

Response regarding the overall findings of the NTHA panel.

1. The NTHA process has come a long way since the original submission from the DBH. That first report was fraught with so many problems, faulty assumptions and errors that, in my view, should not have been published in its present form.
2. Nevertheless, the first analysis and report provided a useful starting point to the second round of NTHA recently completed. Main accomplishments in this second round have included;
  - a. Modeling of the beam column joints,
  - b. End-on-end analysis of earthquakes commencing 4/9/10 through 22/2/11
  - c. REHS motion now included
  - d. A more realistic concrete strength
  - e. A PMM concrete failure surface for the columns largely due to the fiber-element modeling used for the columns.
3. Notwithstanding these improvements, the second phase still needs further fleshing out for sake of completeness and to raise confidence in the comprehensiveness of the results.
4. Specific modeling enhancements that remain to be done are:
  - a. Improvements in the beam column joint modeling. It is contended that the interior joint strengths assumed remains excessively high. Rational mechanics results show this. And while it may be possible under some rare circumstances to justify the chosen model capacities, it is contended that, at best, this high strength can only apply for the initial cycle of loading until the joint cracks. Subsequent cyclic softening is not adequately modeled, but is more likely to be similar to that given in the cited Park and Mosalam paper.
  - b. Another major problem with the joint modeling is the capacity is set based on an average axial load, while in reality it will be a function of axial load, and should be permitted to fluctuate accordingly.
  - c. Rebars within the joint, particularly the pair adjacent to each side without a beam, will be prone to buckle under modest axial strain. This buckling effect is considered to assist in breaking off the “wings” in the precast units leaving the joint completely exposed to rapid failure. Attempts should be made to model this phenomenon and then capture its effect in the subsequent analyses.
  - d. The connections are based on post processing using a C/D ratio process. This approach is archaic, and given the power of the modeling should be avoided wherever possible. Instead, direct inelastic behavior should be modeled and the member performance permitted to be whatever it needs to be without bias. In this way complete failure can be follow through until collapse is observed.
  - e. True geometric nonlinear analysis is not handled directly, only inferred via stiffness matrix modifications.
5. With the above changes implemented it is likely to confirm that the interior frames on lines 2 and 3 were indeed weaker, and the location of the collapse initiation.