Review of Expert Panel and Beca Report on PGC Building

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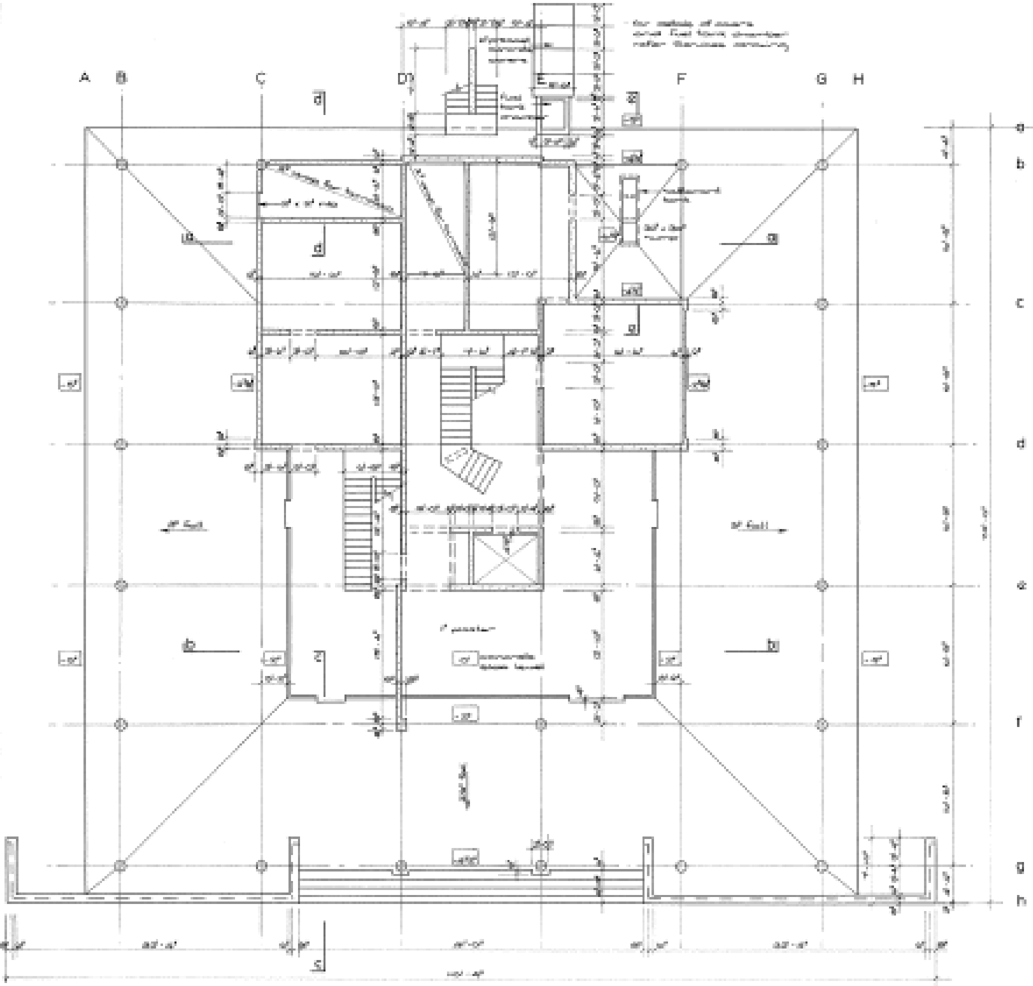
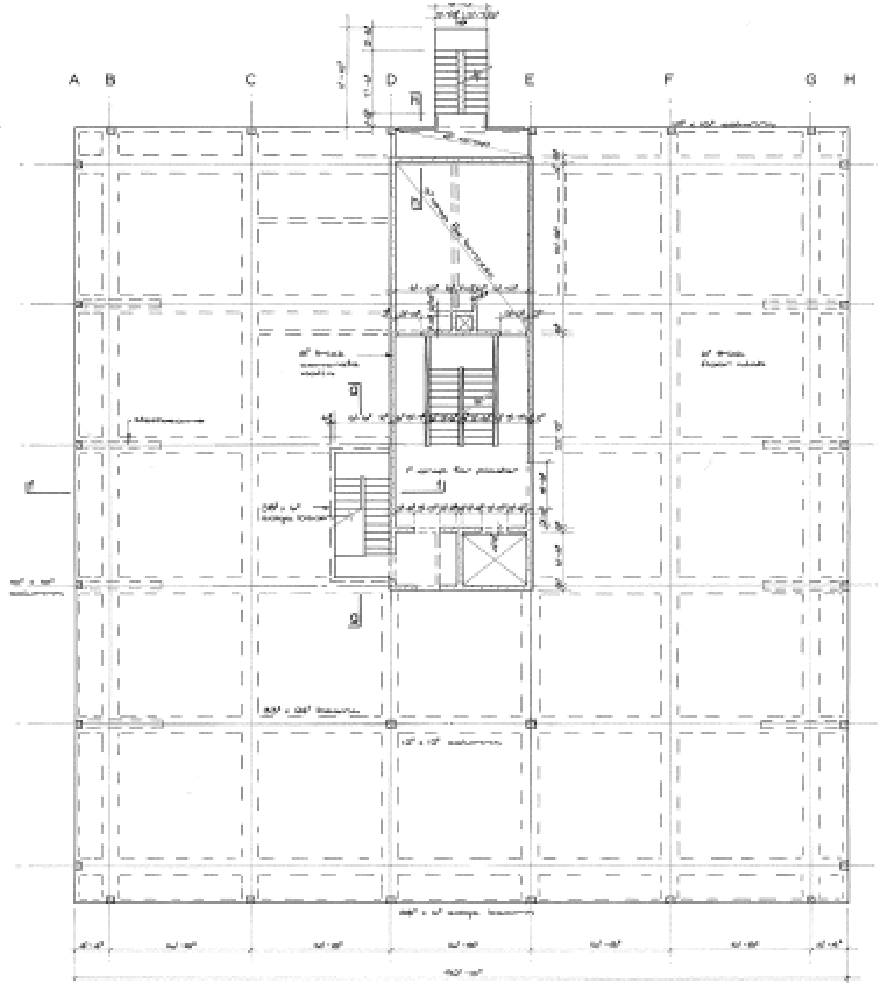
Structural plan of Ground and Level 1





Pyne Gould Corporation Building

- All agree that building collapsed due to failure of the central tower at floor 1-2
  - Failure caused large movement of Level 2 downward and to the east (about 3 m)

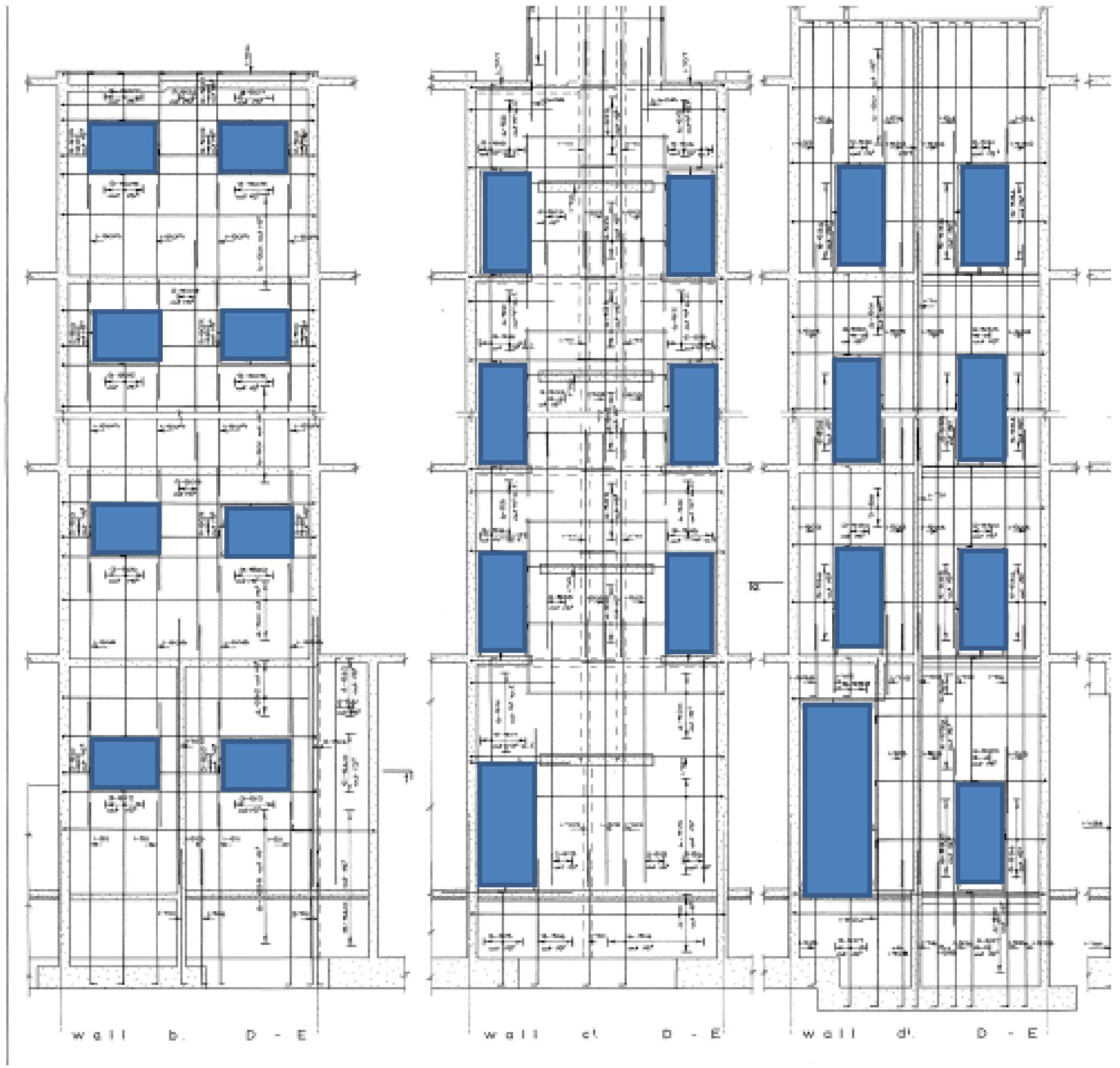

Original position
Known distance
3 m
2 bays
10'±
12'6"
story
ht.
85
= 83.3'

Pyne Gould Corporation Building

- All agree that building collapsed due to failure of the central tower at floor 1-2
  - Failure caused large movement of Level 2 downward and to the east (about 3 m)
  - Some girders supported by tower pulled away and collapsed (in unknown sequence)
  - Props placed behind perimeter columns as a retrofit were to provide supplemental support for the columns under excessive drifts (range of 5 cm), not meters. Exterior columns therefore collapsed. (in unknown sequence)
    - It is interesting to speculate if the "props" provided any assistance to the columns in Sept.

Level 1-2 had many seismic deficiencies

- Light central reinforcement.
  - Weak in global flexure (overturning)
  - Weak in EW shear (many openings, low R/F ratio, small trim bars. Piers in North Wall appear to be "shear critical"



Can these walls provide sufficient coupling of east and west wall for the tower to act as a unit?

If so, would the south wall fail in shear prior to a flexural tower failure?

Our calculations indicate these various failure modes have reasonably close yield strengths.— Too close to call.

Additional Seismic deficiencies

- Discontinuity at north end of east wall

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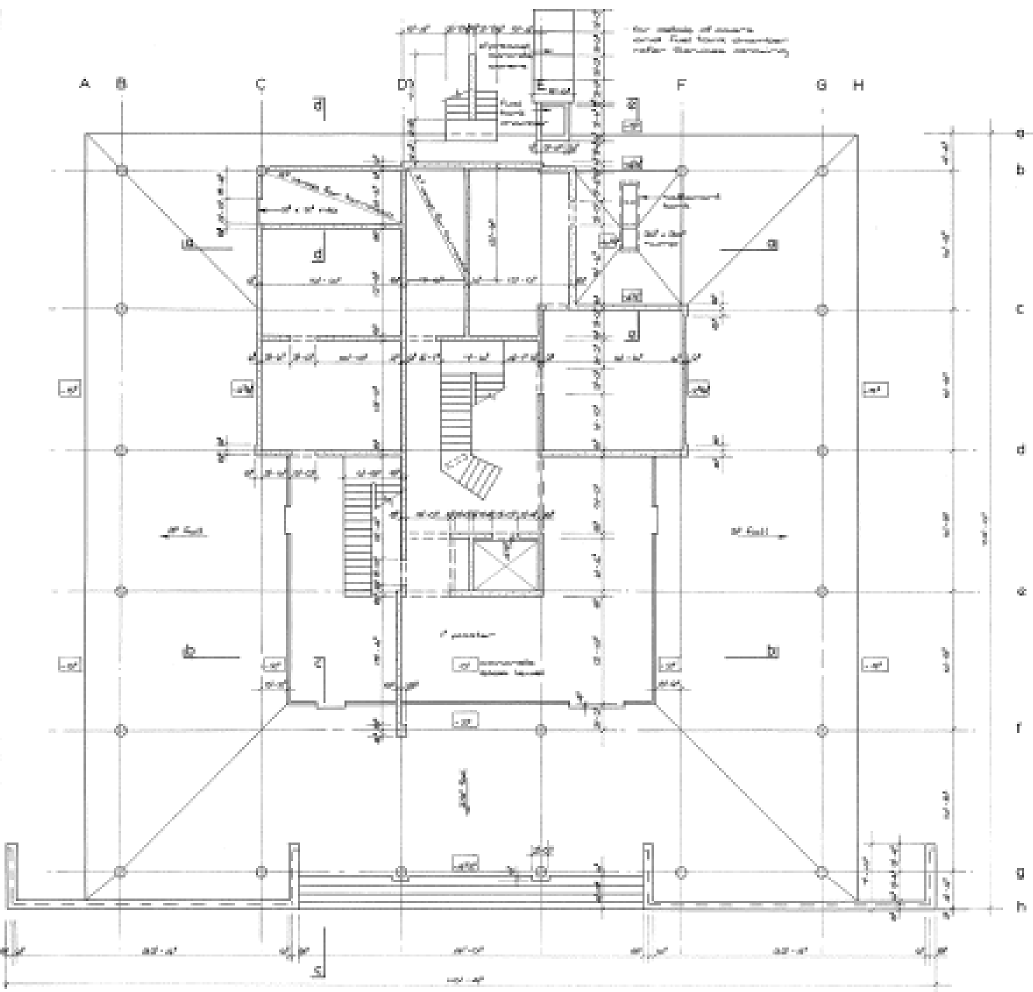

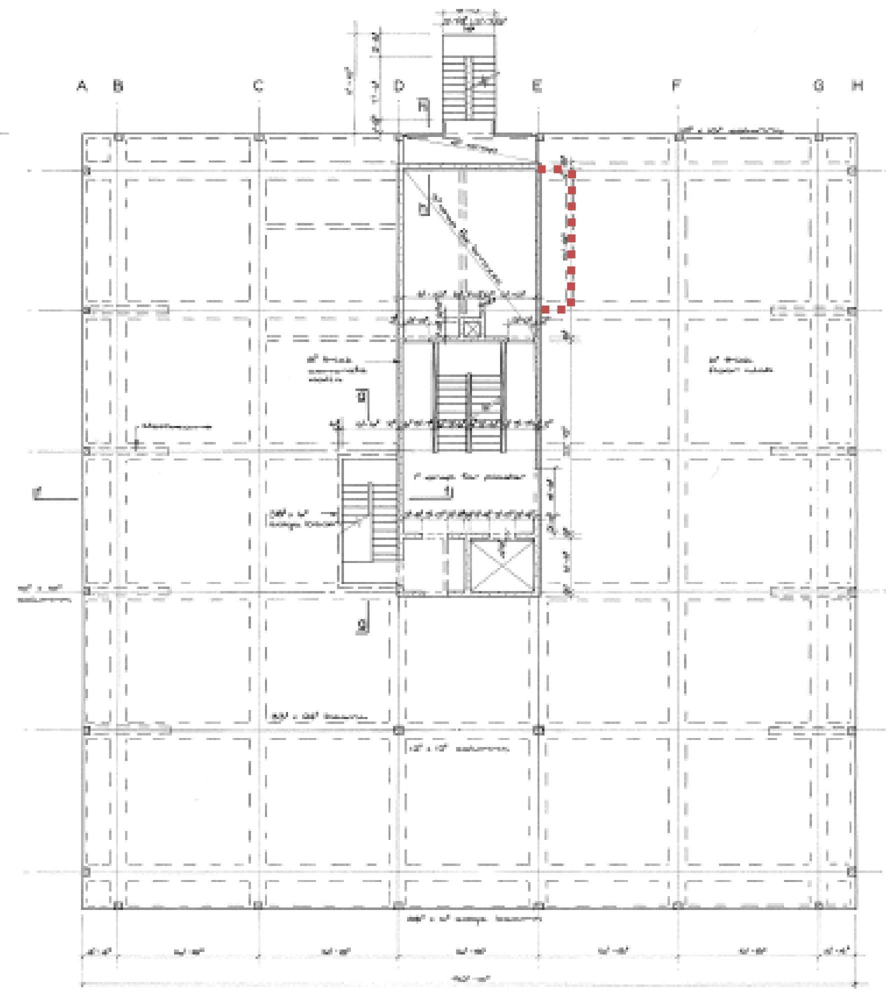

Seismic deficiencies

- Discontinuity at north end of east wall
- No confined “column” elements under floor girders
- Poor connection of girders to tower at all levels
- Displacement critical gravity columns at perimeter (retrofit props not intended to support gravity loads under very large displacements.)

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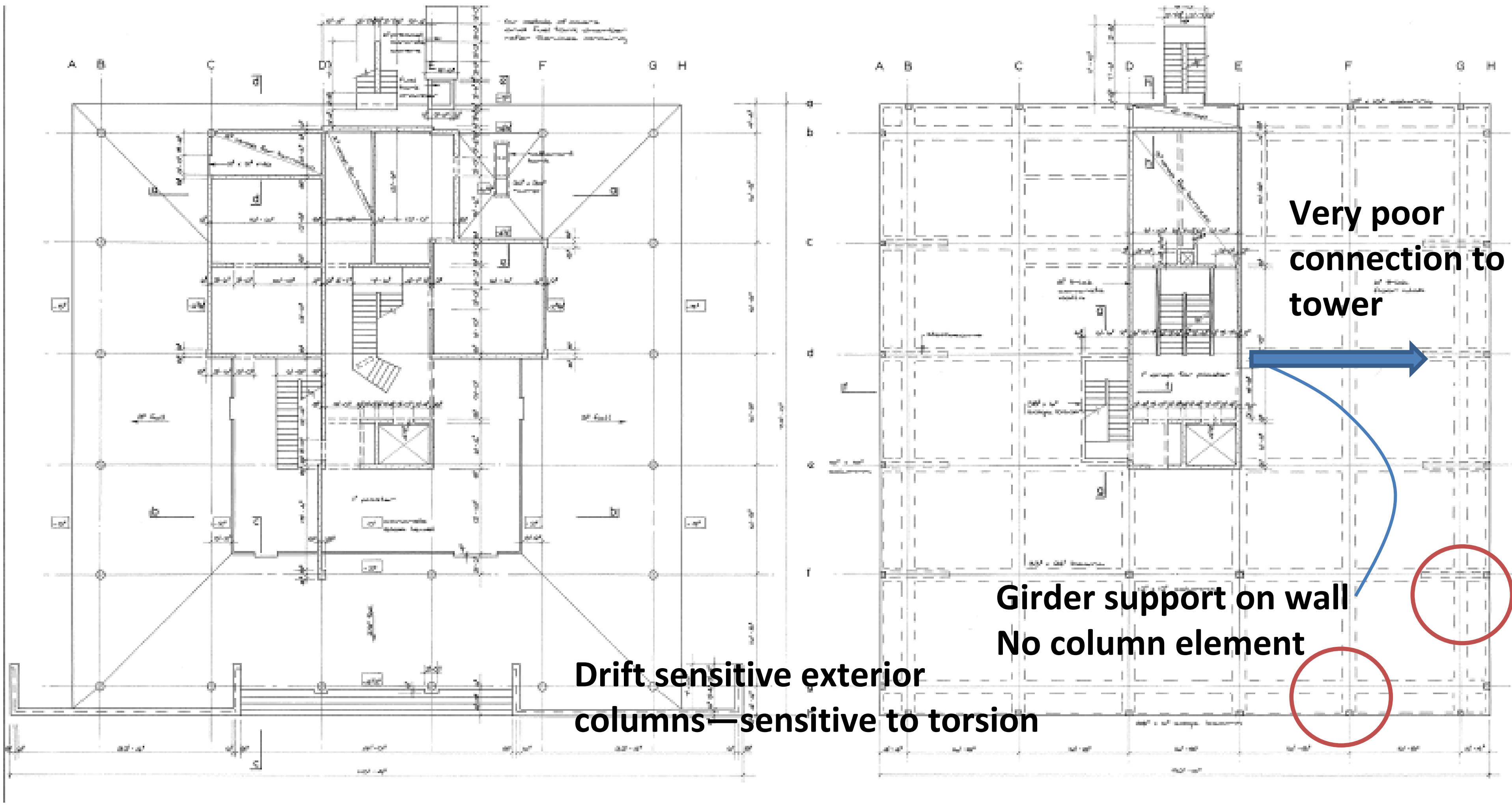

Comment on use of Capacity Spectrum Method

- In Appendix A5, a pushover curve representing the structure and a spectral displacement vs spectral acceleration plot are superimposed to estimate maximum displacements. Normally in this method the a-d plot is reduced for increased damping due to damage.
- This would change the ratios used to estimate %NBS

Lessons for other "older" concrete buildings

- What conditions should be considered "Critical Structural Weaknesses"? Did it take a combination of the deficiencies to cause failure?
- Use of %N BS
  - Assessments of 33%-50% NBS but building was only slightly damaged in September, which, arguably, had shaking of the same order of magnitude as 100% NBS.
  - Brittle buildings of 100% NBS may be dangerous with only a small increase in shaking intensity.
    - However, it is unrealistic to evaluate buildings for very rare shaking (e.g. 2500 year return)
    - Brittle buildings examined for potential catastrophic failure modes at greater than 100% NBS?