Chapter 8 Commentary

STEEL STRUCTURE DESIGN REQUIREMENTS

8.1 REFERENCE DOCUMENTS: The reference documents presented in this section are the current specifications for the design of steel members, systems, and *components* in *buildings* as approved by the American Institute of Steel Construction (AISC), the American Iron and Steel Institute (AISI), the American Society of Civil Engineers (ASCE) and the Steel Joist Institute (SJI).

Revise the AISC Seismic Commentary Sec. C9.3 as follows: At the end of the second paragraph add the following: "This provision requires that the panel zone be proportioned using the method used to proportion the panel zone thickness of successfully tested connections. This should not be constructed to mean that the thickness is required to be the same as the tested connection, only that the same method must be used to proportion it. For example, if the test were preformed on a one-sided connection and the same beam and column sizes were used in two-sided connection, the panel zone would be twice as thick as that of the tested connection."

8.2 SEISMIC REQUIREMENTS FOR STEEL STRUCTURES:

8.3 SEISMIC DESIGN CATEGORIES A, B, AND C: Structures assigned to Seismic Design Categories A, B, and C do not require the same level of ductility capacity to provide the required performance as those assigned to the higher categories. For this reason, such structures are permitted to be designed using the requirements of any of the listed references, provided that the lower *R* value specified in Table 5.2.2 is used. Should the registered deisgn professional choose to use the higher *R* values in the table, it is required that the detailing requiorements for the higher Seismic Design Categories be used.

8.4 SEISMIC DESIGN CATEGORIES D, E, AND F: Structures assigned to these categories must be designed in anticipation of significant ductility demands that may be placed on the structures during their useful life. Therefore, structures in these categories are required to be designed to meet special detailing requirements as referenced in this section.

8.5 COLD-FORMED STEEL SEISMIC REQUIREMENTS: The allowable stress and allowable load levels in AISI are incompatible with the force levels in Chapter 5 of the *Provisions*. It is therefore necessary to modify the provisions of AISI for use with the *Provisions*. ANSI/ASCE 8-90 and SJI are both based on LRFD and thus are consistent with the force levels in Chapter 5 of the *Provisions*. As such, only minor modifications are needed to correlate those load factors for seismic loads to be consistent with the *Provisions*. The modifications of all of the reference documents affect only designs involving seismic loads.

8.6 LIGHT-FRAMED WALLS: The provisions of this section apply to buildings framed with cold-formed steel studs and joists. Lateral resistance is typically provided by diagonal braced (braced frames) or wall sheathing material. This section is only required for use in Seismic Design Categories D, E, and F. The required strength of connections is intended to

assure that inelastic behavior will occur in the connected members prior to connection failure. Since pull-out of screws is a sudden or brittle type of failure, designs using pull-out to resist seismic loads are not permitted. Where diagonal members are used to resist lateral forces, the resulting uplift forces must be resolved into the foundation or other frame members without relying on the bending resistance of the track web. This often is accomplished by directly attaching the end stud(s) to the foundation, frame, or other anchorage device.

Table 8.6 presents nominal shear values for plywood and oriented strand board attached to steel stud wall assemblies. Design values are determined by multiplying the nominal values by a phi (ϕ) factor as presented in Sec. 8.6.5. These nominal values are based upon tests performed at Santa Clara University (Serrette, 1996). The test program included both cyclic and static tests; however, the values presented in Table 8.6 are based upon the cyclic tests as they are intended for use in seismic resistance. In low seismic areas where wind loads dominate, nominal values have been recommended for wind resistance by AISI based upon monotonic tests (AISI, 1996). The cyclic tests were performed using the assemblies that were determined to be the most critical from the static tests. The assemblies cyclically tested consisted of 3.5 x 1.625 inch C studs fabricated with ASTM A446 Grade A (33 ksi) with a minimum base metal thickness of 0.033 inch. Since the tests were conducted, ASTM A446 Grade A has been redesignated ASTM A653 SQ Grade 33. The test panels were four ft wide and 8 ft high, the sheathing material was applied vertically to only a single side of the studs, and there was no sheathing or bracing applied to the other side.

The cyclic tests were performed using a sequential phase displacement protocol under development at the time of the test by an *ad hoc* Committee of the Structural Engineers Association of Southern California. Nominal values were conservatively established by taking the lowest load in the last set of stable hysteretic loops. It is expected that subsequent testing of steel stud shear wall assemblies will reduce or modify some of the restrictive limits currently proposed for the use of the system such as the nominal maximum thickness of the studs of 0.043 inch, the aspect ratio of 2:1, and the ability to use sheathing on both sides of the wall.

8.7 SEISMIC REQUIREMENTS FOR STEEL DECK DIAPHRAGMS: Since the design values for steel deck are based on allowable loads, it is necessary to present a method of deriving design strengths. Two ϕ values are presented — 0.60 for steel deck that is mechanically attached and 0.50 for welded steel deck. These factors are consistent with current proposals being circulated for inclusion in updates of ANSI/ASCE 8-90.

8.8 STEEL CABLES: The provisions of Sec. 8.5 are virtually unchanged from previous editions. Although the provisions in ASCE 19 are dated, they are the only ones available and there was no sentiment to eliminate them from the *Provisions*. The allowable stress levels of steel cable structures specified in ASCE 19 are modified for seismic load effects. The value of $1.5T_4$ was chosen as a reasonable value to compare with increases given to other working stress levels.

REFERENCES:

Serette. 1996. *Shear Wall Values for Light Weight Steel Framing.* American Iron and Steel Institute.