Topic 3: Consideration (or reconsideration) of the appropriateness of current approaches for scaling to the results of an equivalent lateral force (ELF) analysis
- Topic 4: Application of a multi-degree-of-freedom factor
- Topic 6: Revisit triggers for Dynamic RSA in ASCE 7 and realign with efforts of ATC 123

Moment Frame Study

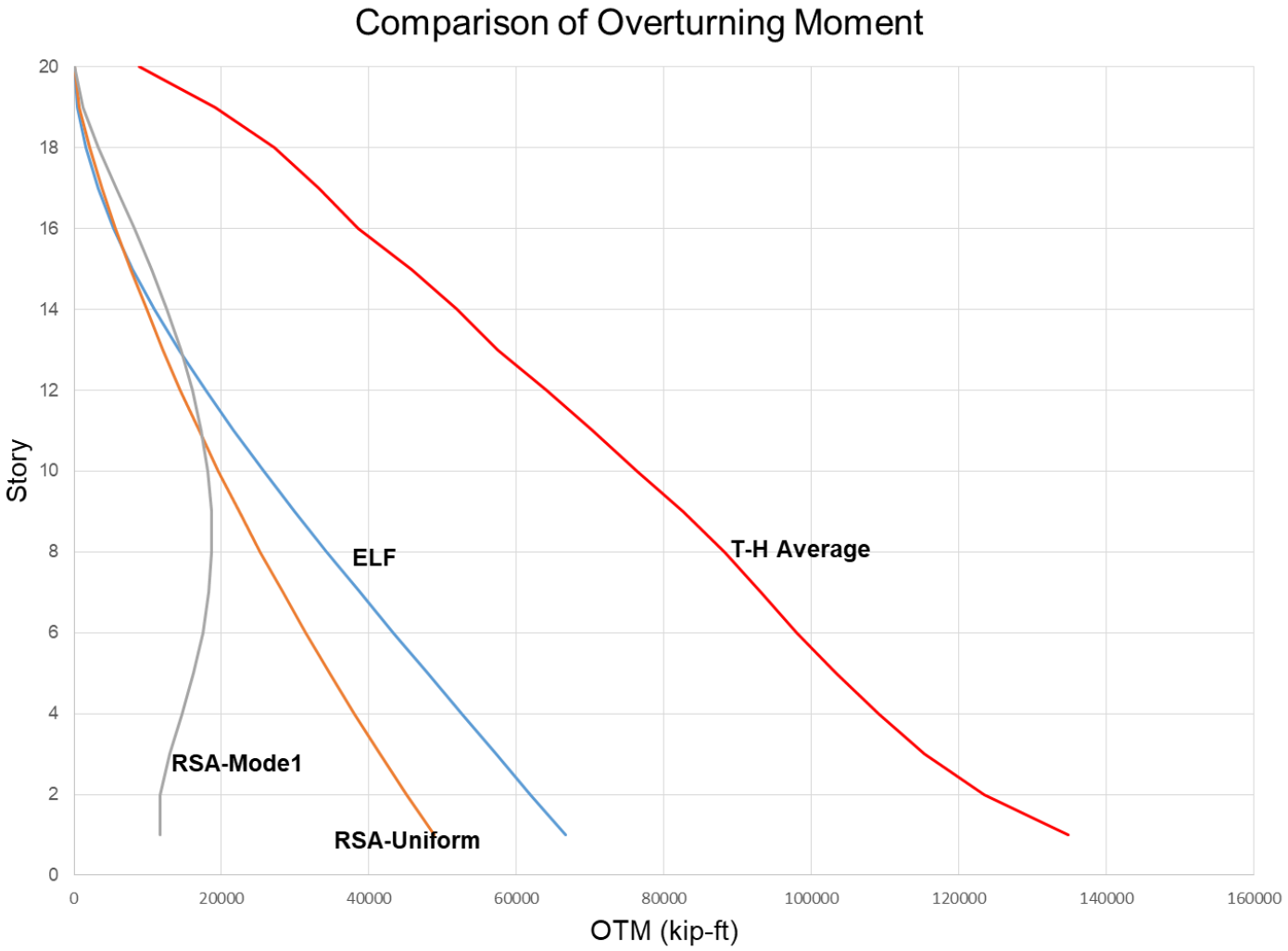


- Complete the moment frame study with a 20 story building
- Re-design the building using SDS = 1.3 and SD1 = 0.78
- Re-scale time histories and complete the analysis

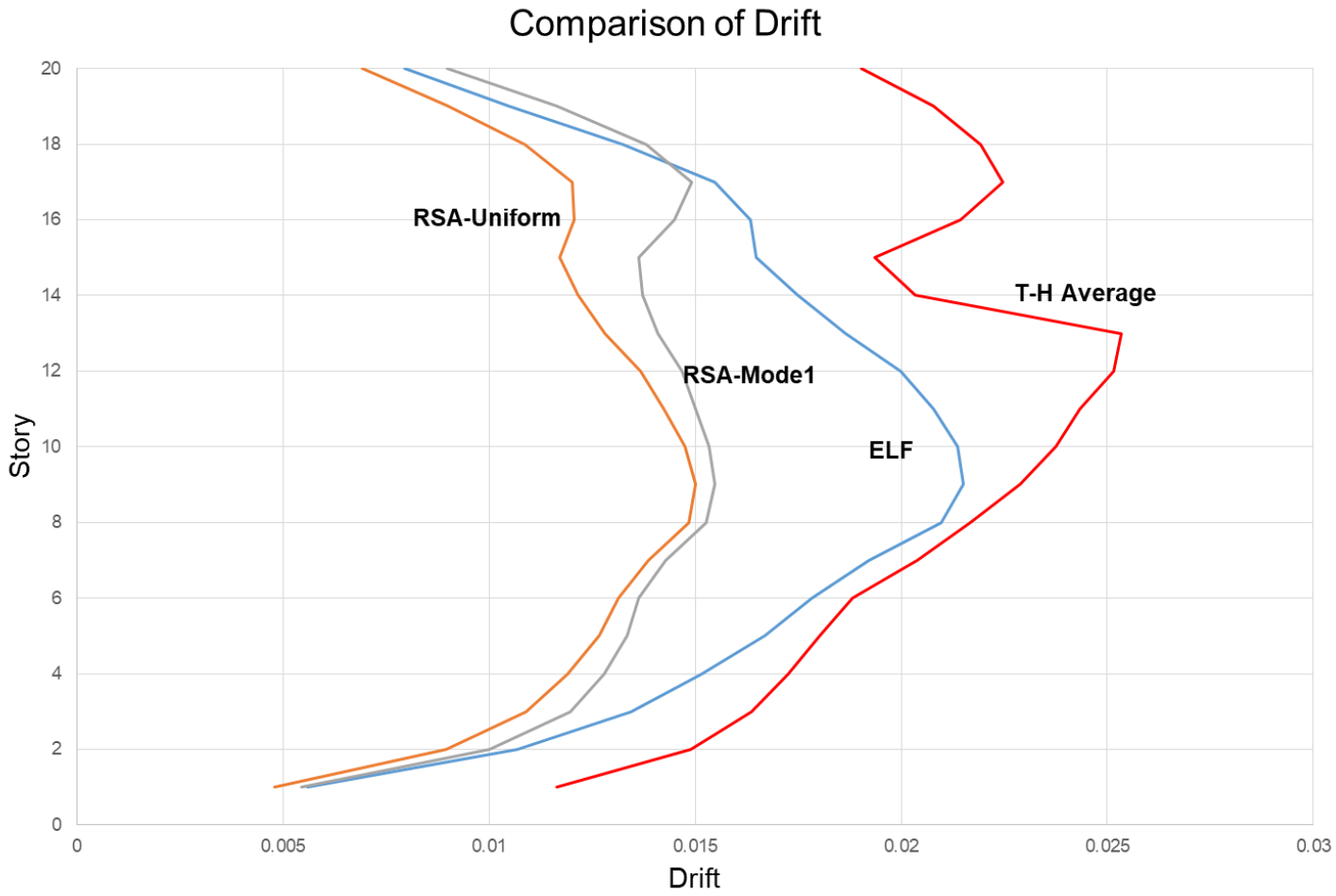
20 Story MF Study



20 Story MF Study



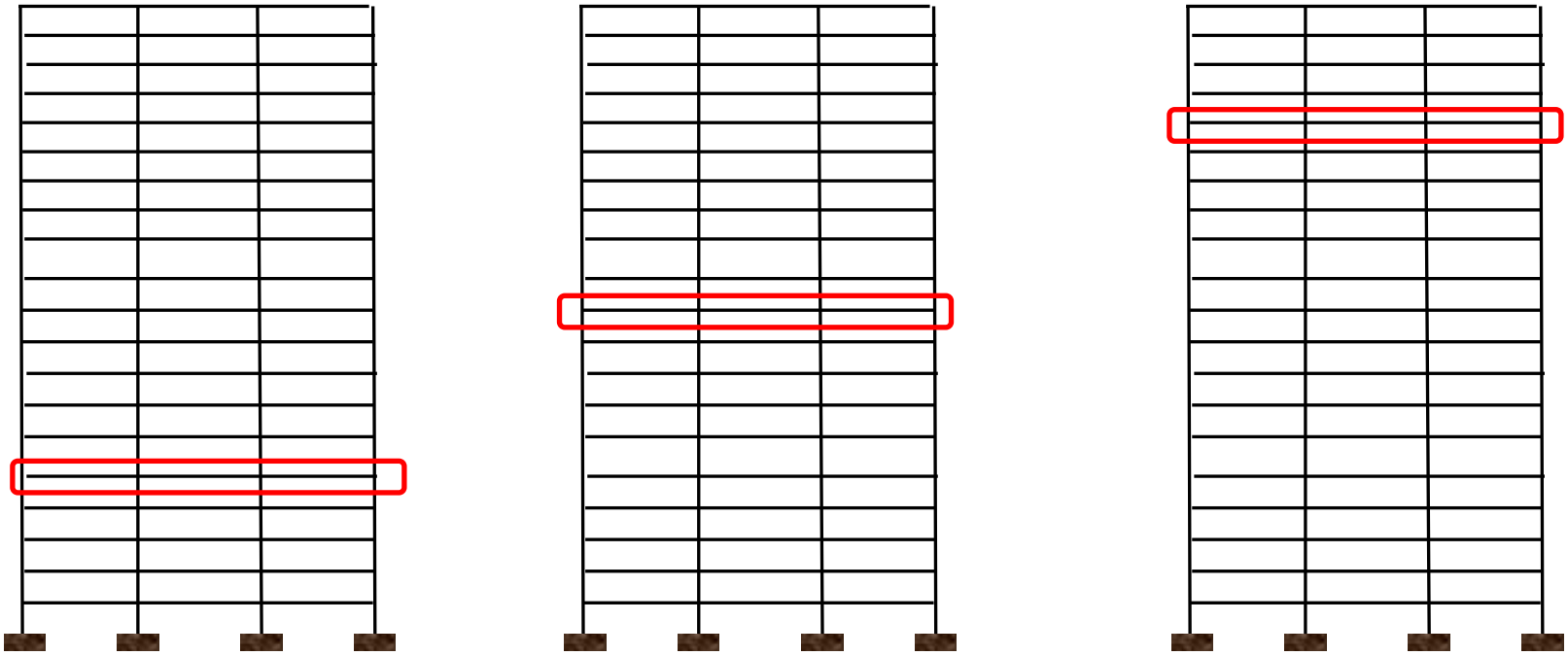
20 Story MF Study



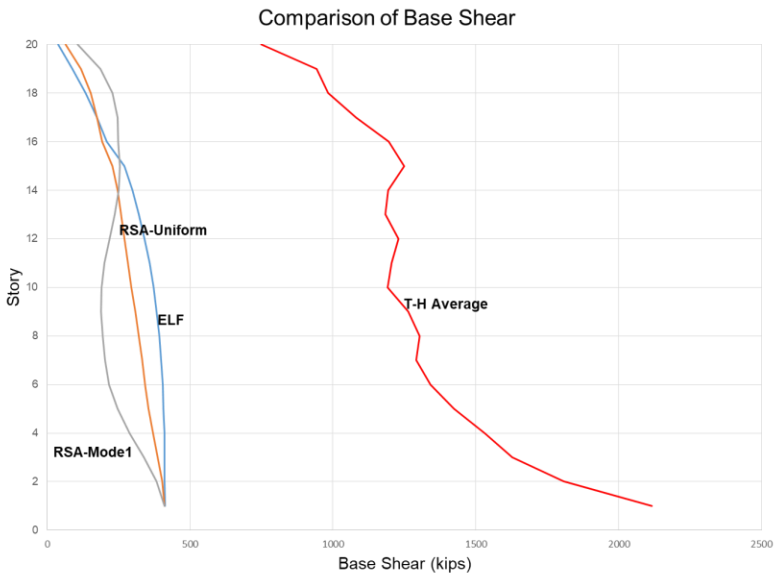
Study of Irregular Buildings

Mass Irregularity

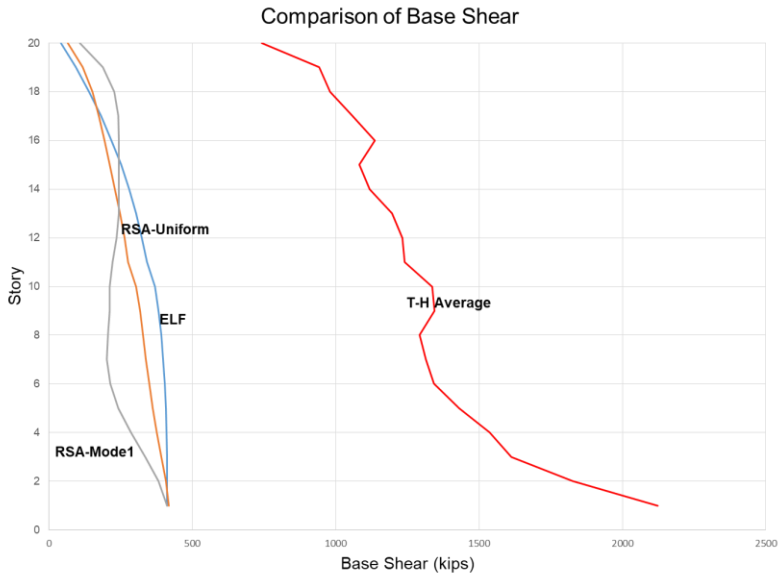
- 20 Story SMRF Buildings
- Mass in RED box = 2 times adjacent story mass
- Study 3 Cases



20 Story Mass Irreg. MF Study

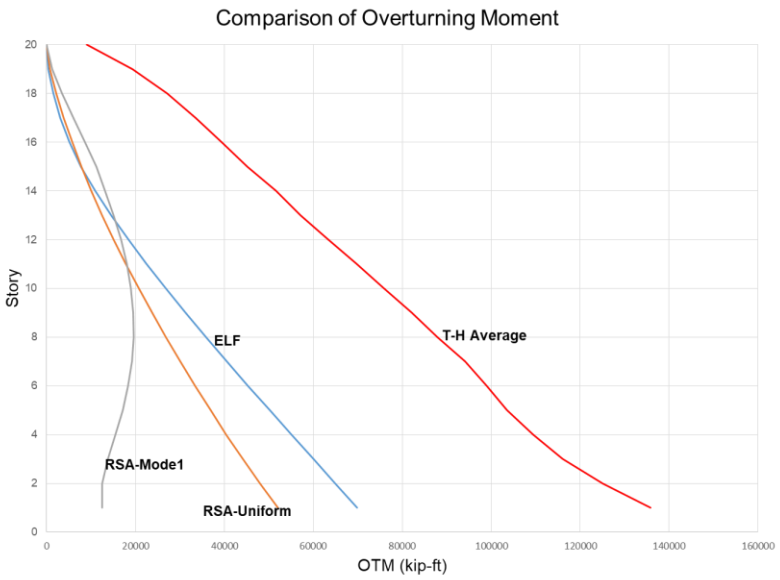


Double Mass at Level 15

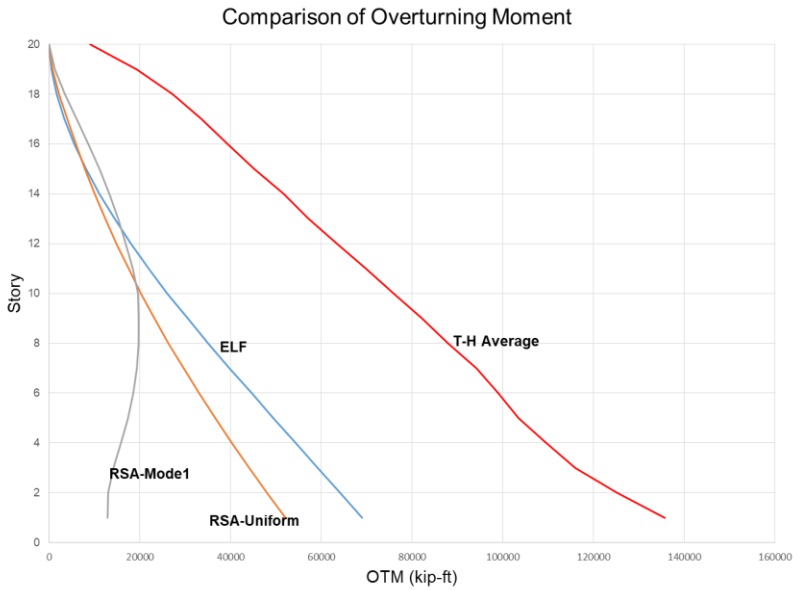


Double Mass at Level 10

20 Story Mass Irreg. MF Study

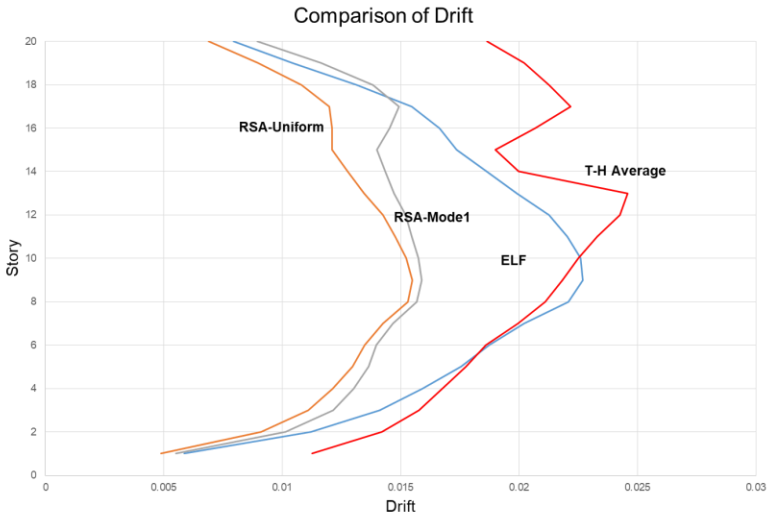


Double Mass at Level 15

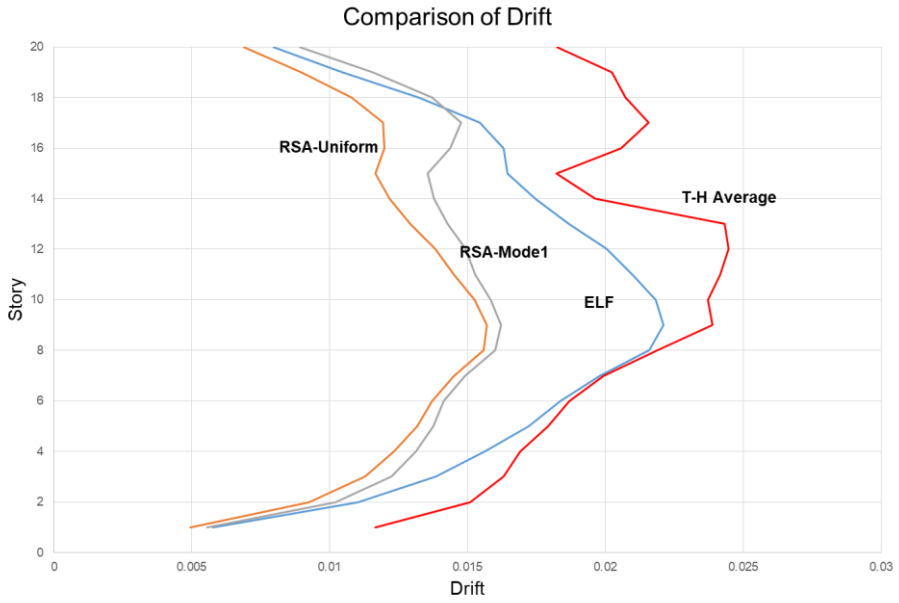


Double Mass at Level 10

20 Story Mass Irreg. MF Study



Double Mass at Level 15

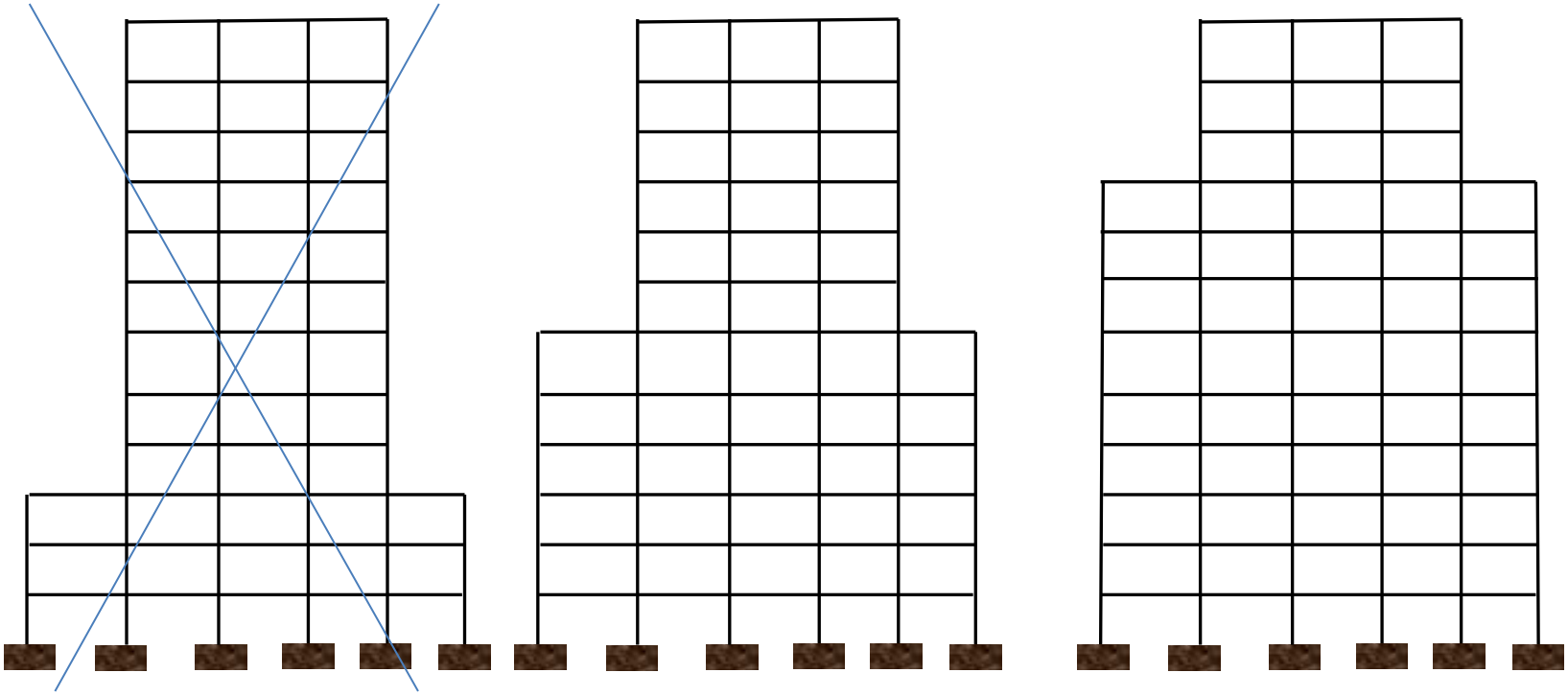


Double Mass at Level 10

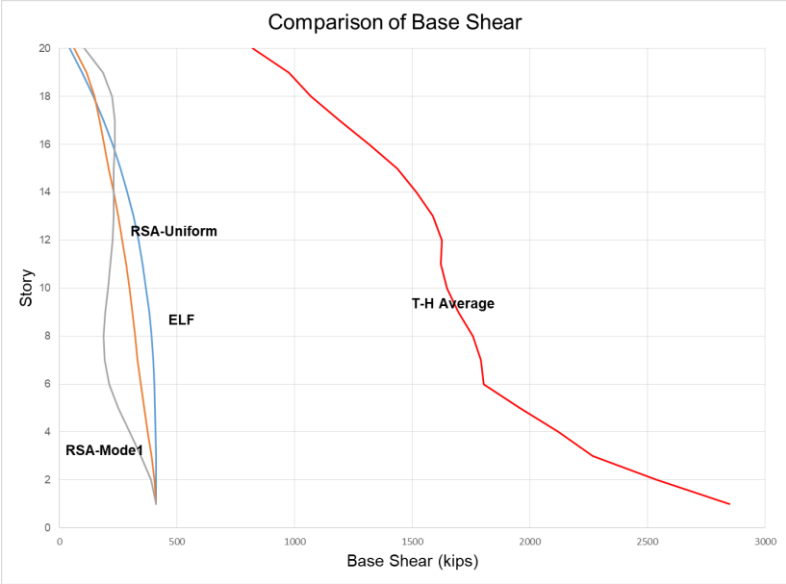
Study of Irregular Buildings

Stiffness/Offset Irregularity

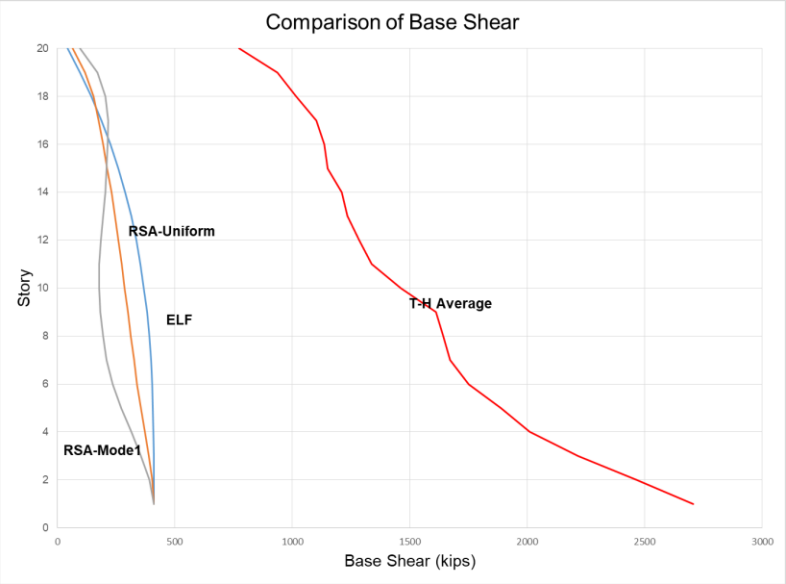
- 12 Story SMRF Buildings
- Study 3 Cases



20 Story Stiffness Irreg. MF Study

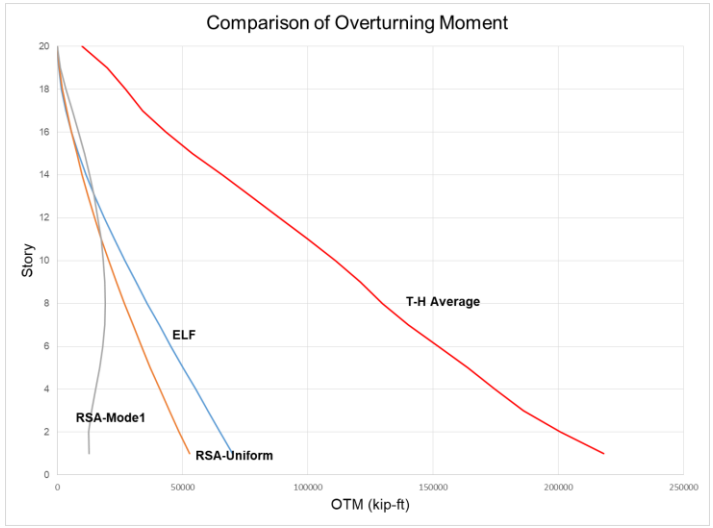


Stiffness Irreg. at Level 15

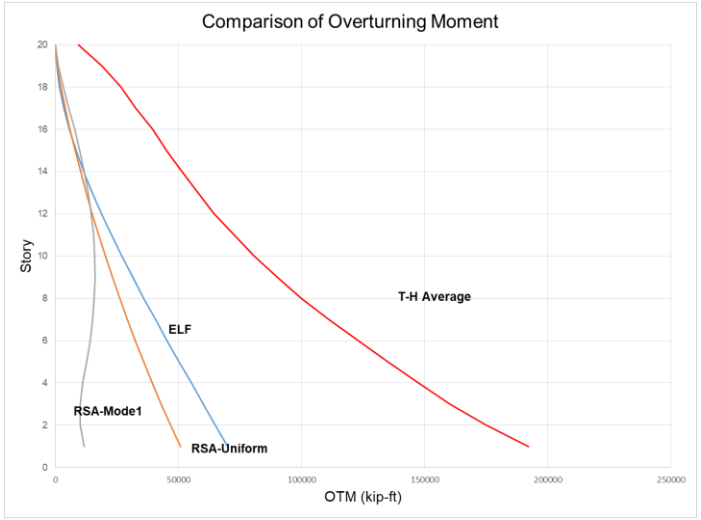


Stiffness Irreg. at Level 10

20 Story Stiffness Irreg. MF Study

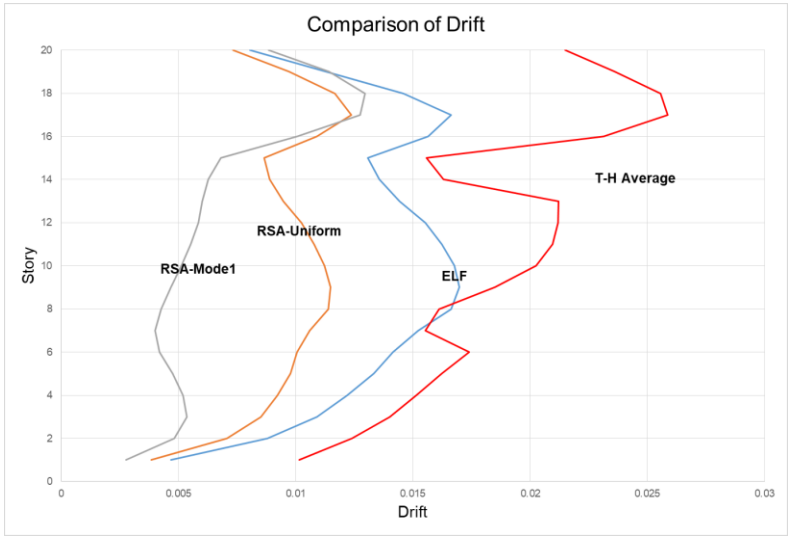


Stiffness Irreg. at Level 15

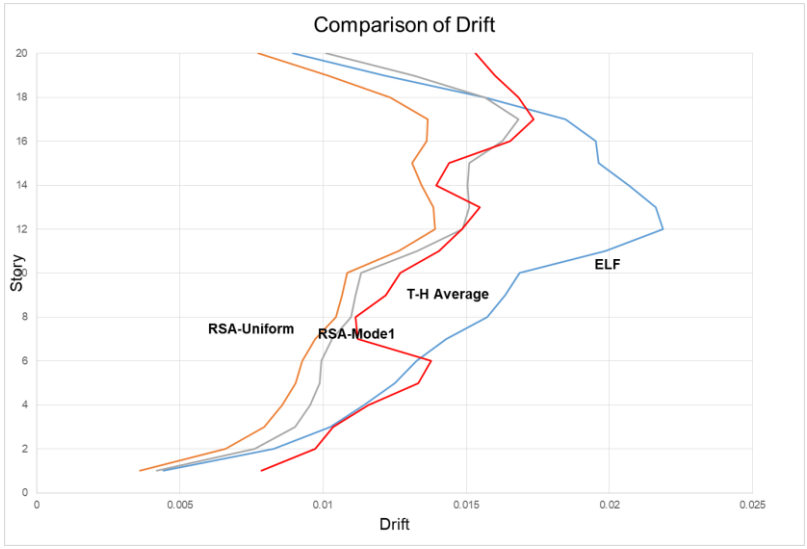


Stiffness Irreg. at Level 10

20 Story Stiffness Irreg. MF Study



Stiffness Irreg. at Level 15



Stiffness Irreg. at Level 10

Findings

- Scaling the RSA base shear to 100% ELF does not necessarily result in equivalency in terms of overturning moment at the base
- ELF OTM is always greater than scaled RSA OTM. Scaled RSA-Mode1 OTM is significantly less than ELF OTM
- ELF drifts for 2D regular, mass irregular and stiffness irregular cases are less than both RSA and RSA-Mode1

Study of Irregular Buildings

Torsional Irregularity

- 8 Story CSW Building modeled after ATC 123
- Study 3 Cases
- Wall location to be adjusted to create torsional irregularity

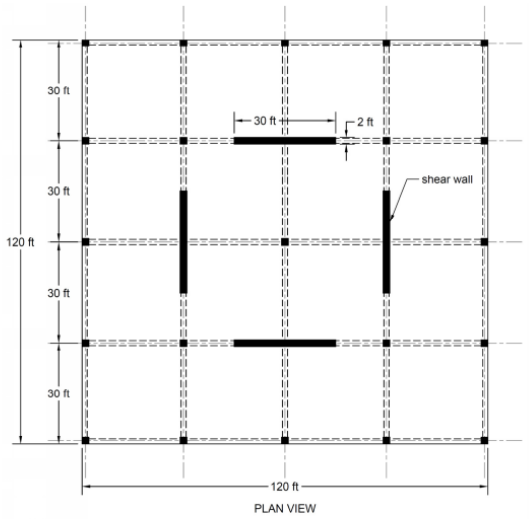


Figure 5-12 Building plan view for 8-story buildings designed for D_{max} and B_{max} spectra. Note that the wall length is 20 ft. for B_{max} designs.

Base Case

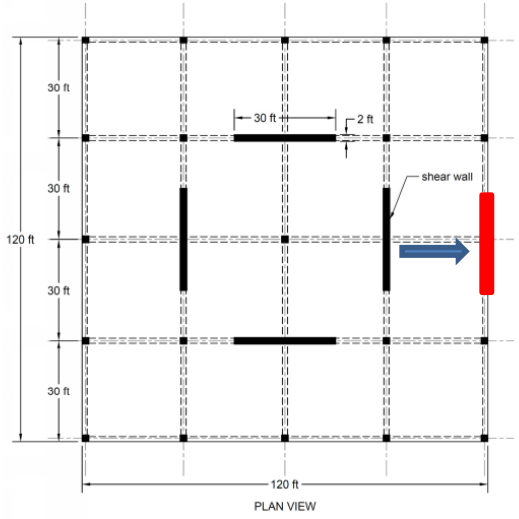


Figure 5-12 Building plan view for 8-story buildings designed for D_{max} and B_{max} spectra. Note that the wall length is 20 ft. for B_{max} designs.

Torsionally Irregular about One Axis

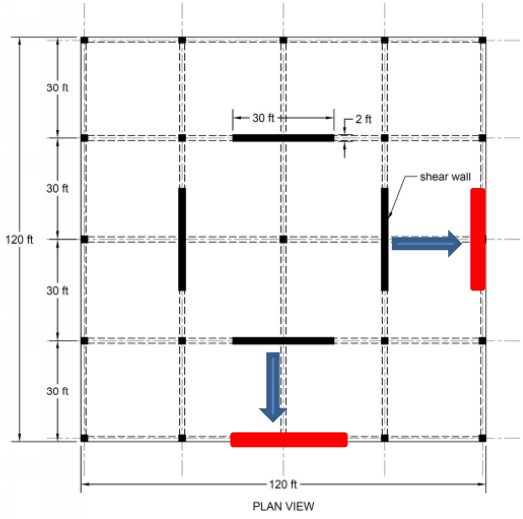


Figure 5-12 Building plan view for 8-story buildings designed for D_{max} and B_{max} spectra. Note that the wall length is 20 ft. for B_{max} designs.

Torsionally Irregular about Both Axes

WORK IN PROGRESS

Agenda for this Year

- Start looking at data from Moment Frame & Braced Frame studies for Topics 3 & 4.
- Complete Stiffness and Torsional Irregularity Studies and bring them in alignment with Topics 3 & 4.
- Create an outline for a White Paper on topics 1 3 and 4
- Summarize recommendations of ATC 123 and revise trigger for MRSA in ASCE 7 as necessary