Structural Advisory Board Meeting August 24, 2011

Summary of Meeting Minutes

Topic: Use of Corrugated Metal Deck as Shear Walls

Present

Board members:
David Bugni – David Bugni and Associates
Joe Gehlen – Kramer Gehlen and Associates *
Chris Thompson – Catena Consulting Engineers
Tim Rippey – T.M. Rippey Consulting Engineers

City Staff:
Amit Kumar – Bureau of Development Services, City of Portland
Eric Thomas - Bureau of Development Services, City of Portland

Applicant:
David A. Lee - NW Steel Systems
Alan Jones – Holst Architecture
Patrick Reilly - Urban Self Storage, Inc.
Patrick Bodwell – ASC Profiles, Inc.
Dave King – AEP Span a division of ASC Profiles Inc.

Amit thanked the members of the board for their time and effort serving on the structural advisory board. The board was informed that the term of the current board expires August 31, 2011. The plan going forward is to seek applications from engineers from the local structural engineering community who would be interested in serving on the board. It is currently proposed that at least two of the existing board members be re-appointed and the remaining positions be filled with new members.

Following this the board took up the discussion of the appeal item before the board for this meeting. Amit provided an overview of the issue.

Background and Proposal:

The proposed structure is two stories tall used for storage within a building that has overall dimensions of 159 ft x 308 ft. One quarter of this building houses a charter school and the remainder of the building will house the proposed storage structure.

The storage structure is approximately 159 ft x 231 ft. The first elevated level of the storage structure is concrete on metal deck supported by metal stud bearing walls. The

metal studs are 16 gage and spaced at 30"o.c where the floor bears on the wall and at 58"o.c. where the metal deck runs parallel to the wall below. The metal stud walls are sheathed with corrugated 1½", 26 gage metal deck. The deck spans perpendicular to the metal studs and is connected to the metal studs with #12 screws @ 6"o.c.

The applicant has proposed a lateral system using shear walls constructed of metal studs with corrugated steel sheathing. The applicant has requested that the proposed lateral system be considered a pre-approved lateral system under ASCE 7-05, item A.13 from Table 12.2-1 " Light framed walls sheathed with wood structural panels rated for shear resistance or **steel sheets**. " . The seismic coefficients associated with this system provided in ASCE 7-05 are R= 6.5, Cd= 4, and Ω=3.

Patrick Bodwell with ASC Pacific presented his case to the board requesting approval of the proposed lateral and the associated seismic coefficients. Attached with these minutes is a letter from Patrick Bodwell to the board laying out his case.

After the presentation from Patrick Bodwell, Amit presented the City of Portland's view on this issue. Amit stated that the city staff had contacted several people with knowledge of the proposed system. These included, Bonnie Manley – Regional Director with AISI and member of AISI committee on Lateral loads, John Hooper – Chair of ASCE 7-05 seismology committee, Steve Tipping –Principal with Tipping Mar and Jim Malley – Structural Engineer with Degenkolb Engineers and Member of AISC seismic committee.

All the references the city staff contacted agreed that the proposed system of corrugated metal deck on metal stud walls would NOT qualify as a prequalified "Light framed walls sheathed with wood structural panels rated for shear resistance or **steel sheets"** of ASCE 7-05. The steel sheets referred to in ASCE 7-05 is meant to be for flat light gauge steel sheets NOT corrugated steel. Limited research and testing done by Tipping Mar suggests that using an R=6.5 would be inappropriate, but R=4.0 may be more appropriate as long as detailing requirements from the testing are followed. Professor Deierlein with Stanford University who analyzed results of earlier testing concluded that the corrugated steel panel archetypes do not pass the criteria to justify the R-value of 6.5 and suggested that R-values, probably on the order of 3 to 4, should be used for design.

Based on this, the City Staff recommended that an R=3.0 with Cd= 2.5 Ω=3. This is because this particular system has not been codified and is still undergoing peer review and the fact that Prof. Deierlein's review using the ATC-63 protocol suggests a range of R values between 3 to 4. In addition to the seismic coefficients the detailing for this system should be specified and must meet specific detailing requirement such as in used in the testing by Steve Tipping. This must include detailing items such as specific screw sizes, blocking requirements at vertical and horizontal seams, capacities based on different gauge of stud and metal deck thickness, spacing of metal studs, height to width ratios etc.

Discussion ensued on the proposal. It was generally agreed that the proposed system is a viable lateral load resisting system. The question to be settled therefore was what seismic design coefficients to assign and what, if any, detailing requirements would be necessary.

At the beginning it was agreed by all members of the board, the city and the applicant that it would not be appropriate to use an R=6.5. Discussion followed on whether an R=3.0 or 4.0 should be assigned. Dave Bugni preferred to use a coefficient of R=3.0 for reasons set forth by the city staff. Chris Thompson indicated that he was comfortable in allowing the use of R=4.0 since in his opinion the system would perform better or at least as good as a system with flat strap bracing which has an assigned R of 4.0 in ASCE 7-05. After much discussion the majority of the board voted to assign an R=4.0 based on comparison to flat strap bracing of ASCE 7-05. (Chris Thompson and Tim Rippey voted to use R=4.0 and Dave Bugni voted to use R=3.0)
The discussion then turned to detailing requirements that would be required. See conclusions below for the specific requirements that were agreed upon.

Conclusion:

The Structural Advisory Board concluded the following :

1) The proposed lateral system using metal stud with corrugated steel sheathing as vertical elements of the lateral load resisting system is a viable lateral system.
2) It is **not appropriate** to consider this system as a pre-approved lateral system covered under the preapproved system of "Light framed walls sheathed with wood structural panels rated for shear resistance or **steel sheets"** ASCE 7-05 with seismic coefficients R= 6.5, Cd= 4, and Ω=3.
3) It **would be** appropriate to use the following seismic coefficients : R= 4.0, Cd= 3.5, and Ω=2.0
4) This system can be used only in structures less than or equal to 35 ft in height.
5) The decking material shall be a minimum of 26 gage.
6) The thickness of the metal stud backing shall be greater than or equal to the thickness of the metal deck.
7) The lateral capacity of the system may be based on testing or calculated using principles of mechanics, using values of fastener strength and sheathing shear resistance per procedures of AISI standard, S100 " North American Specification for the design of Cold formed Steel", and AISI S213, "North American Standard for the design of Cold formed Steel Framing- Lateral Design"
8) The thickness of the metal studs shall be such that the governing failure mode for the fasteners is " Shear limited by Tilting and Bearing", section E4.3.1 of AISI S100

* Recused himself during vote on the resolutions because of conflict of interest