Seismic Provisions for Structural Steel Buildings (1997) Supplement No. 1

February 15, 1999

AMERICAN INSTITUTE OF STEEL CONSTRUCTION

Seismic Provisions for Structural Steel Buildings (1997) Supplement No. 1

February 15, 1999

1. **Part I Glossary**
   Change definition of Reduced Beam Section as follows:
   "A reduction in cross-section . . . <remainder unchanged>"

2. **Section 2**
   Add ASTM A992-98 under American Society for Testing & Materials.

3. **Section 6.1**
   Add ASTM A992 to the list of material specifications that are approved for use in the Seismic Force Resisting System.

4. **Section 7.3b**
   Change language as follows:
   "All ~~complete-joint-penetration groove~~ welds used in primary members and connections in the Seismic Force Resisting System shall be made with a filler metal that has a minimum ~~CVN~~ Charpy V-notch toughness of 20 ft-lbs at minus 20 degrees F, as determined by AWS classification or manufacturer certification. This requirement . . . <remainder unchanged>"

5. **Section 9.2a**
   Add the following sentence at the end of the last paragraph:
   "Columns and connection elements with a tested yield strength that is more than 15 percent above or below F_{ye} shall not be used in qualification testing."

6. **Section 9.3a**
   Change the second sentence as follows:

"R_u need not exceed the shear force determined from 0.8 times ΣM^*_{pb} of the beams framing to the column flanges at the connection.

7. Section 9.6

Change definition of ΣM^*_{pb} as follows:

"The sum of the moment(s) in the beam(s) at the intersection of the beam and column centerlines. ΣM^*_{pb} is determined by summing the projections of the expected beam flexural strength(s) . . . "

8. Section 13.2d

Change language as follows:

"Width-thickness Ratios: Width-thickness ratios of stiffened and unstiffened compression elements of braces shall meet the compactness requirements in LRFD Specification Table B5.1 (i.e., $\lambda < \lambda_p$) and the following requirements:

1. ~~Braced shall be compact (i.e., $\lambda < \lambda_p$) .~~ The width-thickness ratio of angles shall not exceed $52/\sqrt{F_y}$
2. I-shaped members and channels used as braces shall comply with λ_p in Table I-9-1.
3. Round HSS shall have… <remainder unchanged>"

9. Section 16

Add the following sentence at the end of the Section:

"When welds from web doubler plates or continuity plates occur in the "k-area" of rolled steel columns, the "k-area" adjacent to the welds shall be inspected after fabrication, as required by the Engineer of Record, using approved nondestructive methods conforming to AWS D1.1."

10. Section S3

Add the following definition:

"*Complete Loading Cycle.* A cycle of rotation taken from zero force to zero force, including one positive and one negative peak."

11. Section S5.5

Change #2 as follows:

"The yield stress of the beam shall not be more than 15 percent below F_{ye} for the grade of steel to be used for the corresponding elements of the Prototype. Columns and connection elements with a tested yield stress shall not be more than 15 percent above or below F_{ye} for the grade of steel to be used for the corresponding elements of the Prototype. F_{ye} shall be determined in accordance with Section 6.2."

12. Part II, Section 6.5c

Change Equation 6-3 as follows:

$$b\sqrt{F_y\ /(2E_s)}$$

13. Commentary Section CS6

Add the following paragraph:

"As an alternative to the loading sequence specified in Section S6.3, the SAC loading protocol (SAC, 1997) is considered acceptable. The control variable in this protocol is total drift, whereas that in Section S6.3 is the plastic rotation.

14. Commentary Section 9.2a

Add the following paragraph:

"Limitations are placed on permissible differences between the tested yield strength and F_{ye} for beams, columns and connection elements. It is not intended that these limitations be applied retroactively to the existing database of qualification tests. Rather, these requirements are intended to apply for use in new qualification testing."

15. Commentary Section C9.3

Change the first paragraph on page 72 as follows:

"Web doubler plates may extend between top and bottom continuity plates that are welded directly to the column web and web doubler plate or they may extend above and below top and bottom continuity plates that are welded to the doubler plate only. In the former case, the welded joint connecting the continuity plate to the column web and web doubler plate is required to be configured to transmit the proportionate force from the continuity plate to each element of the panel-zone. In the latter case, the welded joint connecting the continuity plate to the web doubler plate is required to be sized to transmit the force from the continuity plate to the web doubler plate and the web doubler plate thickness ~~and welding~~ is required to be selected to transmit this same force; minimum-size fillet welds per LRFD Specification Table J2.4 are used to connect along the column-web edges."

16. Commentary Section C13.1

Modify the fourth full paragraph on page 84 as follows:

For brace buckling out of the plane of single plate gussets, weak-axis bending in the gusset is induced by member end rotations. This results in flexible end conditions with plastic hinges at midspan in addition to the hinges that form in the gusset plate. Satisfactory performance can be ensured by allowing the gusset plate to develop restraint-free plastic rotations. This requires that the free length between the end of the brace and the assumed line of restraint for the gusset be sufficiently long to permit plastic rotations, yet short enough to preclude the occurrence of plate buckling prior to member buckling. A length of two times the plate thickness is recommended (Astaneh et al., 1986). Note that this free distance is measured from the end of the brace to a line that is perpendicular to the brace centerline, drawn from the point on the gusset plate nearest to the brace end that is constrained from out-of-plane rotation. See Figure C-13.2. Alternatively, connections with stiffness in two directions, such as crossed gusset plates, can be detailed. Test results indicate that forcing the plastic hinge to occur in the brace rather than the connection plate results in greater energy dissipation capacity (Lee and Goel, 1987).

17. Commentary Figure C-13.2

Replace the existing Figure C-13.2 with the attached Figure C-13.2.

18. Commentary Section C13.2a.

Change the third sentence as follows:

“Tang and Goel (1989) and Goel and Lee (1992) showed that the post-buckling cyclic fracture life of bracing members generally increases ~~decreases~~ with an increase in slenderness ratio.”

19. Commentary Section C13.3c.

Change the third sentence as follows:

“Testing has demonstrated that where a single gusset plate connection is used, the rotations can be accommodated as long as the brace end is separated by at least two times the gusset thickness from a line perpendicular to the brace axis about which the gusset plate may bend unrestrained by the beam, column, or other brace joints (Astaneh et al., 1986)."

20. Commentary Section C13.3c.

Add the following at the end of the first paragraph:

"More information on seismic design of gusset plates can be obtained from Astaneh (1998)."

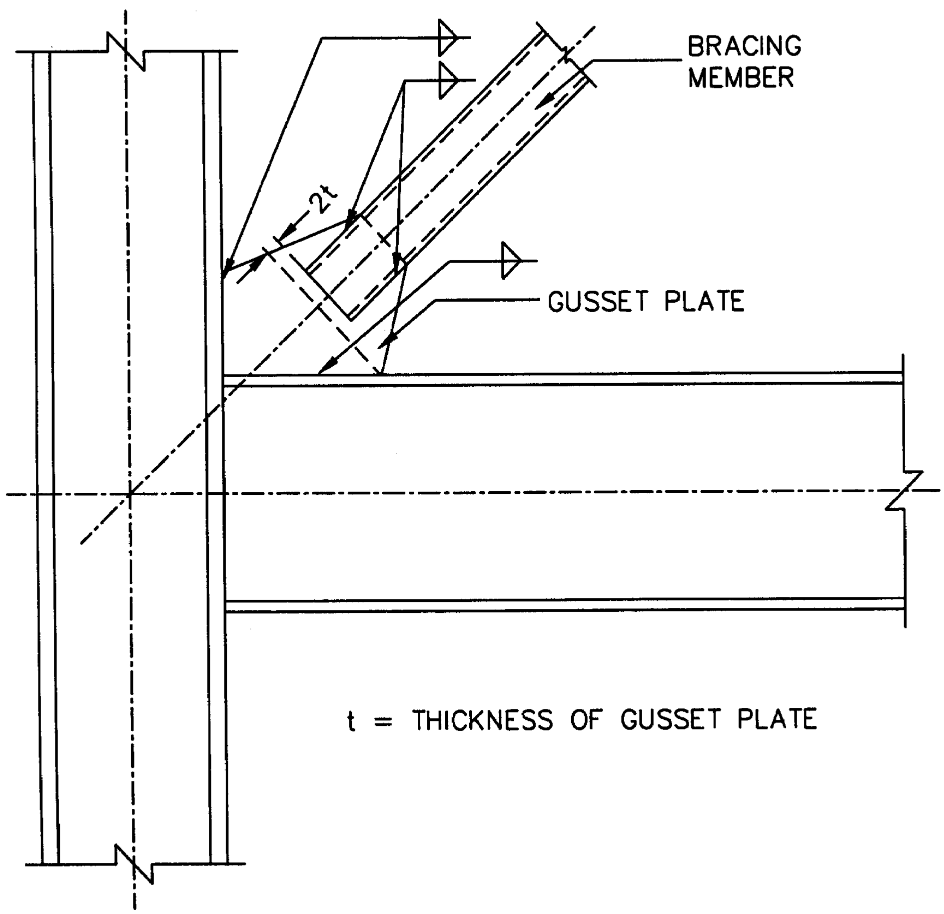

Fig. C-13.2. Brace-to-gusset plate requirement for buckling out-of-plane bracing system.

21. Commentary Section C16.

Add the following paragraph:

"Commentary Section C6.3 indicates that the k-area of rotary-straightened wide-flange columns may have reduced notch toughness. Preliminary recommendations (AISC, 1997) discouraged the placement of welds in this area due to the susceptibility to post-weld cracking that has occurred on past projects. Where such welds are to be placed, it is deemed necessary to perform inspections to verify that such cracking has not occurred. Typically, such inspections would incorporate magnetic particle or dye penetrant testing with acceptance criteria as specified in AWS D1.1. The required frequency of such inspections should be specified in the contract documents."

22. Commentary Section CS6

Add the following paragraph:

"As an alternative to the loading sequence specified in Section S6.3, the SAC loading protocol (SAC, 1997) is considered acceptable. It should be noted that the control variable in the SAC protocol is total drift, rather than plastic rotation as is used in Section S6.3. Modification of the acceptance criteria will be required in order to account for the elastic portion of the specimen displacements. Also, for structures located in the near field to causative faults, as defined in ICBO (1997a), loading sequences that focus on the response to near-field ground motions are permitted to be used in lieu of the Basic Loading Sequence. SAC has generated such a loading sequence based upon extensive nonlinear building analyses."

23. References

Add the following reference:

Astaneh, A., 1998, "Seismic Behavior and Design of Gusset Plates for Braced Frames," *Steel Tips*, Structural Steel Education Council, Moraga, CA.

24. References

Add the following reference:

SAC, 1997, SAC/BD-97/02 Version 1.1, "Protocol for Fabrication, Inspection, Testing, and Documentation of Beam-Column

Connection Test and Other Specimens," SAC Joint Venture, Sacramento, CA.

25. References

Change the reference Schneider (1998) as follows:

Schneider, S.P., 1998, "Axially Loaded Concrete-Filled Tubes," *Journal of Structural Engineering*, Vol. 124, No. 10, pp. 1125-1138, ASCE, Reston, VA.

NOTES

NOTES

American Institute of Steel Construction, Inc.
One East Wacker Drive, Suite 3100
Chicago, IL 60601-2001

Pub. No. S341s (5M699)