Ghosh: Range of materials presented here. Need to identify core people on committee to address each topic. Objective should be to write a summary for Part 3 of the Provisions. This may lead to Part 1 proposals.

- Steel plate shear walls. Coupled steel plate shear walls; and rocking, self-centering steel plate shear walls. Hooper: connect with members of TC9 of AISC.
- Wood shear walls: Cobeen slide 8: load path to support anticipated performance. Perhaps recruit others to join discussion.

### 8. Shear Wall Load Path

#### Detailing Criteria

- Issue: Shear wall load paths (tie-down systems, shear transfer) are currently designed based on code design force levels and perceived adequate performance to date. No consideration is given to 1) the load and deformation behavior to occur under anticipated seismic forces 2) that the building stock has expanded beyond past experience. It needs to be determined if changes to detailing practice are required ensure shear wall performance.
- Resources: Available testing and analytical studies (including ATC-116).
- Could Accomplish: Part 3 discussion of anticipated shear wall behavior and guidance for shear wall detailing.
• Masonry shear walls: partially grouted shear walls.
  Performance may be improved with improvements in detailing.
  Perhaps recruit others.

• Concrete shear walls:
  Ghosh: Gino’s presentation on coupled shear walls with PT through coupling beams demonstrates there are now many forms of coupling beams, e.g. steel, precast, cast-in-place. Coupled shear walls are an efficient system for EQ resistance, especially when compared to non-coupled shear walls. Believes coupled shear walls should have their own R factor. Important first step is to define a coupled shear wall. Canadian code has a definition of coupled shear walls. Klemencic has noted that the R factor should be related to energy dissipation. He and Fields have been working on analytical studies of walls with varying degrees of coupling, multiple heights, response history analysis. Fields: examining trends in hysteretic energy absorption. It’s possible to have too much coupling. Ideal and simple way to define coupled shear walls in terms of coupling beam aspect ratio, but this does not seem entirely possible. Probably need to formulate the definition with some other parameter or parameters. Berman: What about other IT’s? S.K. will send out a list. Lehman: Agrees that it is likely coupled shear walls should have a higher R factor, for well-behaved systems. There may be some systems with lower R-factors. Need to distinguish between well-behaved and less well-behaved coupled shear walls. Ghosh: need to form a group on coupled concrete shear walls.

  o If coupled concrete shear walls are to gain acceptance by ASCE 7 into the R-factor table, it appears a P695 study is required. This may not be a full-scale study, but a more abbreviated study. This needs to be discussed further. Maffei: do we think that a P-695 study will result in a higher R? Ghosh: It is not at all clear at this point. There are some concerns about the P695 process. Lehman will summarize her concerns in writing. Should emphasize
how to characterize the system based on considerations other than P695. Ghosh believes these need to be brought forward to a larger audience. Maffei: could the study be based on failure conditions rather than actual collapse, such as runaway P-delta, or toe crushing. Cobeen: wood research has gone from using a drift limit to define collapse to using collapse mechanism to define collapse. Maffei: at some point we begin to lose confidence in the ability of our model to represent true behavior. Cobeen: there is only limited test data on components and systems that have been loaded all the way to a collapse condition. Berman: could define limit states that represent collapse.

- Klemencic and Fields are performing their study in order to develop a definition of coupled concrete shear walls for inclusion in ACI 318. Without a definition in ACI 318, an R factor cannot be defined in ASCE 7.
- Ghosh: Gino also gave a presentation on hybrid concrete shear walls. This brought up some interesting collateral issues, such as splices at wall bases. Should IT4 study hybrid shear walls further? System is already classified. Gino suggested studying emulative systems. After further discussion decided there is no urgent topic in this area that needs IT4's attention.
- Ghosh: Concrete shear wall details. Rather than focusing on changes in details, step back and look at the system design approach in general. Each detailed change usually has some merit, but taken together the small changes may discourage the use of concrete shear walls. Furthermore, a broad review of shear wall design may yield more benefit than focusing on detailed changes. Shear design, in particular, needs to be re-examined. IT4 should take a look at available research and synthesize it to make global improvements in shear design. Maffei: the existing provisions for various types of walls and materials
are inconsistent. Fields: Important to establish a distinction between flexure-critical and shear-critical concrete shear walls. Typically we are under-designing for shear and over-designing for flexure. Lehman agreed. Need to re-examine shear capacity evaluation, and shear demand. Maffei: there appears to be general agreement in this group that important changes are needed. Ghosh: suggests developing a comprehensive document for Part 3 of the provisions. There is also the possibility of taking provisions directly to ACI 318 sub-H (Seismic Provisions). A second option is to propose Part 1 changes, with the intention that they be adopted later by ACI 318. Lehman: we may need a larger experimental database (of flanged walls) or further numeric simulations. Ghosh: We could make inroads in the area of flexure-controlled vs. shear-controlled walls. Xia: What is done in other countries, like Japan? Do they have higher shear design forces? Maffei: Yes, they do. The same is true in Europe, New Zealand, Canada.

- Ghosh: First, proposes sharing current ACI 318 Sub-H proposal from Wallace with IT4 members. Taylor will check with ACI 318 chair. Second, distribute information to IT4 on research about shear strength of shear walls. There is a large body of test data and analytical studies available. Ghosh would like IT4 to examine what information is available and what is not. Suggested devoting half a day at the next meeting to this topic.

Berman: What about height-dependence of behavior? He has found that in braced frames, lower-rise buildings are much closer to collapse that high-rise buildings using the same R factor. Cobeen: work is being done in this area for masonry shear walls – a comprehensive re-examination of R factors. Maffei: If we end up creating a range of R factors for various shear walls systems, we need to assign a name to each system. Currently these distinctions are
made using the terms “ordinary”, “intermediate” and “special”. Suggests we don’t assign such names, but instead create detailing rules that lead directly to R factors.

○ Ghosh: should concrete shear walls be looked at separately from composite or steel plate shear walls? Lehman and Berman: there aren’t any shear concerns, but wall-to-foundation connections are important. Berman: details are also important, e.g. end-of-wall confinement. Ghosh: who is active in this area? Bruneau, Mike Kreger, Roberto Leon, Jerry Hajjar. Berman: the details for other types of composite construction don’t necessarily translate well to composite shear walls.