Structural Testing of the Telling Industries, LLC True-Bridge Clip

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Structural Testing of the Telling Industries, LLC True-Bridge Clip

1 Introduction

Telling Industries produces a line of cold-formed steel framing members and related components including the True-Bridge Clips. These clips are used as connect lateral bridging to studs. The connections are made with self-drilling screws through the pre-drilled holes in the clip. The photograph in Figure 1-1 shows the True-Bridge Terminating and Joining Clips.

Figure 1-1: Photograph of the True-Bridge Clips

2 Objective

The objective of the work described in this report was to test combinations of the True-Bridge clips attached to different sizes of streel studs. The clips were subjected to lateral and rotational loading. These test results can be used to determine allowable loads for these connectors to be used in an engineered design.

3 Scope

A test matrix was determined based on providing a representative number of tests covering the range of products offered. Listed in Table 3-1 is the test matrix.

Table 3-1: Test Matrix

Clip Type	Stud Size	Stud Thickness (mils)
True-Bridge 18 ga.	362S162	68
		97
	600S162	68
		97

4 Test Set-Up and Procedures

4.1 Test Standard

The test procedure used was developed by Telling based on industry practice for similar types of connectors.

4.2 Test Set-up

The photograph in Figure 4-1 shows the lateral loading set-up. The bridging channel was connected to a 4 ft. length of stud through the punch-out using the True-Bridge clip. The lateral load was applied with an actuator and measured with a load cell position between the actuator and the channel. The lateral deflection of the bridging channel relative to the stud was measured periodically using a digital caliper.

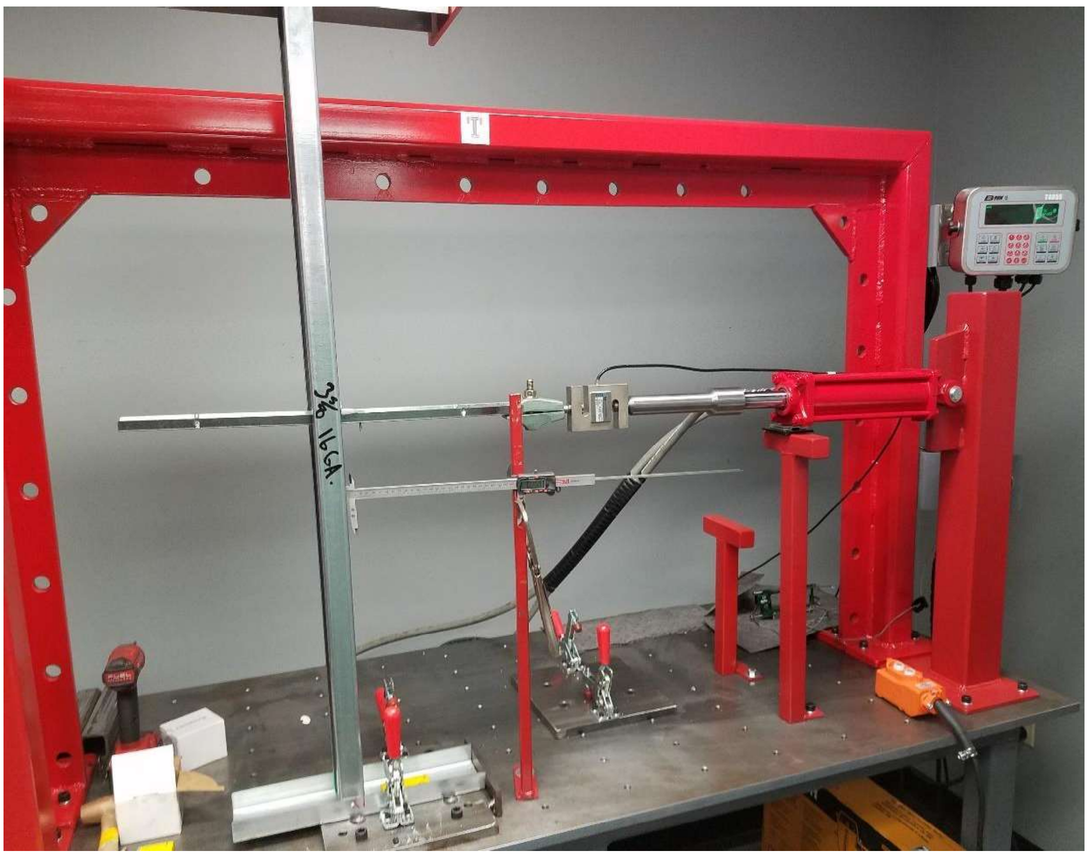

Figure 4-1: Photograph Lateral Loading Test Set-Up

The photograph in Figure 4-2 shows the rotational loading set-up. The bridging channel was connected to a 4 ft. length of stud through the punch-out using the True-Bridge clip. The rotational load was applied with an actuator pushing on both ends of the channel. The load was measured with a load cell positioned between each actuator and the channel. The deflection of the channel relative to the stud was measured using a displacement transducer attached to each end of the channel. The loads were applied to the channel 8 in. away from the stud. The deflections were measured at the point of load application by displacement transducers.

Figure 4-2: Photograph of the Rotational Loading Test Set-Up

5 Test Results and Analysis

5.1 Test Results

The plots of the rotational load tests are given in Figures 5-1 and 5-2 for the 362S162 and 600S162 stud sizes respectively. The plots of the lateral load tests are given in Figures 5-3 and 5-4 for the 362S162 and 600S162 stud sizes respectively.

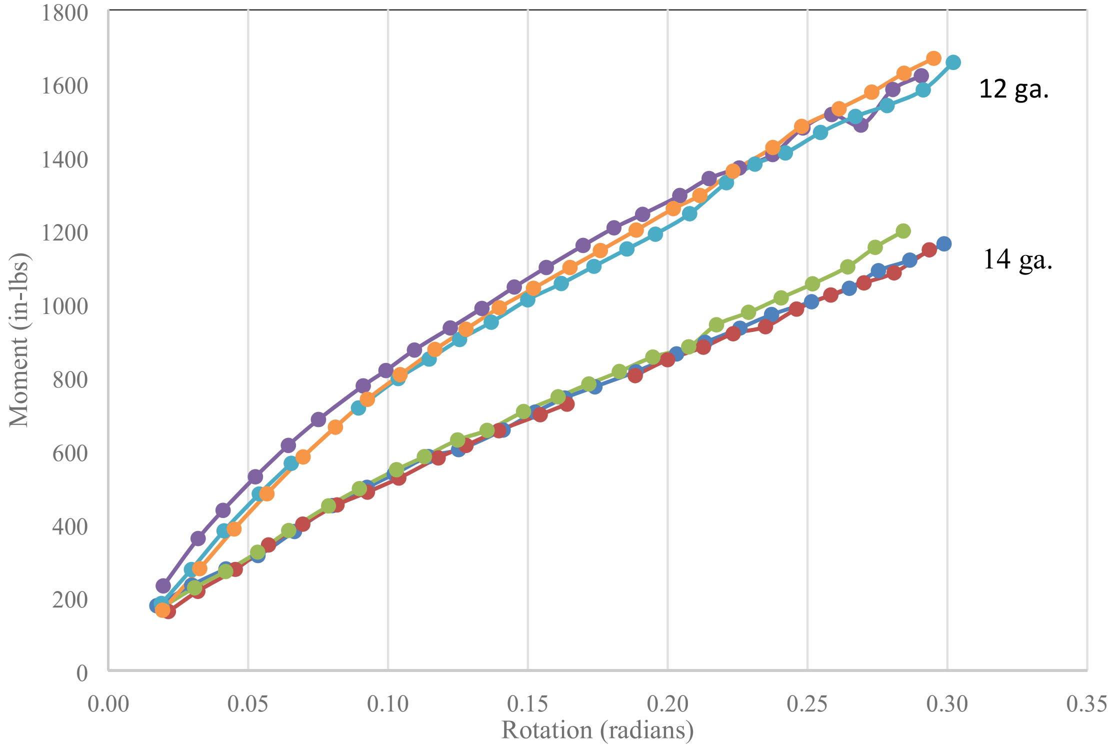

Figure 5-1: Rotational Loading Plots for 362S162 Studs

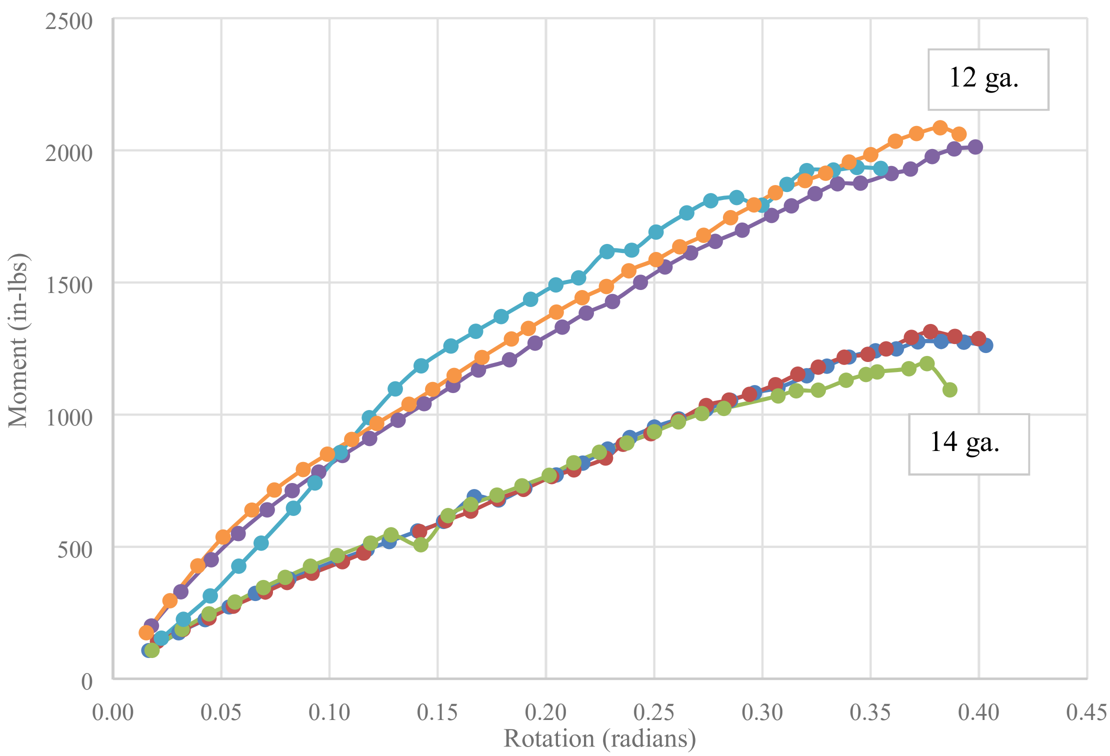

Figure 5-2: Rotational Loading Plots for 600S162 Studs

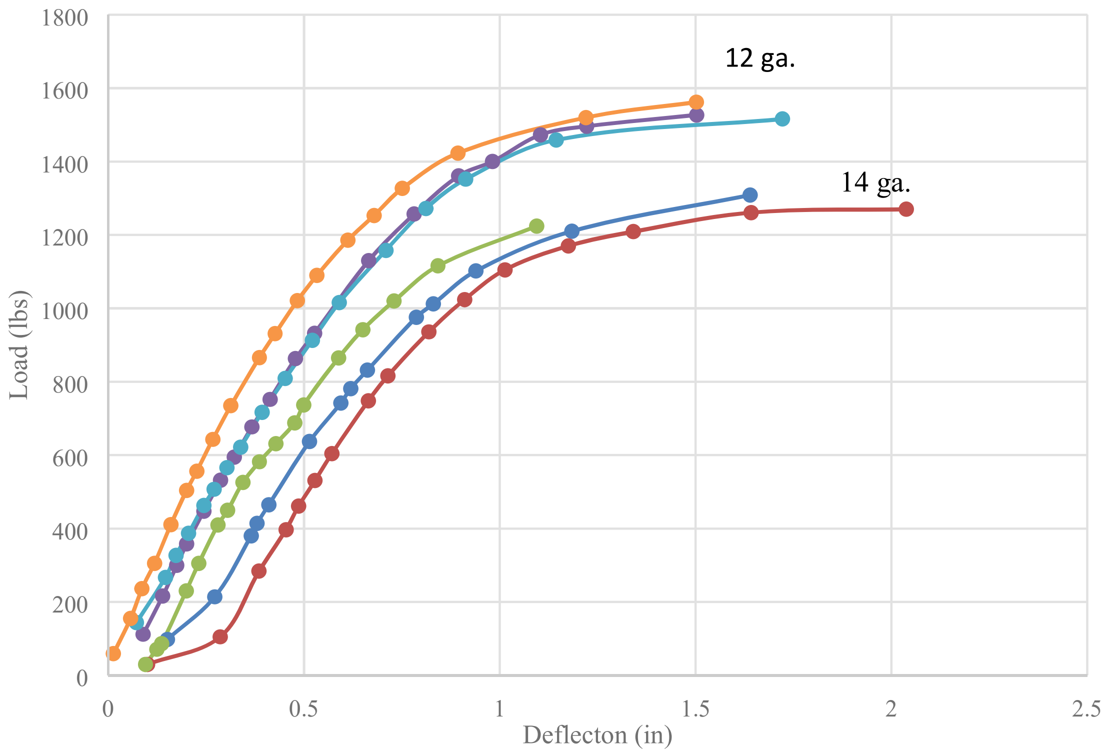

Figure 5-3: Lateral Loading Plots for 362S162 Studs

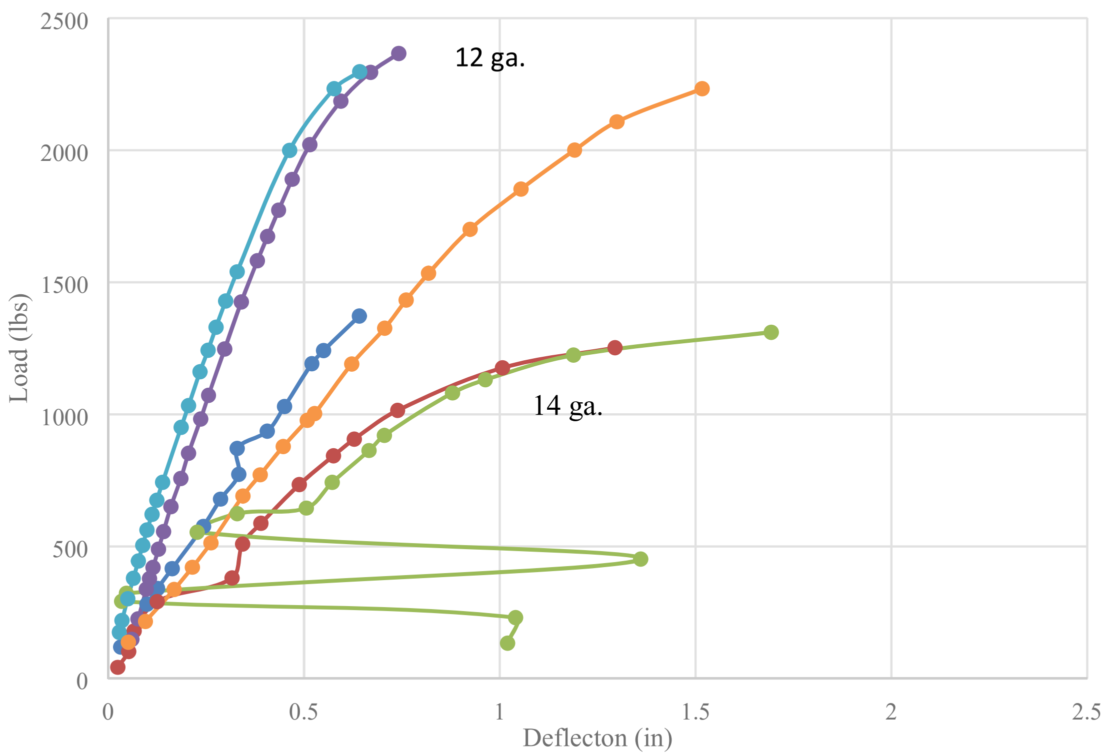

Figure 5-4: : Lateral Loading Plots for 600S162 Studs

5.2 Calculation of the Safety Factor

The tested strengths are required to be reduced by a safety factor, Ω, determined in accordance with the provisions of AISI S100 using the statistical parameters based on "Other Connections and Fasteners". The first step is to determine the resistance factor using Eq. 5-1 reproduced from S100.

$$\phi = C_\phi (M_m F_m P_m) e^{-\beta_o \sqrt{V_M^2 + V_F^2 + C_P V_P^2 + V_Q^2}} \qquad \text{Eq. 5-1}$$

where,

C_φ = 1.52
M_m = 1.0
F_m = 1.0
P_m = 1.0
β_0 = 2.5
V_M = 0.10
V_F = 0.05
C_P = $(1 + 1/n)m/(m-2)$ for $n \geq 4$
n = number of tests
m = degrees of freedom = n-1
V_P = COV of test results ≥ 0.065
V_Q = 0.21

Once the resistance factor is determined using Eq. 5-1, the corresponding safety factor is calculated as follows:

$$\Omega = 1.6/\varphi \qquad \text{Eq. 5-2}$$

6 Allowable Loads

6.1 Allowable Loads and Stiffness for Rotational Loading

The allowable rotational loads for the 18-gauge True-Bridge clip connecting a 16-gauge bridging channel to the various stud sizes are given in Table 6-1. The rotational stiffnesses for these same connections are given in Table 6-2. The stiffness is calculated based on the average of deflection divided by the load for all data points shown in Figures 5-1 and 5-2.

Table 6-1: Allowable Rotational Loads

CFS Member	Ultimate Moment (in-lbs)				COV	Ω	Allowable (in-lbs)
	Test #1	Test #2	Test #3	Average			
362S162-68	1197	1146	1162	1168	0.022	2.141	**546**
362S162-97	1668	1656	1620	1648	0.015	2.141	**770**
600S162-68	1193	1314	1277	1261	0.049	2.141	**589**
600S162-97	2086	1936	2013	2011	0.037	2.141	**939**

Table 6-2: Rotational Stiffness

CFS Member	Stiffness (in-lbs/radian)			
	Test #1	Test #2	Test #3	Average
362S162-68	5112	4642	5043	**4932**
362S162-97	6990	6697	7230	**6972**
600S162-68	4029	4019	4030	**4026**
600S162-97	7327	7065	6900	**7097**

6.2 Allowable Loads and Stiffness for Lateral Loading

The allowable lateral loads for the 18-gauge True-Bridge clip connecting a 16-gauge bridging channel to the various stud sizes are given in Table 6-3. The lateral stiffnesses for these same connections are given in Table 6-4. The stiffness is calculated based on the deflection divided by the load at approximately 50% of the ultimate load.

Table 6-3: Allowable Lateral Loads

CFS Member	Ultimate Load (lbs)				COV	Ω	Allowable (lbs)
	Test #1	Test #2	Test #3	Average			
362S162-68	1224	1270	1309	1268	0.034	2.141	**592**
362S162-97	1562	1516	1527	1535	0.016	2.141	**717**
600S162-68	1311	1252	1372	1312	0.046	2.141	**613**
600S162-97	2233	2298	2367	2299	0.029	2.141	**1074**

Table 6-4: Lateral Stiffness

CFS Member	Stiffness (lbs/in) at 0.5 P_{ult}			
	Test #1	Test #2	Test #3	Average
362S162-68	1474	1058	1249	**1260**
362S162-97	2348	1824	1821	**1998**
600S162-68	1275	1505	2366[1]	**1390**
600S162-97	1915[1]	4962	4188	**4575**

1. These values were considered outliers and not included in the average.