RESEARCH*Note*
on Cold-Formed Steel

Testing and Establishing Design Values for Slip Clips

By
Roger LaBoube, P.E., Ph.D.
University of Missouri/Rolla

- **Test Method**
- **Allowable Load Ratings**
- **Commentary on the Serviceability Design Limit**

Introduction and Scope

Slip clips are used to transfer wind loads from wall systems composed of cold-formed steel studs to the primary frame of a building. In addition to providing load transfer, the slip clip enables relative vertical movement between the steel stud wall system and the primary frame of the building.

This standard provides a procedure for evaluating slip clips used for wall-to-primary frame structural connections. Such connections enable the relative movement of the wall system and the sructural member. The standard also describes test methods used to determine the positive and negative wind load capacities of the slip clip, and considers both strength and serviceablility capacities. A method of assigning design loads to slip clips based on the measured load capacities is also provided.

Test Method

1.0 Summary of Test Method

1.1 The test specimen shall consist of a slip clip attached of a length of cold-formed steel C-section (stud member). Using a suitable test machine, a simulated wind positive and negative load application is applied. During the test, applied load and corresponding deflection of the clip is recorded to provide load-deflection data.

2.0 Apparatus

2.1 Testing Machine – A testing machine that is capable of operation at a constant rate of motion of the movable crosshead or a constant rate of loading and a measuring device that is calibrated in accordance with Method E4.

3.0 Materials

3.1 Steel – All steel materials shall have a specified minimum yield strength and a specified minimum ultimate strength as determined by ASTM E 370.

4.0 Sampling

4.1 Sampling should provide a selection of representative test material on an objective and unbiased basis.

4.2 As a minimum, a series of three identical tests shall be performed for each combination of variables that affect the performance of the slip clip, provided the deviation of any individual test result from the average value obtained from all tests does not exceed ± 15 percent. If such deviation from the average value exceeds 15 percent, more tests of the same kind shall be made until the deviation of any individual test result does not exceed ± 15 percent, or until at least three additional tests have been made.

5.0 Test Specimens

5.1 The test specimen may consist of an individual slip clip attached to a short

LGSEA

Light Gauge Steel Engineers Association

October 2002

stud section, or a slip clip attached to a simply supported stud section. All components of the test must be representative of field installations.

5.2 When a short stud section is used, the test specimen shall consist of an assembly of a slip clip attached to supporting stud section. The stud section shall be a minimum length of 12 inches.

5.3 When the test specimen consists of a simple span beam, the stud section shall have a length of at least 18 in.

5.4 For slip clips not readily adaptable to such assemblies, an alternate assembly producing comparable results may be used.

6.0 Procedure

6.1 The specimen shall be loaded such that the load is applied with reference to the intended application of the slip clip.

6.2 An initial load, or preload, is permitted to be applied to the slip clip to seat the assembly. This preload shall not exceed 20 percent of the expected ultimate load.

6.3 The slip clip is to be evaluated at the intended service load to ensure functionality of the slip clip. The slip clip must enable relative movement between the slip clip and the stud section perpendicular to the direction of the load application.

6.4 Load-deflection characteristics of the slip clip shall be determined. The deflection in question is the relative movement between the slip clip and the supporting structural member in the direction of the applied load. Deflections are to be recorded to the nearest 0.001 inch at a sufficient number of load levels to permit the establishment of a load-deflection curve. At least eight readings shall be taken prior to reaching 1/8 in. of deflection.

6.3 The speed of testing as determined by the rate of separation of the testing machine heads shall be limited to greater of 0.05 in. per minute, or the rate caused by a loading rate of 500 pounds per minute.

6.4 Determine the mechanical properties of the steel in accordance with ASTM A 370.

7.0 Report

7.1 The test report shall contain the following:

7.1.1 A description of the slip clip tested including a sketch or drawing of the slip clip showing the pertinent dimensions and material specifications.

7.1.2 A description of the specimens including the following items.

7.1.2.1 A description of the slip clip, including actual dimensions.

7.1.2.2 A description of the mechanical properties of the steel, including the measured yield stress, tensile strength, and uncoated material thickness.

7.1.3 Data on both the service load and ultimate load observed.

7.1.4 Type and location of failure and a description of the general behavior of the specimen.

8.0 Allowable Load Ratings

8.1 Design loads for a slip clip shall be defined by the design limit of the wall system's structural members (studs).

8.2 Strength Design Limit

8.2.1 When the wall structural members are governed by a strength design limit, the design load of the clip is to be taken as the tested ultimate load divided by a factor of safety for Allowable Stress Design or multiplied by a phi factor for Load and Resistance Factor Design. The factor of safety or phi factor is prescribed by Section F1 of the *Specification for the Design of Cold-Formed Steel Structural Members*.

8.3 Serviceability Design Limit

When the wall structural members are governed by deflection, the design load of the slip clip shall be determined as follows:

8.3.1 When three tests are made, the load capacity rating shall be the average ultimate load divided by a factor of safety for Allowable Stress Design or multiplied by a phi factor for Load and Resistance Factor Design. The factor of safety or the phi factor is prescribed by Section F1 of the *Specification for the Design of Cold-Formed Steel Structural Members*. However, no such load capacity rating shall be greater than the average load at which the vertical deflection of the clip is 1/8 in.

8.3.2 When six or more tests are made and the wall structural member's deflection limit is greater than or equal to span/600, the clip's load capacity rating shall be the average test load at which the deflection of the clip in the direction of loading is 1/8 in.

8.3.3 When six or more tests are made and the wall structural member's deflection limit, d, is less than span/600, the clip's load capacity rating shall be the average test load at which the vertical deflection of the clip is 1/8 in. multiplied by (d/L/600).

Commentary on the Serviceability Design Limit (Section 8.3, above):

Criteria based on the number of tests are pattern after ICBO Evaluation Services' "Acceptance Criteria for Joist Hangers and Similar Devices.

Wall system design is commonly deflection controlled. Therefore, the deflection limit of 1/8 inch for the slip clip parallel to the application of the load is intended to ensure that the clip will not interfere with the performance of the wall system. The provisions of Section 11.3 in this Research Note are based on a wall stud deflection limit of span/600.

As the span of the stud decreases, the deflection limit approaches the clip test limit of 1/8 inch. For example, if the span is 12 ft., the deflection limit is 0.24 in. (12'x12/600). The margin between stud deflection and clip deflection is 1.92 (0.24"/0.125"). This margin may be construed as a design factor of safety.

As the deflection limit becomes more stringent, i.e. less than span/600, the design factor of safety will decrease. To maintain an appropriate factor of safety, Section 11.3.2 reduces the clip's design load capacity by imposing the reduction factor d/L/600. For example, if the stud deflection limit is span/1000 for a span of 12 ft., the reduction factor would be 0.60 (0.144"/0.24").

References

1. ASTM Standards
   E 4 Practices for Load Verification of Testing Machines

   A 370 Standard Test Methods and Definitions for Mechanical Testing of Steel Products

2. Other Standards
   Specification for the Design of Cold-Formed Steel Structural Members, 1996, American Iron and Steel Institute, Washington, D.C.

   Test Methods for Mechanically Fastened Cold-Formed Steel Connections, *Cold-Formed Steel Design Manual*, 1996, American Iron and Steel Institute, Washington, D.C.

   Acceptance Criteria for Joist Hangers and Similar Devices (AC 13), 2001, ICBO Evaluation Service, Inc., Whittier, CA