

# **CALIBRATIONS OF BOLTED COLD-FORMED STEEL CONNECTIONS IN BEARING (WITH AND WITHOUT WASHERS)**

## **Final Report**

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1101 17<sup>th</sup> Street, NW  
Washington, DC 20036-4700**

**By**

**James A. Wallace  
*Research Assistant***

**Professor R. A. LaBoube  
and  
Professor R. M. Schuster  
*Project Directors***

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## **Abstract**

Contained in this report are the calibration results of single and double shear cold-formed steel bolted connections failing in bearing. Connections with and without washers were evaluated. The test data was compared with the current AISI Specification, the proposed AISI Specification ballot and S136 Standard methods for determining the bearing strength of cold-formed steel bolted connections. In addition, comparisons were made with a new proposed method resulting from this study. Calibrations were carried out in accordance with the AISI Commentary and Chapter F of the AISI Specification to establish the resistance factors for AISI and S136 and the respective factors of safety for AISI.

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## 1.0 Introduction

The bearing strength of bolted connections is treated differently in the two current North American Standards for the design of cold formed steel structural members (AISI-96 [1] and CSA S136-94 [2]), from hereon simply referred to as AISI [1] and S136 [2], respectively. In the case of S136 [2], only one expression is presented that applies to all bolted connections such as single and double shear, as well as, with and without washers. In AISI [1], however, a distinction is made between single shear and double shear connections and the use of washers. More specifically, the following two categories are presented, with and without washers:

- 1) Inside sheet of double shear connection and
- 2) Single shear and outside sheet of double shear connection.

Having recently carried out calibrations using the available bolted connection data found in the published literature, it was discovered that no data exists for the case of a double shear connection without washers where the outside sheets fail in bearing. Based on this, tests were carried out at the University of Waterloo to fill the gap in this category. It was also decided to test additional single shear specimens failing in bearing to add to the pool of existing data. As well, all of these tests were duplicated with washers in order to obtain a good comparison with the specimens without washers [3].

AISI [2] is currently considering a new design approach for bearing of bolted connections with washers and a ballot has been issued for consideration [4]. This design approach is similar to the current S136 [2] design approach.

Contained in this report are the calibration results of single and double shear cold formed steel bolted connections with and without washers that failed in bearing. The test data, contained in Appendix A, was compared with the current AISI and S136 methods for determining the bearing strength of a cold formed steel bolted connection. In addition, comparisons were made with the new bearing approach currently being considered by AISI [4] and with a proposed method resulting from this study. Calibrations were also carried out in accordance with the AISI Commentary and Chapter F of the AISI Specification to establish the resistance factors for AISI and S136 and the respective factors of safety for AISI. The factor of safety was calibrated in accordance with the procedure outlined in the AISI Commentary.

## 2.0 Bearing Strength Methods

### 2.1 Current AISI Approach (Section E3.3) [1]

Section E3.3 of AISI presents an approach similar to S136 to determine the nominal bearing strength. As in S136, AISI uses a similar formulation as Equation 2.1 to determine the nominal bearing strength. Unlike S136, AISI uses a table of nominal bearing strength expressions containing the bearing factor, which varies from 2.22 to 3.33. Summarized in Tables 1 and 2 are the AISI design provisions. The AISI method recognises that the use of washers does increase the bearing strength, however, the  $d/t$  ratio is not included in the expressions. The equations in Tables 1 and 2 give the nominal bearing strength per bolt.

**Table 1: Nominal Bearing Strength for Bolted Connections With Washers Under Both Bolt Head and Nut**

Thickness of Connected Part, $t$ in. (mm)	Type of Joint	$F_u/F_{sy}$ ratio of Connected Part	$\Omega$ ASD	$\phi$ LRFD	Nominal Strength $P_n$
$0.024 \leq t < 0.1875$ ( $0.61 \leq t < (4.76)$ )	Inside sheet of double shear connection	$\geq 1.08$	2.22	0.55	$3.33 F_u d t$
		$< 1.08$	2.22	0.65	$3.00 F_u d t$
	Single shear and outside sheets of double shear connection	No Limit	2.22	0.60	$3.00 F_u d t$
$t \geq 3/16$ $t \geq (4.76)$	See AISC ASD or LRFD Specifications				

**Table 2: Nominal Bearing Strength for Bolted Connections Without Washers Under Both Bolt Head and Nut, or With Only One Washer**

Thickness of Connected Part, t in. (mm)	Type of Joint	$F_u/F_{sy}$ ratio of Connected Part	$\Omega$ ASD	$\phi$ LRFD	Nominal Strength $P_n$
$0.036 \leq t < 0.1875$	Inside sheet of double shear connection	$\geq 1.08$	2.22	0.65	$3.00 F_u d t$
$(0.914) \leq t < (4.76)$	Single shear and outside sheets of double shear connection	$\geq 1.08$	2.22	0.70	$2.22 F_u d t$
$t \geq 3/16$ $t \geq (4.76)$	See AISC ASD or LRFD Specifications				

**2.2 Current S136 Approach (Clause 7.3.5.1) [2]**

Currently, the factored bearing resistance per bolt,  $B_r$ , is computed in accordance with Clause 7.3.5.1 of S136 (Equation 2.1). No differentiation is made between single and double shear bolted connections, with or without washers. The term,  $C$ , is the bearing factor, which is a function of the ratio of the nominal bolt diameter to the uncoated sheet thickness,  $d/t$ .

$$B_r = \phi_u C d t F_u \tag{2.1}$$

- Where
- $C$  = value from Table 1
  - $d$  = nominal bolt diameter
  - $t$  = uncoated sheet thickness
  - $F_u$  = tensile strength of sheet
  - $\phi_u$  = resistance factor (= 0.75)

Although it is recommended that a washer be used at the end of the fastener that is turned, the values of Table 3 also apply if washers are not used. The bearing resistance is independent of whether the thread or shank bears, or if the bolt is pretensioned.

**Table 3: Bearing Factor, C**

<b>Ratio of fastener diameter to member thickness, d/t</b>	<b>C</b>
$d/t < 10$	3
$10 \leq d/t \leq 15$	$30(t/d)$
$d/t > 15$	2

### 2.3 Proposed AISI Method (Ballot) [4]

The proposed AISI method for bearing in a bolted connection with washers is based on Equation 2.1. However, a linear transition function for the bearing factor, C, is proposed (Table 4). This new formulation of the bearing factor, C, is based on the research by Rogers and Hancock [5, 6]. A distinction between connections with washers and connections without washers would continue to be recognised. Reduced bearing capacity values would still result for connections without washers. The equation defines the bearing capacity per bolt.

**Table 4: Bearing Factor, C, for Bolted Connections With Washers**

<b>Ratio of fastener diameter to sheet thickness, d/t</b>	<b>C</b>
$d/t < 10$	3.0
$10 \leq d/t \leq 22$	$4 - 0.1(d/t)$
$d/t > 22$	1.8

For connections without washers, the design would be based on the current AISI approach (Table 2).



## 2.4 Proposed Method

It is proposed that a unified design method be adopted. The unified method uses the Rogers and Hancock concept for all bolted connections with or without washers. The nominal bearing strength is determined by the following expression:

$$P_n = C d t F_u \quad (2.2)$$

Where

- C = bearing factor as given in Tables 5, 6 and 7
- d = nominal bolt diameter
- t = uncoated sheet thickness
- F<sub>u</sub> = ultimate stress of sheet

### 2.4.1 Single Shear and Outside Sheets of Double Shear Connection With Washers

Using the data of Table B1 of Appendix B, the bearing factor, C, was established and is summarized in Table 5. These values are as proposed by Rogers and Hancock (Table 4). The data used was based on the identification of a bearing failure by the researcher(s), by itself or in combination with other possible failure modes.

**Table 5: Bearing Factor, C, for Single Shear and Outside Sheets of Double Shear Bolted Connection With Washers**

<b>Ratio of fastener diameter to sheet thickness, d/t</b>	<b>C</b>
d/t < 10	3.0
10 ≤ d/t ≤ 22	4 – 0.1(d/t)
d/t > 22	1.80

### 2.4.2 Single Shear and outside Sheets of Double Shear Connection Without Washers

Using the data of Table B2 of Appendix B, the bearing factor, C, was established and is summarized in Table 6. The C values of Table 6 indicate a 25% reduction in connection capacity when washers are not used. That is, the C values in Table 6 are 75% of the C values listed in Table 5. Therefore, based on the data of Table B2, a reduction in bearing strength of 25% is being experienced when washers are not used in comparison to when washers are used. The data used was based on the identification of a bearing failure by the researcher(s), by itself or in combination with other possible failure modes.

**Table 6: Bearing Factor, C, for Single Shear and Outside Sheets of Double Shear Bolted Connection Without Washers**

<b>Ratio of fastener diameter to sheet thickness, d/t</b>	<b>C</b>
d/t < 10	2.25
10 ≤ d/t ≤ 22	3 – 0.75(d/t)
d/t > 22	1.35

**2.4.3 Inside Sheet of Double Shear Connection With or Without Washers**

Using the data of Table B3 of Appendix B, the bearing factor, C, was established and is summarized in Table 7. The only data used was based on the identification of a bearing failure by the researcher(s). The Table 5 C values for the case of single shear and outside sheets of double shear connections with washers with the results of Table 7, it can be concluded that the values in Table 7 are 33% larger than those of Table 5. This is due to the fact that the inner sheet of a double shear connection is completely contained, i.e., the sheet can not curl outward as is the case with the outside sheets failing in bearing of a double shear connection.

**Table 7: Bearing Factor, C, for Inside Sheet of Double Shear Bolted Connection With or Without Washers**

<b>Ratio of fastener diameter to sheet thickness, d/t</b>	<b>C</b>
d/t < 10	4.0
10 ≤ d/t ≤ 22	5.3 – 0.133(d/t)
d/t > 22	2.4

### 3.0 Comparison of the Various Methods

#### 3.1 Comparisons

Summarised in Tables 8, 9, and 10 are the comparison statistical results of the bearing design methods currently used by AISI, the proposed AISI ballot method and the proposed method (Section 2.4).

##### 3.1.1 Single Shear and Outside Sheets of Double Shear Connection With Washers

Summarised in Table 8 are the statistical results from Table C1 of Appendix C for single shear and outside sheets of double shear bolted connections with washers.

**Table 8: Comparisons of Single Shear and Outside Sheets of Double Shear Bolted Connection With Washers**

	Number of Specimens	Average $P_t/P_c$	Standard Deviation	Factor of Variation
AISI-96	289	0.879	0.212	0.241
S136-94	289	1.076	0.219	0.203
Proposed AISI Ballot Method	289	1.052	0.175	0.167

##### 3.1.2 Single Shear and Outside Sheets of Double Shear Connection Without Washers

Summarised in Table 9 are the statistical results from Table C2 of Appendix C for single shear and outside sheets of double shear bolted connections without washers.

**Table 9: Comparisons of Single Shear and Outside Sheets of Double Shear Bolted Connection Without Washers**

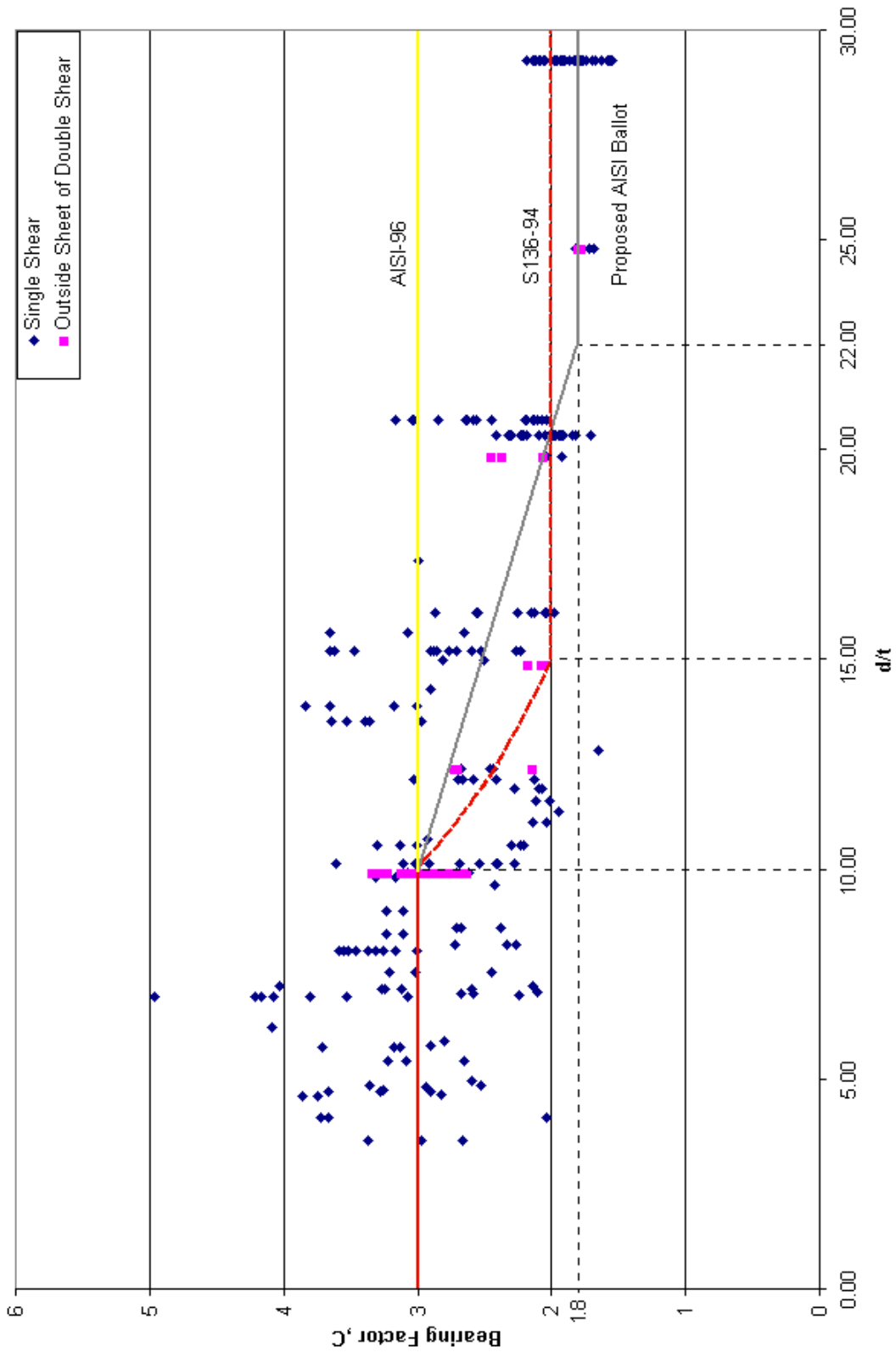
	Number of Specimens	Average $P_t/P_c$	Standard Deviation	Factor of Variation
AISI-96	123	0.965	0.182	0.188
S136-94	123	0.783	0.144	0.183
Proposed Method	123	1.012	0.153	0.151

### 3.1.3 Inside Sheet of Double Shear Connection With or Without Washers

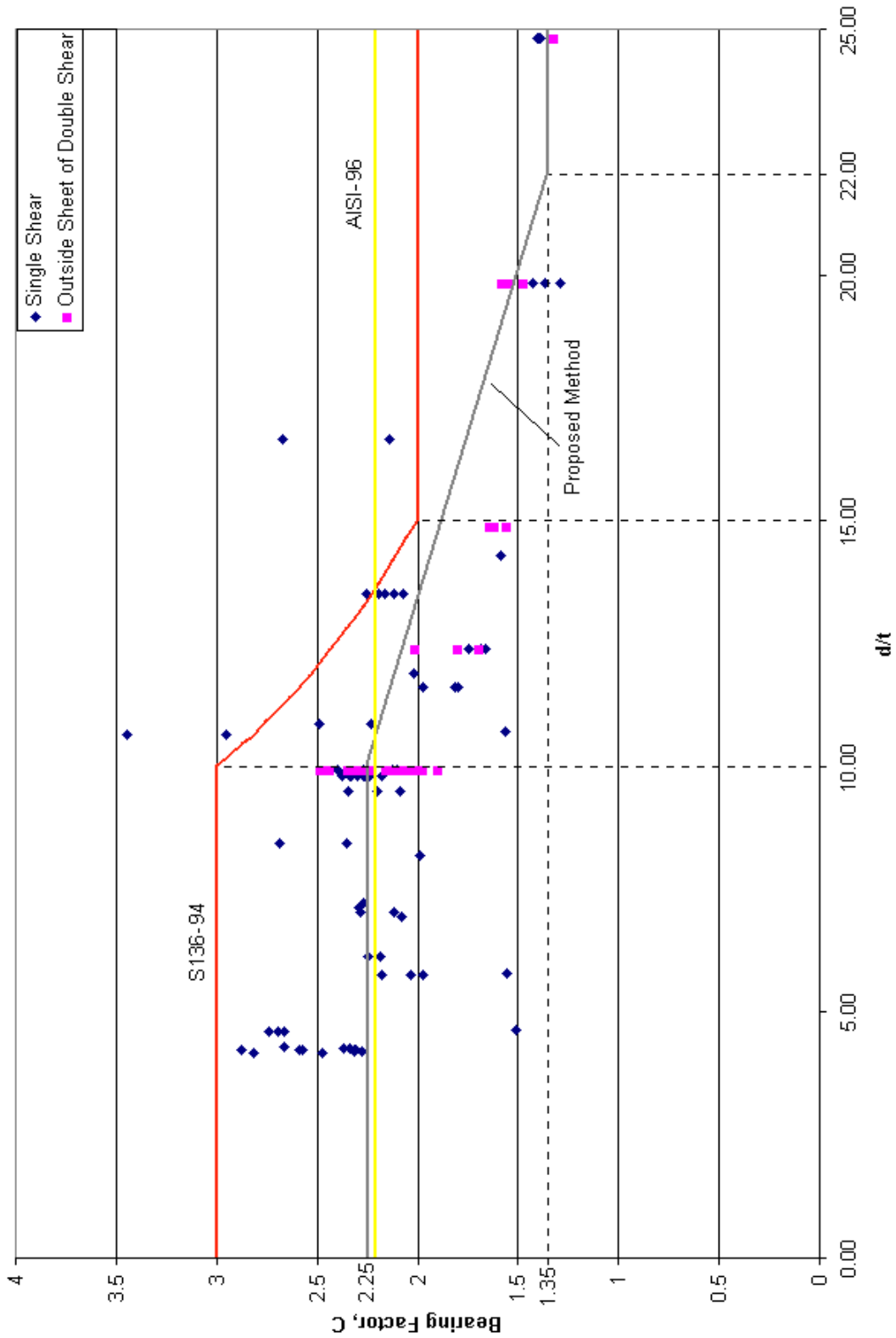
Summarised in Table 10 are the statistical results from Table C3 of Appendix C for inside sheet of double shear bolted connections with or without washers. The values under the proposed method in Table 10 are the values obtained by increasing the bearing factor values of Table 5 by 33%.

**Table 10: Comparisons of Inside Sheet of Double Shear Bolted Connection  
With or Without Washers**

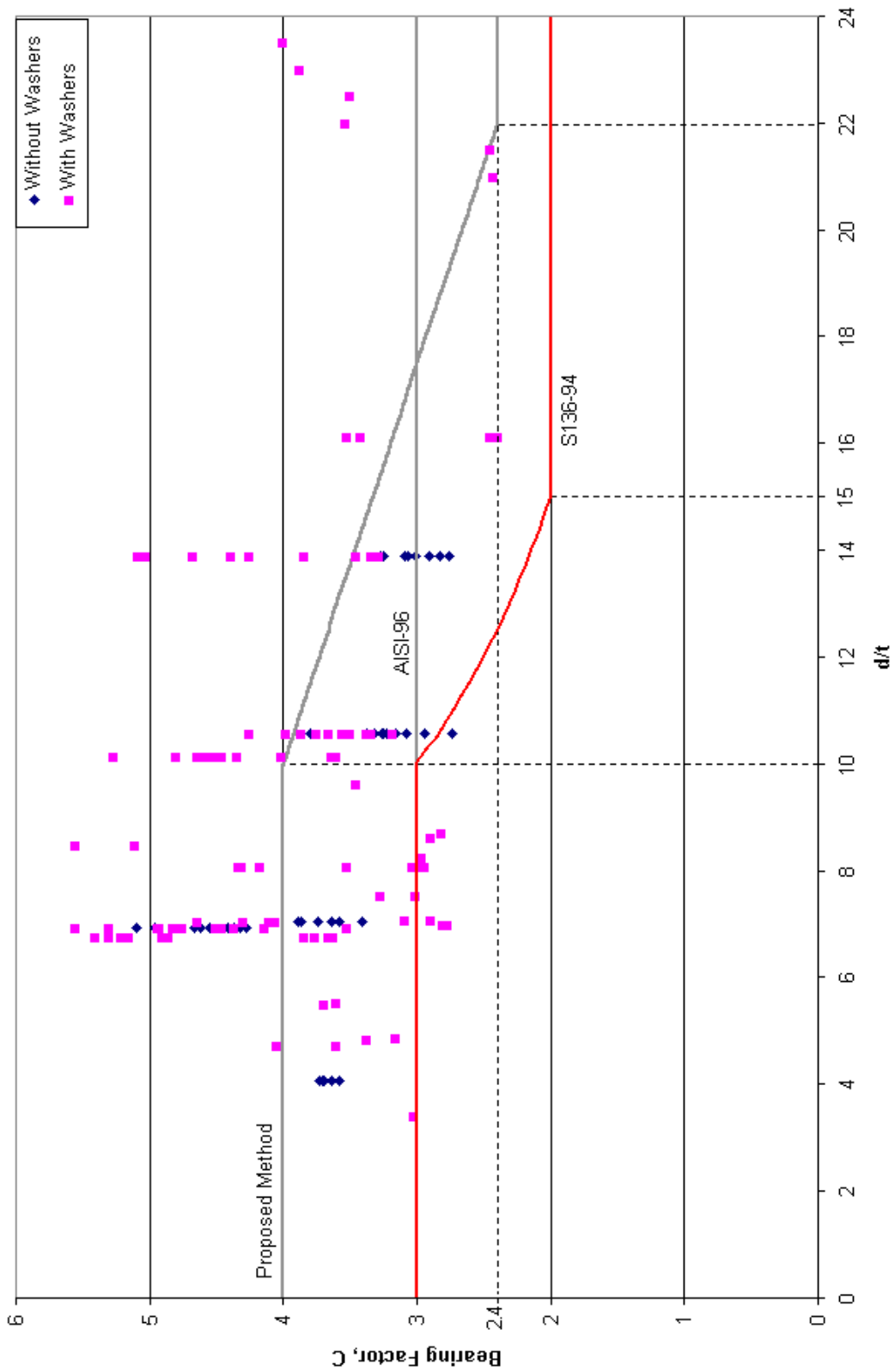
	Number of Specimens	Average $P_t/P_c$	Standard Deviation	Factor of Variation
AISI-96	130	1.283	0.254	0.198
S136-94	130	1.396	0.291	0.208
Proposed Method	130	1.001	0.189	0.188



**Figure 1: Bearing Factor,  $C$ , for Single Shear and Outside Sheets of Double Shear Bolted Connections [With Washers]**



**Figure 2: Bearing Factor,  $C$ , for Single Shear and Outside Sheets of Double Shear Bolted Connections [Without Washers]**



**Figure 3: Bearing Factor, C, for Inside Sheet of Double Shear Bolted Connections [With and Without Washers]**

### 3.2 Calibration

Resistance factors,  $\phi$ , are used with the LRFD design method in AISI [1] and the LSD design method in S136 [2] to reduce the nominal resistances. They are determined in conformance with load factors to provide a target reliability index,  $\beta$ , value of 3.5 according to the AISI [1] provisions and 4.0 for the S136 [2] provisions.

A satisfactory design can be obtained by equating the factored resistance to the factored loads:

$$\phi R_n = c(\alpha_D D_n + \alpha_L L_n) \quad (3.1)$$

Where  $R_n$  is the nominal resistance and  $\alpha_D$  and  $\alpha_L$  are the dead and live load factors, respectively, such that the load combinations are  $1.2D + 1.6L$  for AISI[1] and  $1.25D + 1.5L$  for S136 [2]. The dead to live load ratios,  $D/L$ , are  $1/5$  in AISI[1] and  $1/3$  in S136 [2].

Considering Equation (3.1), it can be shown that the resistance factors,  $\phi$ , can be determined as follows.

$$\text{For AISI} \quad \phi = \frac{1.521(P_m M_m F_m)}{e^{\beta \sqrt{V_R^2 + V_Q^2}}} \quad (3.2)$$

$$\text{For S136} \quad \phi = \frac{1.420(P_m M_m F_m)}{e^{\beta \sqrt{V_R^2 + V_Q^2}}} \quad (3.3)$$

Where:

$$V_R = \sqrt{V_P^2 + V_M^2 + V_F^2} \quad (3.4)$$

$$V_Q = \frac{\sqrt{(D_m V_D)^2 + (L_m V_L)^2}}{D_m + L_m} \quad (3.5)$$

- $P_m$  = mean ratio of experimental to calculated results
- $M_m$  = mean ration of actual yield point to minimum specified value
- $F_m$  = mean ratio of actual to specified section modulus
- $D_m$  = mean dead load intensity (=  $1.05 D_n^*$ )
- $L_m$  = mean live load intensity (=  $L_n^*$ )

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\* Values recommended by Hsiao et al. [9]



- $D_n$  = nominal dead load intensity
- $L_n$  = nominal live load intensity
- $V_P$  = Factor of variation of experimental to calculated results
- $V_M$  = Factor of variation reflecting material properties' uncertainties
- $V_F$  = Factor of variation reflecting geometric uncertainties
- $V_D$  = Factor of variation of the dead load intensities
- $V_L$  = Factor of variation of the live load intensities

Since the S136 Commentary [7] does not contain a detailed description and development of how to determine the resistance factors, it was decided to use the methodology outlined in the AISI Commentary [8]. Hence, the values of  $M_m = 1.10$ ,  $V_M = 0.08$ ,  $F_m = 1.00$ , and  $V_F = 0.05$  were adopted in this report and were taken from Table F1 – Statistical Data for the Determination of Resistance Factor in AISI [1].

By knowing the resistance factor,  $\phi$ , the corresponding factor of safety,  $\Omega$ , can be computed as follows:

$$\text{For AISI} \quad \Omega = \frac{1.2 \frac{D}{L} + 1.6}{\phi(\frac{D}{L} + 1)} = 1.533/\phi \quad (3.6)$$

Summarised in Table 11 are the statistical values used and the corresponding factors of safety,  $\Omega$ , and resistance factors,  $\phi$ , calculated for the given test data. Calibrations for S136 and AISI have only been performed for the proposed methods, with and without washers.

**Table 11: Resistance Factors and AISI Factors of Safety for Bolted Connections Failing in Bearing**

	Single Shear and Outside Sheets of Double Shear Connection							Inside Sheet of Double Shear Connection		
	With Washers				Without Washers			With or Without Washers		
	AISI 1996	S136 1994	Proposed Method	AISI 1996	S136 1994	Proposed Method	AISI 1996	S136 1994	Proposed Method	
Quantity	289	289	289	123	123	123	130	130	130	
Mean	0.879	1.076	1.052	0.965	0.783	1.012	1.283	1.396	1.001	
S.D.	0.212	0.219	0.175	0.182	0.144	0.153	0.254	0.291	0.189	
C.O.V.	0.241	0.203	0.167	0.188	0.183	0.151	0.198	0.208	0.188	
$M_m$	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	
$V_M$	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	
$F_m$	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
$P_m$	0.879	1.076	1.052	0.965	0.783	1.012	1.283	1.396	1.001	
$V_F$	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
$m$	288	288	288	122	122	122	129	129	129	
$C_P$	1.01	1.01	1.01	1.02	1.02	1.02	1.02	1.02	1.02	
$\beta$ (AISI)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	
D/L (AISI)	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	
$V_Q$ (AISI)	0.207	0.207	0.207	0.207	0.207	0.207	0.207	0.207	0.207	
$\beta$ (S136)	4	4	4	4	4	4	4	4	4	
D/L (S136)	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	
$V_Q$ (S136)	0.187	0.187	0.187	0.187	0.187	0.187	0.187	0.187	0.187	
$\Omega$	3.33	2.48	2.34	2.67	3.25	2.35	2.05	1.93	2.57	
$\phi$	0.461	0.619	0.656	0.575	0.472	0.651	0.747	0.794	0.596	
$\phi$	0.383	0.523	0.563	0.489	0.402	0.563	0.633	0.670	0.507	
$\Omega$	3.34	2.48	2.34	2.68	3.27	2.36	2.06	1.94	2.58	
$\phi$	0.460	0.618	0.564	0.572	0.469	0.649	0.743	0.790	0.593	
$\phi$	0.381	0.522	0.562	0.486	0.400	0.560	0.629	0.665	0.504	
AISI	AISI									
Commentary	S136									
Chapter F of AISI Spec	AISI									

## 4.0 Conclusions and Recommendations

The proposed AISI ballot method for bolted connections in bearing with washers, based on the work by Rogers and Hancock [5 and 6], yielded good statistical results when compared to the available data (Appendix A).

The proposed method in Section 2.4 of this study for single shear and outside sheets of double shear bolted connections failing in bearing without washers resulted in better statistical predictions in comparison to the current AISI and S136 design methods. This was also true for the inside sheet of a double shear bolted connection failing in bearing, with or without washers.

Based on the findings of this study, it is recommended that both AISI and S136 adopt the proposed method of this report, which is summarised as follows.

$$P_n = C d t F_u$$

Where     d = nominal bolt diameter  
           t = uncoated sheet thickness  
           F<sub>u</sub> = ultimate stress of sheet

### **C = the bearing factor**

- i) For single shear and outside sheets of double shear bolted connections **with washers** the bearing factor values are given in the table below.

**Bearing Factor, C, for Single Shear and Outside Sheets of Double Shear Bolted Connection With Washers**

<b>Ratio of fastener diameter to sheet thickness, d/t</b>	<b>C</b>
d/t < 10	3.0
10 ≤ d/t ≤ 22	4 – 0.1(d/t)
d/t > 22	1.80

- ii) For single shear and outside sheets of double shear bolted connections **without washers** the bearing factor values in the above table are to be multiplied by **0.75**.
- iii) For inside sheets of double shear bolted connections **with or without washers** the values in the above table are to be multiplied by **1.33**.

## 5.0 References

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## Appendix A – Sources of Data

**Table A1: Data Reference Numbers**

Reference No.	Actual Reference
1	Carril, Jeffery L., LaBoube, Roger A., and Yu, Wei-Wen "Tensile and Bearing Capacities of Bolted Connections," First Summary Report, University of Missouri-Rolla, May 1994.
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## Appendix B – Geometric Properties and Test Loads

**Table B1: Geometric Properties and Test Loads of Single Shear and Outside Sheets of Double Shear Bolted Specimens With Washers**

Specimen Notation	Source	Double /Single Shear	Number of Bolts Used	t-1 (in.)	t-2 (in.)	d (in.)	h (in.)	s (in.)	e (in.)	e1 (in.)	F <sub>u</sub> (ksi)	P <sub>t</sub> (kip)
ay22-1	1	S	1	0.072	0.072	0.500	0.563	3.27	1.99	-	52.5	5.80
ay22-2	1	S	1	0.070	0.070	0.500	0.563	3.26	2.00	-	52.5	5.73
ay23-1	1	S	1	0.070	0.070	0.500	0.563	4.02	2.01	-	52.5	5.96
ay23-3	1	S	1	0.070	0.070	0.500	0.563	4.03	2.00	-	52.5	6.00
by13-1	1	S	2	0.042	0.042	0.500	0.563	4.00	2.01	-	55.8	4.85
by13-2	1	S	2	0.043	0.043	0.500	0.563	4.01	2.01	-	55.8	5.08
by13-3	1	S	2	0.044	0.044	0.500	0.563	4.01	2.01	-	55.8	4.79
ay12-1	1	S	1	0.042	0.042	0.500	0.563	3.24	2.00	-	55.8	2.45
ay12-2	1	S	1	0.043	0.043	0.500	0.563	3.24	2.00	-	55.8	2.42
by12-1	1	S	2	0.045	0.045	0.500	0.563	3.24	2.00	-	55.8	5.37
by12-2	1	S	2	0.045	0.045	0.500	0.563	3.24	2.00	-	55.8	5.13
by12-3	1	S	2	0.042	0.042	0.500	0.563	3.24	2.00	-	55.8	5.33
by22-1	1	S	2	0.071	0.071	0.500	0.563	3.27	2.00	-	52.5	9.63
by22-2	1	S	2	0.070	0.070	0.500	0.563	3.26	2.00	-	52.5	9.53
by22-3	1	S	2	0.070	0.070	0.500	0.563	3.27	2.00	-	52.5	9.53
20A41SS	3	S	1	0.036	0.036	0.250	0.281	4.00	1.13	-	41.8	1.87
14A43SS	3	S	1	0.080	0.080	0.500	0.563	4.00	2.25	-	43.4	7.10
12Y-L8	3	S	1	0.106	0.106	0.375	0.406	2.53	1.50	-	72.8	9.74
12Y-L9	3	S	1	0.106	0.106	0.500	0.563	3.41	1.75	-	72.8	14.15
12Y-L16	3	S	1	0.106	0.106	0.500	0.563	2.04	1.75	-	72.8	11.18
12Y-L18	3	S	1	0.106	0.106	0.750	0.813	3.04	2.65	-	72.8	12.16
20ZT12	3	S	1	0.038	0.038	0.188	0.219	2.08	0.66	-	99.8	1.85
20A24SS	3	S	1	0.036	0.036	0.625	0.688	4.00	1.56	-	41.8	2.82
IOE36SS	4	S	1	0.143	0.143	1.000	1.063	4.00	3.50	-	76.8	24.63
14E25SS	4	S	1	0.078	0.078	0.750	0.813	4.00	1.88	-	70.4	10.00
16FAXL17	5	S	1	0.062	0.062	0.500	0.563	5.00	1.75	-	45.9	4.28
12Y-L7	5	S	1	0.106	0.106	0.500	0.563	4.00	1.75	-	72.8	12.67
12Y-L11	5	S	1	0.106	0.106	0.375	0.406	2.00	1.49	-	72.8	8.59
12Y-L10	5	S	1	0.106	0.106	0.625	0.688	4.12	2.11	-	72.8	13.52
7Y-T5	5	S	1	0.183	0.183	0.750	0.813	3.00	1.75	-	91.3	25.53
16FAX-L16	5	S	1	0.062	0.062	0.500	0.563	2.50	1.75	-	45.9	4.80
12Y-L12	5	S	1	0.106	0.106	0.500	0.563	2.66	1.75	-	72.8	11.18
12Y-L15	5	S	1	0.106	0.106	0.375	0.406	1.52	1.50	-	72.8	7.71
7Y-L6	5	S	1	0.183	0.183	0.750	0.813	3.75	3.75	-	83.8	42.14
16FAX-L16	5	S	1	0.062	0.062	0.500	0.563	2.50	1.75	-	45.9	4.72
12Y-L12	5	S	1	0.104	0.104	0.500	0.563	2.66	1.75	-	72.8	11.12
12Y-L14	5	S	1	0.104	0.104	0.750	0.813	3.93	2.60	-	72.8	22.90
7Y-L6	5	S	1	0.183	0.183	0.750	0.813	3.75	3.75	-	83.1	42.47
20Z-T11	5	S	1	0.039	0.039	0.500	0.563	2.50	1.50	-	94.4	3.04
12Y-L18	5	S	1	0.104	0.104	0.750	0.813	3.04	2.65	-	72.4	12.10
SS2	6	S	1	0.116	0.116	0.875	0.938	8.00	3.06	-	49.4	16.09
SS2-1	6	S	1	0.116	0.116	0.875	0.938	8.00	3.06	-	49.4	12.31
SS3	6	S	1	0.116	0.116	0.875	0.938	8.00	4.40	-	49.4	15.15
SS5	6	S	1	0.116	0.116	1.000	1.063	8.00	3.50	-	49.4	15.53

**Table B1: Continued**

Specimen Notation	Source	Double /Single	Number of Bolts	t-1 (in.)	t-2 (in.)	d (in.)	h (in.)	s (in.)	e (in.)	e1 (in.)	F <sub>u</sub> (ksi)	P <sub>t</sub> (kip)
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		Shear	Used									
SS5-1	6	S	1	0.116	0.116	1.000	1.063	8.00	3.50	-	49.4	13.64
SS6	6	S	1	0.116	0.116	1.000	1.063	8.00	3.50	-	49.4	15.34
SS8	6	S	1	0.181	0.181	0.875	0.938	8.00	3.06	-	62.1	33.00
SS8-1	6	S	1	0.181	0.181	0.875	0.938	8.00	3.06	-	62.1	24.80
SS9	6	S	1	0.185	0.185	0.875	0.938	8.00	4.38	-	62.1	32.75
SS11	6	S	1	0.184	0.184	1.000	1.063	8.00	3.50	-	62.1	36.80
SS11-1	6	S	1	0.184	0.184	1.000	1.063	8.00	3.50	-	62.1	30.30
SS12	6	S	1	0.184	0.184	1.000	1.063	8.00	5.00	-	62.1	35.30
1	7	S	1	0.037	0.037	0.500	0.563	4.00	2.00	-	58.9	3.70
2	7	S	1	0.037	0.037	0.500	0.563	4.03	2.00	-	58.9	3.66
5	7	S	1	0.037	0.037	0.313	0.344	4.06	2.06	-	58.9	2.12
6	7	S	1	0.037	0.037	0.313	0.344	4.06	2.04	-	58.9	2.20
8	7	S	1	0.037	0.037	0.500	0.563	4.00	1.50	-	58.9	3.24
10	7	S	1	0.037	0.037	0.500	0.563	4.00	2.50	-	58.9	3.84
12	7	S	1	0.051	0.051	0.500	0.563	4.00	2.03	-	50.1	4.05
13	7	S	1	0.051	0.051	0.500	0.563	4.00	2.03	-	50.1	4.23
21	7	S	1	0.061	0.061	0.500	0.563	4.03	1.03	-	74.1	5.28
22	7	S	1	0.061	0.061	0.500	0.563	4.06	1.03	-	74.1	5.12
23	7	S	2	0.061	0.061	0.500	0.563	2.03	1.94	-	74.1	12.30
11	7	S	1	0.037	0.037	0.500	0.563	3.00	2.00	-	58.9	3.97
B-1-15-1-O-SS	8	S	1	0.036	0.036	0.250	0.281	2.47	0.88	-	48.9	1.55
B-1-15-2-O-SS	8	S	1	0.036	0.036	0.250	0.281	2.47	0.88	-	48.9	1.55
B-1-15-3-L-SS	8	S	1	0.036	0.036	0.250	0.281	2.50	0.89	-	48.9	1.79
B-1-15-4-L-SS	8	S	1	0.036	0.036	0.250	0.281	2.47	0.88	-	48.9	1.67
B-1-15-5-H-SS	8	S	1	0.036	0.036	0.250	0.281	2.47	0.88	-	48.9	1.83
B-1-15-6-H-SS	8	S	1	0.036	0.036	0.250	0.281	2.50	0.88	-	48.9	1.85
B-1-24-1-O-SS	8	S	1	0.074	0.074	0.750	0.813	5.25	2.69	-	53.7	9.00
B-1-24-2-O-SS	8	S	1	0.074	0.074	0.750	0.813	5.25	2.69	-	53.7	9.28
B-1-24-4-L-SS	8	S	1	0.074	0.074	0.750	0.813	5.25	2.66	-	53.7	10.75
B-1-35-1-O-SS	8	S	1	0.031	0.031	0.250	0.281	2.25	0.88	-	74.5	1.88
B-1-35-2-O-SS	8	S	1	0.031	0.031	0.250	0.281	2.25	0.88	-	74.5	2.00
B-1-35-3-L-SS	8	S	1	0.031	0.031	0.250	0.281	2.25	0.88	-	74.5	2.05
B-1-35-4-L-SS	8	S	1	0.031	0.031	0.250	0.281	2.25	0.88	-	74.5	1.83
B-1-35-5-H-SS	8	S	1	0.031	0.031	0.250	0.281	2.25	0.88	-	74.5	2.07
B-1-35-6-H-SS	8	S	1	0.031	0.031	0.250	0.281	2.25	0.88	-	74.5	2.03
B-1-44-1-O-SS	8	S	1	0.071	0.071	0.750	0.813	6.00	2.63	-	69.3	11.10
B-1-44-3-O-SS	8	S	1	0.071	0.071	0.750	0.813	6.00	2.63	-	69.3	12.20
B-1-16-1-O-SS	8	S	1	0.036	0.036	0.500	0.563	4.00	1.75	-	48.9	3.37
B-1-16-2-O-SS	8	S	1	0.036	0.036	0.500	0.563	4.00	1.75	-	48.9	3.21
B-1-16-3-L-SS	8	S	1	0.036	0.036	0.500	0.563	4.00	1.75	-	48.9	2.64
B-1-16-4-L-SS	8	S	1	0.036	0.036	0.500	0.563	4.00	1.75	-	48.9	2.80
B-1-24-5-O-SS	8	S	1	0.074	0.074	0.750	0.813	5.25	2.66	-	53.7	7.20
B-1-24-6-O-SS	8	S	1	0.074	0.074	0.750	0.813	5.25	2.66	-	53.7	7.15
B-1-24-7-L-SS	8	S	1	0.074	0.074	0.750	0.813	5.25	2.69	-	53.7	7.55
B-1-24-8-L-SS	8	S	1	0.074	0.074	0.750	0.813	5.25	2.63	-	53.7	6.80
B-1-24-9-H-SS	8	S	1	0.074	0.074	0.750	0.813	5.25	2.63	-	53.7	8.70
B-1-24-10-H-SS	8	S	1	0.074	0.074	0.750	0.813	5.25	2.66	-	53.7	8.00
B-1-36-1-O-SS	8	S	1	0.031	0.031	0.500	0.563	4.25	1.75	-	74.5	2.60

**Table B1: Continued**

Specimen Notation	Source	Double /Single Shear	Number of Bolts Used	t-1 (in.)	t-2 (in.)	d (in.)	h (in.)	s (in.)	e (in.)	e1 (in.)	F <sub>u</sub> (ksi)	P <sub>t</sub> (kip)
B-1-36-2-O-SS	8	S	1	0.031	0.031	0.500	0.563	4.25	1.75	-	74.5	2.49
B-1-36-3-L-SS	8	S	1	0.031	0.031	0.500	0.563	4.25	1.75	-	74.5	2.94
B-1-36-4-L-SS	8	S	1	0.031	0.031	0.500	0.563	4.25	1.75	-	74.5	2.96

B-1-36-5-0-SS	8	S	1	0.031	0.031	0.500	0.563	4.25	1.75	-	74.5	2.37
B-1-36-6-0-SS	8	S	1	0.031	0.031	0.500	0.563	4.25	1.75	-	74.5	2.29
B-1-36-7-L-SS	8	S	1	0.031	0.031	0.500	0.563	4.25	1.75	-	74.5	2.46
B-1-36-8-L-SS	8	S	1	0.031	0.031	0.500	0.563	4.25	1.75	-	74.5	2.36
B-1-36-10-H-SS	8	S	1	0.031	0.031	0.500	0.563	4.25	1.75	-	74.5	3.32
B-1-43-1-0-SS	8	S	1	0.071	0.071	0.500	0.563	4.25	1.66	-	69.3	6.58
B-1-44-4-L-SS	8	S	1	0.071	0.071	0.750	0.813	6.00	2.63	-	69.3	11.55
B-1-44-5-0-SS	8	S	1	0.071	0.071	0.750	0.813	6.00	2.63	-	69.3	8.25
B-1-44-8-L-SS	8	S	1	0.071	0.071	0.750	0.813	6.00	2.63	-	69.3	8.15
B-1-44-9-H-SS	8	S	1	0.071	0.071	0.750	0.813	6.00	2.63	-	69.3	8.50
B-1-8-3-1-SS	9	S	1	0.025	0.025	0.375	0.406	5.22	1.31	-	52.0	1.37
B-1-3-3-T-SS	9	S	1	0.025	0.025	0.375	0.406	5.23	1.31	-	52.0	1.22
B-1-9-1-T-SS	9	S	1	0.024	0.024	0.375	0.406	5.22	1.96	-	52.0	1.44
B-1-9-2-T-SS	9	S	1	0.024	0.024	0.375	0.406	5.22	1.69	-	52.0	1.24
B-1-9-3-T-SS	9	S	1	0.024	0.024	0.375	0.406	5.22	1.69	-	52.0	1.71
1W	9	S	1	0.035	0.035	0.500	0.563	2.00	2.00	-	47.4	2.41
2W	9	S	1	0.035	0.035	0.375	0.406	1.50	2.00	-	47.4	1.82
3W	9	S	1	0.108	0.108	0.500	0.563	2.00	2.50	-	47.4	7.24
4W	9	S	1	0.108	0.108	0.625	0.688	2.50	3.00	-	47.4	9.30
080-G550-B1-48X75-M12-ILc	10	S	1	0.031	0.031	0.472	0.563	2.96	1.85	-	96.9	4.07
080-G550-B1-48X75-M12-ITc	10	S	1	0.031	0.031	0.472	0.563	2.95	1.88	-	105.6	4.02
080-G550-B1-48X75-M12-IDc	10	S	1	0.031	0.031	0.472	0.563	2.95	1.89	-	97.9	3.98
100-G550-B1-48X75-M12-ILc	10	S	1	0.039	0.039	0.472	0.563	2.96	1.88	-	92.2	5.15
100-G550-B1-48X75-M12-ITc	10	S	1	0.039	0.039	0.472	0.563	2.95	1.89	-	101.2	5.04
100-G550-B1-48X75-M12-IDc	10	S	1	0.039	0.039	0.472	0.563	2.96	1.89	-	94.6	4.20
080-G300-B1-48X75-M12-ILc	10	S	1	0.031	0.031	0.472	0.563	2.96	1.87	-	59.5	3.19
080-G300-B1-48X75-M12-ITc	10	S	1	0.031	0.031	0.472	0.563	2.96	1.88	-	59.9	3.06
080-G300-B1-48X75-M12-IDc	10	S	1	0.031	0.031	0.472	0.563	2.96	1.87	-	61.2	3.26
042-G550-B1-36x75-M12-CL	10	S	1	0.016	0.016	0.472	0.563	2.95	1.43	-	104.3	1.35
042-G550-B1-36x75-M12-IL	10	S	1	0.016	0.016	0.472	0.563	2.95	1.40	-	104.3	1.66
042-G550-B1-48x75-M12-CL	10	S	1	0.016	0.016	0.472	0.563	2.95	1.88	-	104.3	1.63
042-G550-B1-48x75-M12-IL	10	S	1	0.016	0.016	0.472	0.563	2.95	1.90	-	104.3	1.74
042-G550-B1-60x75-M12-CL	10	S	1	0.016	0.016	0.472	0.563	2.95	2.37	-	104.3	1.48

**Table B1: Continued**

Specimen Notation	Source	Double /Single Shear	Number of Bolts Used	t-1 (in.)	t-2 (in.)	d (in.)	h (in.)	s (in.)	e (in.)	e1 (in.)	F <sub>u</sub> (ksi)	P <sub>t</sub> (kip)
042-G550-B1-60x75-M12-IL	10	S	1	0.016	0.016	0.472	0.563	2.95	2.35	-	104.3	1.67
042-G550-B1-36x75-M12-CT	10	S	1	0.016	0.016	0.472	0.563	2.95	1.43	-	118.5	1.41
042-G550-B1-	10	S	1	0.016	0.016	0.472	0.563	2.95	1.43	-	118.5	1.77



36x75-M12-IT												
042-G550-B1-48x75-M12-CT	10	S	1	0.016	0.016	0.472	0.563	2.95	1.91	-	118.5	1.75
042-G550-B1-48x75-M12-IT	10	S	1	0.016	0.016	0.472	0.563	2.95	1.90	-	118.5	1.78
042-G550-B1-60x75-M12-CT	10	S	1	0.016	0.016	0.472	0.563	2.95	2.37	-	118.5	1.51
042-G550-B1-60x75-M12-IT	10	S	1	0.016	0.016	0.472	0.563	2.95	2.37	-	118.5	1.60
042-G550-B1-36x75-M12-CD	10	S	1	0.016	0.016	0.472	0.563	2.95	1.42	-	106.0	1.72
042-G550-B1-36x75-M12-ID	10	S	1	0.016	0.016	0.472	0.563	2.95	1.41	-	106.0	1.47
042-G550-B1-48x75-M12-CD	10	S	1	0.016	0.016	0.472	0.563	2.95	1.88	-	106.0	1.62
042-G550-B1-48x75-M12-ID	10	S	1	0.016	0.016	0.472	0.563	2.95	1.89	-	106.0	1.61
042-G550-B1-60x75-M12-CD	10	S	1	0.016	0.016	0.472	0.563	2.95	2.37	-	106.0	1.28
042-G550-B1-60x75-M12-ID	10	S	1	0.016	0.016	0.472	0.563	2.95	2.37	-	106.0	1.66
060-G550-B1-36x75-M12-IL	10	S	1	0.023	0.023	0.472	0.563	2.95	1.43	-	102.0	2.25
060-G550-B1-48x75-M12-IL	10	S	1	0.023	0.023	0.472	0.563	2.95	1.89	-	102.0	2.21
060-G550-B1-60x75-M12-IL	10	S	1	0.023	0.023	0.472	0.563	2.95	2.36	-	102.0	2.50
060-G550-B1-36x75-M12-IT	10	S	1	0.023	0.023	0.472	0.563	2.95	1.42	-	113.9	2.27
060-G550-B1-48x75-M12-IT	10	S	1	0.023	0.023	0.472	0.563	2.95	1.89	-	113.9	2.47
060-G550-B1-60x75-M12-IT	10	S	1	0.023	0.023	0.472	0.563	2.95	2.37	-	113.9	2.14
060-G550-B1-36x75-M12-ID	10	S	1	0.023	0.023	0.472	0.563	2.95	1.43	-	102.5	2.36
060-G550-B1-48x75-M12-ID	10	S	1	0.023	0.023	0.472	0.563	2.95	1.90	-	102.5	2.17
060-G550-B1-60x75-M12-ID	10	S	1	0.023	0.023	0.472	0.563	2.95	2.35	-	102.5	2.07
060-G300-B1-36x75-M12-IL	10	S	1	0.023	0.023	0.472	0.563	2.95	1.43	-	62.5	1.39
060-G300-B1-48x75-M12-IL	10	S	1	0.023	0.023	0.472	0.563	2.95	1.89	-	62.5	1.43

**Table B1: Continued**

Specimen Notation	Source	Double /Single Shear	Number of Bolts Used	t-1 (in.)	t-2 (in.)	d (in.)	h (in.)	s (in.)	e (in.)	e1 (in.)	F <sub>u</sub> (ksi)	P <sub>t</sub> (kip)
060-G300-B1-60x75-M12-IL	10	S	1	0.023	0.023	0.472	0.563	2.95	2.37	-	62.5	1.44
060-G300-B1-36x75-M12-IT	10	S	1	0.023	0.023	0.472	0.563	2.95	1.43	-	62.1	1.36
060-G300-B1-48x75-M12-IT	10	S	1	0.023	0.023	0.472	0.563	2.95	1.90	-	62.1	1.39
060-G300-B1-60x75-M12-IT	10	S	1	0.023	0.023	0.472	0.563	2.95	2.37	-	62.1	1.41
060-G300-B1-	10	S	1	0.023	0.023	0.472	0.563	2.95	1.41	-	63.4	1.49

36x75-M12-ID													
060-G300-B1-48x75-M12-ID	10	S	1	0.023	0.023	0.472	0.563	2.95	1.89	-	63.4	1.50	
060-G300-B1-60x75-M12-ID	10	S	1	0.023	0.023	0.472	0.563	2.95	2.36	-	63.4	1.46	
042-G550-B1W-36x75-M12-CL	10	S	1	0.016	0.016	0.472	0.563	2.95	1.44	-	104.3	1.46	
042-G550-B1W-36x75-M12-IL	10	S	1	0.016	0.016	0.472	0.563	2.95	1.45	-	104.3	1.69	
042-G550-B1W-48x75-M12-CL	10	S	1	0.016	0.016	0.472	0.563	2.95	1.90	-	104.3	1.66	
042-G550-B1W-48x75-M12-IL	10	S	1	0.016	0.016	0.472	0.563	2.95	1.90	-	104.3	1.70	
042-G550-B1W-36x75-M12-CT	10	S	1	0.016	0.016	0.472	0.563	2.95	1.41	-	118.5	1.47	
042-G550-B1W-36x75-M12-IT	10	S	1	0.016	0.016	0.472	0.563	2.95	1.43	-	118.5	1.74	
042-G550-B1W-48x75-M12-CT	10	S	1	0.016	0.016	0.472	0.563	2.95	1.89	-	118.5	1.52	
042-G550-B1W-48x75-M12-IT	10	S	1	0.016	0.016	0.472	0.563	2.95	1.89	-	118.5	1.61	
042-G550-B1W-36x75-M12-CD	10	S	1	0.016	0.016	0.472	0.563	2.95	1.43	-	106.0	1.45	
042-G550-B1W-36x75-M12-ID	10	S	1	0.016	0.016	0.472	0.563	2.95	1.46	-	106.0	1.55	
042-G550-B1W-48x75-M12-CD	10	S	1	0.016	0.016	0.472	0.563	2.95	1.90	-	106.0	1.57	
042-G550-B1W-48x75-M12-ID	10	S	1	0.016	0.016	0.472	0.563	2.95	1.90	-	106.0	1.57	
060-G550-B1W-36x75-M12-IL	10	S	1	0.023	0.023	0.472	0.563	2.95	1.43	-	102.0	2.59	
060-G550-B1W-48x75-M12-IL	10	S	1	0.023	0.023	0.472	0.563	2.95	1.90	-	102.0	2.45	
060-G550-B1W-36x75-M12-IT	10	S	1	0.023	0.023	0.472	0.563	2.95	1.41	-	113.9	2.52	
060-G550-B1W-48x75-M12-IT	10	S	1	0.023	0.023	0.472	0.563	2.95	1.90	-	113.9	2.41	
060-G550-B1W-36x75-M12-ID	10	S	1	0.023	0.023	0.472	0.563	2.95	1.43	-	102.5	2.19	

**Table B1: Continued**

Specimen Notation	Source	Double /Single Shear	Number of Bolts Used	t-1 (in.)	t-2 (in.)	d (in.)	h (in.)	s (in.)	e (in.)	e1 (in.)	F <sub>u</sub> (ksi)	P <sub>t</sub> (kip)
060-G550-B1W-48x75-M12-ID	10	S	1	0.023	0.023	0.472	0.563	2.95	1.90	-	102.5	2.72
060-G300-B1W-36x75-M12-IL	10	S	1	0.023	0.023	0.472	0.563	2.95	1.43	-	62.5	1.65
060-G300-B1W-48x75-M12-IL	10	S	1	0.023	0.023	0.472	0.563	2.95	1.89	-	62.5	2.04
060-G300-B1W-36x75-M12-IT	10	S	1	0.023	0.023	0.472	0.563	2.95	1.41	-	62.1	1.76
060-G300-B1W-48x75-M12-IT	10	S	1	0.023	0.023	0.472	0.563	2.95	1.92	-	62.1	2.03
060-G300-B1W-36x75-M12-ID	10	S	1	0.023	0.023	0.472	0.563	2.95	1.44	-	63.4	1.94
060-G300-B1W-48x75-M12-ID	10	S	1	0.023	0.023	0.472	0.563	2.95	1.91	-	63.4	2.16
060-G550-B1W-36x75-M12-IT-E4	10	S	1	0.023	0.023	0.472	0.563	2.95	1.42	-	113.9	2.27
060-G550-B1W-48x75-M12-IT-E6	10	S	1	0.023	0.023	0.472	0.563	2.95	1.90	-	113.9	2.38
060-G550-B1W-36x75-M12-ID-E4	10	S	1	0.023	0.023	0.472	0.563	2.95	1.43	-	102.5	2.22
060-G550-B1W-48x75-M12-ID-E6	10	S	1	0.023	0.023	0.472	0.563	2.95	1.90	-	102.5	2.61
080-G550-B2-48x95-M12-ILc	10	S	2	0.031	0.031	0.472	0.563	3.76	1.88	-	96.9	7.19
080-G550-B2-48x95-M12-ITc	10	S	2	0.031	0.031	0.472	0.563	3.76	1.91	-	105.6	7.04
080-G550-B2-48x95-M12-IDc	10	S	2	0.031	0.031	0.472	0.563	3.76	1.91	-	97.9	6.43
100-G550-B2-48x95-M12-ILc	10	S	2	0.039	0.039	0.472	0.563	3.75	1.89	-	92.2	8.77
100-G550-B2-48x95-M12-ITc	10	S	2	0.039	0.039	0.472	0.563	3.75	1.87	-	101.2	7.94
100-G550-B2-48x95-M12-IDc	10	S	2	0.039	0.039	0.472	0.563	3.76	1.89	-	94.6	9.28
080-G300-B2-48x95-M12-ILc	10	S	2	0.031	0.031	0.472	0.563	3.74	1.87	-	59.5	5.04
080-G300-B2-48x95-M12-ITc	10	S	2	0.031	0.031	0.472	0.563	3.74	1.87	-	59.9	4.77
080-G300-B2-48x95-M12-IDc	10	S	2	0.031	0.031	0.472	0.563	3.74	1.89	-	61.2	5.22
042-G550-B2-48x75-M12-CL	10	S	2	0.016	0.016	0.472	0.563	2.95	1.91	-	104.3	2.92
042-G550-B2-48x75-M12-IL	10	S	2	0.016	0.016	0.472	0.563	2.95	1.89	-	104.3	3.03
042-G550-B2-48x95-M12-CL	10	S	2	0.016	0.016	0.472	0.563	2.95	1.88	-	104.3	3.03
042-G550-B2-48x95-M12-IL	10	S	2	0.016	0.016	0.472	0.563	2.95	1.88	-	104.3	3.08

**Table B1: Continued**

Specimen Notation	Source	Double	Number	t-1	t-2	d	h	s	e	e1	F <sub>u</sub>	P <sub>t</sub>
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		/Single Shear	of Bolts Used	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(ksi)	(kip)
042-G550-B2-48x75-M12-CT	10	S	2	0.016	0.016	0.472	0.563	2.95	1.90	-	118.5	2.83
042-G550-B2-48x75-M12-IT	10	S	2	0.016	0.016	0.472	0.563	2.95	1.89	-	118.5	3.44
042-G550-B2-48x95-M12-CT	10	S	2	0.016	0.016	0.472	0.563	3.74	1.89	-	118.5	3.06
042-G550-B2-48x95-M12-IT	10	S	2	0.016	0.016	0.472	0.563	3.74	1.89	-	118.5	3.24
042-G550-B2-48x75-M12-CD	10	S	2	0.016	0.016	0.472	0.563	2.95	1.88	-	106.0	2.81
042-G550-B2-48x75-M12-ID	10	S	2	0.016	0.016	0.472	0.563	2.95	1.91	-	106.0	3.01
042-G550-B2-48x95-M12-CD	10	S	2	0.016	0.016	0.472	0.563	3.74	1.88	-	106.0	2.50
042-G550-B2-48x95-M12-ID	10	S	2	0.016	0.016	0.472	0.563	3.74	1.88	-	106.0	2.92
060-G550-B2-48x75-M12-ILc	10	S	2	0.023	0.023	0.472	0.563	2.95	1.90	-	102.0	4.59
060-G550-B2-48x95-M12-ILc	10	S	2	0.023	0.023	0.472	0.563	3.74	1.89	-	102.0	5.17
060-G550-B2-48x75-M12-IL-E10c	10	S	2	0.023	0.023	0.472	0.563	2.95	1.90	-	102.0	4.97
060-G550-B2-48x75-M12-ITc	10	S	2	0.023	0.023	0.472	0.563	2.95	1.88	-	113.9	4.97
060-G550-B2-48x95-M12-ITc	10	S	2	0.023	0.023	0.472	0.563	3.74	1.89	-	113.9	5.01
060-G550-B2-48x75-M12-IT-E15c	10	S	2	0.023	0.023	0.472	0.563	2.95	1.90	-	113.9	4.92
060-G550-B2-48x75-M12-IDc	10	S	2	0.023	0.023	0.472	0.563	2.95	1.89	-	102.5	4.97
060-G550-B2-48x95-M12-IDc	10	S	2	0.023	0.023	0.472	0.563	3.74	1.88	-	102.5	4.72
060-G550-B2-48x75-M12-ID-E20c	10	S	2	0.023	0.023	0.472	0.563	2.95	1.88	-	102.5	5.17
060-G300-B2-48x95-M12-ILc	10	S	2	0.023	0.023	0.472	0.563	3.74	1.90	-	62.5	3.46
060-G300-B2-48x95-M12-ITc	10	S	2	0.023	0.023	0.472	0.563	3.74	1.89	-	62.1	3.46
060-G300-B2-48x95-M12-IDc	10	S	2	0.023	0.023	0.472	0.563	3.74	1.89	-	63.4	3.62
-----	11	S	1	0.051	0.051	0.500	0.563	10.00	2.03	-	50.1	4.05
-----	11	S	1	0.051	0.051	0.500	0.563	10.00	2.03	-	50.1	4.23
-----	11	S	1	0.061	0.061	0.500	0.563	10.00	1.94	-	74.1	6.15
-----	11	S	1	0.037	0.037	0.500	0.563	10.00	2.00	-	58.9	3.70
-----	11	S	1	0.037	0.037	0.500	0.563	10.00	2.00	-	58.9	3.66
-----	11	S	1	0.037	0.037	0.333	0.365	10.00	2.06	-	58.9	2.26
-----	11	S	1	0.037	0.037	0.333	0.365	10.00	2.04	-	58.9	2.35
-----	11	S	1	0.037	0.037	0.500	0.563	10.00	2.50	-	58.9	3.84

**Table B1: Continued**

Specimen Notation	Source	Double /Single Shear	Number of Bolts Used	t-1 (in.)	t-2 (in.)	d (in.)	h (in.)	s (in.)	e (in.)	e1 (in.)	F <sub>u</sub> (ksi)	P <sub>t</sub> (kip)
-----	11	S	1	0.037	0.037	0.500	0.563	10.00	2.00	-	58.9	3.97
1-ww-50	12	D	1	0.054	0.025	0.250	0.313	1.97	1.97	-	52.4	1.96

2-ww-50	12	D	1	0.054	0.025	0.250	0.313	1.97	1.97	-	52.4	1.88
3-ww-50	12	D	1	0.054	0.025	0.250	0.313	1.97	1.97	-	52.4	1.84
1-ww-40	12	D	1	0.054	0.025	0.250	0.313	1.97	1.57	-	52.4	1.83
2-ww-40	12	D	1	0.054	0.025	0.250	0.313	1.97	1.57	-	52.4	2.25
3-ww-40	12	D	1	0.054	0.025	0.250	0.313	1.97	1.57	-	52.4	2.18
1-ww-30	12	D	1	0.054	0.025	0.250	0.313	1.97	1.18	-	52.4	1.85
2-ww-30	12	D	1	0.054	0.025	0.250	0.313	1.97	1.18	-	52.4	1.87
3-ww-30	12	D	1	0.054	0.025	0.250	0.313	1.97	1.18	-	52.4	2.33
1-ww-20	12	D	1	0.054	0.025	0.250	0.313	1.97	0.79	-	52.4	1.91
2-ww-20	12	D	1	0.054	0.025	0.250	0.313	1.97	0.79	-	52.4	2.02
3-ww-20	12	D	1	0.054	0.025	0.250	0.313	1.97	0.79	-	52.4	1.93
1-ww-20-t5	12	D	1	0.054	0.025	0.250	0.313	1.97	0.79	-	52.4	2.04
2-ww-20-t5	12	D	1	0.054	0.025	0.250	0.313	1.97	0.79	-	52.4	1.91
3-ww-20-t5	12	D	1	0.054	0.025	0.250	0.313	1.97	0.79	-	52.4	1.88
1-ww-20-t15	12	D	1	0.054	0.025	0.250	0.313	1.97	0.79	-	52.4	1.98
2-ww-20-t15	12	D	1	0.054	0.025	0.250	0.313	1.97	0.79	-	52.4	2.29
3-ww-20-t15	12	D	1	0.054	0.025	0.250	0.313	1.97	0.79	-	52.4	2.08
1-ww-30-50	12	D	2	0.054	0.025	0.250	0.313	1.97	1.18	1.97	52.4	4.12
2-ww-30-50	12	D	2	0.054	0.025	0.250	0.313	1.97	1.18	1.97	52.4	4.15
3-ww-30-50	12	D	2	0.054	0.025	0.250	0.313	1.97	1.18	1.97	52.4	4.19
1-ww-30-40	12	D	2	0.054	0.025	0.250	0.313	1.97	1.18	1.57	52.4	4.15
2-ww-30-40	12	D	2	0.054	0.025	0.250	0.313	1.97	1.18	1.57	52.4	4.26
3-ww-30-40	12	D	2	0.054	0.025	0.250	0.313	1.97	1.18	1.57	52.4	4.11
1-ww-30-30	12	D	2	0.054	0.025	0.250	0.313	1.97	1.18	1.18	52.4	4.06
2-ww-30-30	12	D	2	0.054	0.025	0.250	0.313	1.97	1.18	1.18	52.4	4.29
3-ww-30-30	12	D	2	0.054	0.025	0.250	0.313	1.97	1.18	1.18	52.4	4.25
1-ww-40-5/8	12	D	1	0.054	0.025	0.375	0.438	1.97	1.57	-	52.4	2.17
2-ww-40-5/8	12	D	1	0.054	0.025	0.375	0.438	1.97	1.57	-	52.4	2.15
3-ww-40-5/8	12	D	1	0.054	0.025	0.375	0.438	1.97	1.57	-	52.4	2.28
1-ww-30-5/16	12	D	1	0.054	0.025	0.313	0.375	1.97	1.18	-	52.4	1.87
2-ww-30-5/16	12	D	1	0.054	0.025	0.313	0.375	1.97	1.18	-	52.4	2.36
3-ww-30-5/16	12	D	1	0.054	0.025	0.313	0.375	1.97	1.18	-	52.4	2.38
1-ww-ss-5/16	12	S	1	0.025	0.025	0.313	0.375	1.97	1.18	-	55.4	1.07
2-ww-ss-5/16	12	S	1	0.025	0.025	0.313	0.375	1.97	1.18	-	55.4	1.17
3-ww-ss-5/16	12	S	1	0.025	0.025	0.313	0.375	1.97	1.18	-	55.4	1.07
1-ww-sst-5/16	12	S	1	0.054	0.054	0.313	0.375	1.97	1.18	-	52.4	3.29
2-ww-sst-5/16	12	S	1	0.054	0.054	0.313	0.375	1.97	1.18	-	52.4	2.82
3-ww-sst-5/16	12	S	1	0.054	0.054	0.313	0.375	1.97	1.18	-	52.4	2.78
1-ww-sst-1/4	12	S	1	0.054	0.054	0.250	0.313	1.97	1.18	-	52.4	2.74
2-ww-sst-1/4	12	S	1	0.054	0.054	0.250	0.313	1.97	1.18	-	52.4	2.74
3-ww-sst-1/4	12	S	1	0.054	0.054	0.250	0.313	1.97	1.18	-	52.4	2.67
1-ww-mix-1/4	12	S	1	0.054	0.025	0.250	0.313	1.97	1.18	-	52.4	1.07
2-ww-mix-1/4	12	S	1	0.054	0.025	0.250	0.313	1.97	1.18	-	52.4	1.02
3-ww-mix-1/4	12	S	1	0.054	0.025	0.250	0.313	1.97	1.18	-	52.4	0.95
1-ww-ss-1/4	12	S	1	0.025	0.025	0.250	0.313	1.97	1.18	-	55.4	1.01
2-ww-ss-1/4	12	S	1	0.025	0.025	0.250	0.313	1.97	1.18	-	55.4	0.91

**Table B1: Continued**

Specimen Notation	Source	Double /Single Shear	Number of Bolts Used	t-1 (in.)	t-2 (in.)	d (in.)	h (in.)	s (in.)	e (in.)	e1 (in.)	F <sub>u</sub> (ksi)	P <sub>t</sub> (kip)
3-ww-ss-1/4	12	S	1	0.025	0.025	0.250	0.313	1.97	1.18	-	55.4	1.02
1-ww-50-1/2	12	D	1	0.054	0.025	0.500	0.563	1.97	1.97	-	52.4	3.30
2-ww-50-1/2	12	D	1	0.054	0.025	0.500	0.563	1.97	1.97	-	52.4	3.42
3-ww-50-1/2	12	D	1	0.054	0.025	0.500	0.563	1.97	1.97	-	52.4	2.87
1-ww-ss-1/2	12	S	1	0.054	0.025	0.500	0.563	1.97	1.97	-	52.4	1.42
2-ww-ss-1/2	12	S	1	0.054	0.025	0.500	0.563	1.97	1.97	-	52.4	1.43

3-ww-ss-1/2	12	S	1	0.054	0.025	0.500	0.563	1.97	1.97	-	52.4	1.35
1-ww-50-5/8	12	D	1	0.054	0.025	0.625	0.688	1.97	1.97	-	52.4	3.12
2-ww-50-5/8	12	D	1	0.054	0.025	0.625	0.688	1.97	1.97	-	52.4	3.15
3-ww-50-5/8	12	D	1	0.054	0.025	0.625	0.688	1.97	1.97	-	52.4	3.09
1-ww-ss-5/8	12	S	1	0.054	0.025	0.625	0.688	1.97	1.97	-	52.4	1.50
2-ww-ss-5/8	12	S	1	0.054	0.025	0.625	0.688	1.97	1.97	-	52.4	1.59
3-ww-ss-5/8	12	S	1	0.054	0.025	0.625	0.688	1.97	1.97	-	52.4	1.47

**Table B2: Geometric Properties and Test Loads of Single Shear and Outside Sheets of Double Shear Bolted Specimens Without Washers**

Specimen Notation	Source	Double /Single Shear	Number of Bolts Used	t-1 (in.)	t-2 (in.)	d (in.)	h (in.)	s (in.)	e (in.)	e1 (in.)	F <sub>u</sub> (ksi)	P <sub>t</sub> (kip)
an32-1	1	S	1	0.118	0.118	0.500	0.563	3.27	2.00	-	53.0	8.09
an32-2	1	S	1	0.116	0.116	0.500	0.563	3.26	2.00	-	53.0	8.20
an33-1	1	S	1	0.118	0.118	0.500	0.563	4.01	2.00	-	53.0	9.00
an33-2	1	S	1	0.120	0.120	0.500	0.563	4.01	2.00	-	53.0	8.95
bn33-1	1	S	2	0.119	0.119	0.500	0.563	4.02	2.00	-	53.0	14.60
bn33-2	1	S	2	0.119	0.119	0.500	0.563	4.02	2.00	-	53.0	14.38
dn12-2	1	S	2	0.043	0.043	0.500	0.563	3.26	2.00	-	55.8	4.74
dn12-3	1	S	2	0.042	0.042	0.500	0.563	3.26	2.00	-	55.8	4.74
dn22-1	1	S	2	0.070	0.070	0.500	0.563	3.26	2.00	-	52.5	8.43
dn22-2	1	S	2	0.071	0.071	0.500	0.563	3.26	2.00	-	52.5	8.50
bn32-1	1	S	2	0.118	0.118	0.500	0.563	3.26	2.00	-	53.0	14.46
bn32-2	1	S	2	0.117	0.117	0.500	0.563	3.25	2.00	-	53.0	14.69
dn32-1	1	S	2	0.120	0.120	0.500	0.563	3.26	2.00	-	53.0	15.75
dn32-2	1	S	2	0.118	0.118	0.500	0.563	3.26	2.00	-	53.0	16.08
en12-1	1	S	4	0.043	0.043	0.500	0.563	3.26	2.00	-	55.8	8.65
en12-2	1	S	4	0.043	0.043	0.500	0.563	3.26	2.00	-	55.8	8.70
en22-1	1	S	4	0.071	0.071	0.500	0.563	3.26	2.00	-	52.5	15.77
en22-2	1	S	4	0.072	0.072	0.500	0.563	3.25	2.00	-	52.5	15.74
en32-1	1	S	4	0.118	0.118	0.500	0.563	3.26	2.00	-	53.0	28.83
en32-2	1	S	4	0.117	0.117	0.500	0.563	3.26	2.00	-	53.0	29.00
24	7	S	1	0.037	0.037	0.500	0.563	4.06	2.06	-	58.9	2.46
25	7	S	1	0.037	0.037	0.313	0.344	4.03	2.04	-	58.9	1.83
26	7	S	1	0.037	0.037	0.313	0.344	4.12	2.06	-	58.9	1.60
29	7	S	1	0.037	0.037	0.500	0.563	4.00	1.00	-	58.9	2.39
32	7	S	1	0.037	0.037	0.500	0.563	4.00	2.50	-	58.9	2.26
34	7	S	1	0.037	0.037	0.500	0.563	4.00	2.50	-	58.9	2.31
36	7	S	1	0.037	0.037	0.500	0.563	4.00	1.00	-	58.9	2.36
55	7	S	1	0.051	0.051	0.500	0.563	4.03	2.06	-	50.1	2.89

**Table B2: Continued**

Specimen Notation	Source	Double /Single Shear	Number of Bolts Used	t-1 (in.)	t-2 (in.)	d (in.)	h (in.)	s (in.)	e (in.)	e1 (in.)	F <sub>u</sub> (ksi)	P <sub>t</sub> (kip)
56	7	S	1	0.051	0.051	0.500	0.563	4.03	2.01	-	50.1	2.98
57	7	S	1	0.051	0.051	0.500	0.563	4.03	2.01	-	50.1	2.94
75	7	S	1	0.079	0.079	0.750	0.813	4.00	3.00	-	65.9	8.60
76	7	S	1	0.079	0.079	0.750	0.813	4.00	3.01	-	65.9	8.15
77	7	S	1	0.079	0.079	0.750	0.813	4.00	3.00	-	65.9	9.17
78	7	S	1	0.104	0.104	0.750	0.813	4.06	3.03	-	70.6	12.50
60	7	S	2	0.051	0.051	0.500	0.563	2.02	1.97	-	50.1	5.57
63	7	S	2	0.051	0.051	0.500	0.563	2.00	1.97	-	74.1	8.98

58	7	S	3	0.051	0.051	0.313	0.344	1.35	2.05	-	50.1	5.24
59	7	S	3	0.051	0.051	0.313	0.344	1.35	2.07	-	50.1	5.39
52	7	S	2	0.037	0.037	0.500	0.563	4.00	1.00	-	58.9	4.32
66	7	S	3	0.037	0.037	0.500	0.563	4.03	1.00	-	74.1	13.10
67	7	S	3	0.037	0.037	0.500	0.563	4.06	1.00	-	74.1	13.50
B-0-32-9-H-SS	8	S	1	0.015	0.015	0.250	0.281	2.00	0.56	-	80.8	0.81
B-0-32-9-H-SS	8	S	1	0.015	0.015	0.250	0.281	2.00	0.55	-	80.8	0.65
B-0-7-1-T-SS	9	S	1	0.046	0.046	0.500	0.563	6.80	1.75	-	55.7	2.86
B-0-7-2-T-SS	9	S	1	0.046	0.046	0.500	0.563	6.80	1.75	-	55.7	3.19
B-0-7-3-T-SS	9	S	1	0.047	0.047	0.500	0.563	6.84	1.75	-	55.7	4.51
B-0-7-4-T-SS	9	S	1	0.047	0.047	0.500	0.563	6.84	1.75	-	55.7	3.87
1	9	S	1	0.035	0.035	0.500	0.563	1.75	2.00	-	47.8	1.33
2	9	S	1	0.035	0.035	0.375	0.406	1.25	1.75	-	47.8	0.98
3	9	S	1	0.108	0.108	0.500	0.563	1.75	2.25	-	47.4	3.86
4	9	S	1	0.108	0.108	0.625	0.688	2.19	2.75	-	47.4	4.99
C-M/17-1	11	S	1	0.051	0.051	0.500	0.563	10.00	2.06	-	50.1	2.89
C-M/17-2	11	S	1	0.051	0.051	0.500	0.563	10.00	2.01	-	50.1	2.98
C-M/17-3	11	S	1	0.051	0.051	0.500	0.563	10.00	2.01	-	50.1	2.94
C-M/17-4	11	S	1	0.051	0.051	0.313	0.344	10.00	2.05	-	50.1	1.75
C-M/17-5	11	S	1	0.051	0.051	0.313	0.344	10.00	2.07	-	50.1	1.80
C-M/17-6	11	S	1	0.051	0.051	0.500	0.563	10.00	1.97	-	50.1	2.79
C-M/16-7	11	S	1	0.061	0.061	0.500	0.563	10.00	1.97	-	74.1	4.49
C-M/14-8	11	S	1	0.079	0.079	0.750	0.813	10.00	3.00	-	65.9	8.60
C-M/14-9	11	S	1	0.079	0.079	0.750	0.813	10.00	3.01	-	65.9	8.15
C-M/14-10	11	S	1	0.079	0.079	0.750	0.813	10.00	3.00	-	65.9	9.17
C-M/12-11	11	S	1	0.104	0.104	0.750	0.813	10.00	3.03	-	70.6	12.50
C-M/17-12	11	S	1	0.051	0.051	0.500	0.563	10.00	1.50	-	50.1	2.86
C-M/17-13	11	S	1	0.051	0.051	0.500	0.563	10.00	1.44	-	50.1	2.90
1-wo-50	12	D	1	0.054	0.025	0.250	0.313	1.97	1.97	-	55.4	1.41
2-wo-50	12	D	1	0.054	0.025	0.250	0.313	1.97	1.97	-	55.4	1.56
3-wo-50	12	D	1	0.054	0.025	0.250	0.313	1.97	1.97	-	55.4	1.47
1-wo-40	12	D	1	0.054	0.025	0.250	0.313	1.97	1.57	-	55.4	1.49
2-wo-40	12	D	1	0.054	0.025	0.250	0.313	1.97	1.57	-	55.4	1.38
3-wo-40	12	D	1	0.054	0.025	0.250	0.313	1.97	1.57	-	55.4	1.51
1-wo-30	12	D	1	0.054	0.025	0.250	0.313	1.97	1.18	-	55.4	1.43
2-wo-30	12	D	1	0.054	0.025	0.250	0.313	1.97	1.18	-	55.4	1.44
3-wo-50	12	D	1	0.054	0.025	0.250	0.313	1.97	1.18	-	55.4	1.40
1-wo-20	12	D	1	0.054	0.025	0.250	0.313	1.97	0.79	-	55.4	1.32
2-wo-20	12	D	1	0.054	0.025	0.250	0.313	1.97	0.79	-	55.4	1.39

**Table B2: Continued**

Specimen Notation	Source	Double /Single Shear	Number of Bolts Used	t-1 (in.)	t-2 (in.)	d (in.)	h (in.)	s (in.)	e (in.)	e1 (in.)	F <sub>u</sub> (ksi)	P <sub>t</sub> (kip)
3-wo-20	12	D	1	0.054	0.025	0.250	0.313	1.97	0.79	-	55.4	1.48
1-wo-20-t5	12	D	1	0.054	0.025	0.250	0.313	1.97	0.79	-	55.4	1.63
2-wo-20-t5	12	D	1	0.054	0.025	0.250	0.313	1.97	0.79	-	55.4	1.49
3-wo-20-t5	12	D	1	0.054	0.025	0.250	0.313	1.97	0.79	-	55.4	1.45
1-wo-20-t15	12	D	1	0.054	0.025	0.250	0.313	1.97	0.79	-	55.4	1.60
2-wo-20-t15	12	D	1	0.054	0.025	0.250	0.313	1.97	0.79	-	55.4	1.46
3-wo-20-t15	12	D	1	0.054	0.025	0.250	0.313	1.97	0.79	-	55.4	1.73
1-wo-30-50	12	D	2	0.054	0.025	0.250	0.313	1.97	1.18	50	55.4	3.25
2-wo-30-50	12	D	2	0.054	0.025	0.250	0.313	1.97	1.18	50	55.4	3.44
3-wo-30-50	12	D	2	0.054	0.025	0.250	0.313	1.97	1.18	50	55.4	3.18
1-wo-30-40	12	D	2	0.054	0.025	0.250	0.313	1.97	1.18	40	55.4	3.18

2-wo-30-40	12	D	2	0.054	0.025	0.250	0.313	1.97	1.18	40	55.4	3.27
3-wo-30-40	12	D	2	0.054	0.025	0.250	0.313	1.97	1.18	40	55.4	3.19
1-wo-30-30	12	D	2	0.054	0.025	0.250	0.313	1.97	1.18	30	55.4	3.40
2-wo-30-30	12	D	2	0.054	0.025	0.250	0.313	1.97	1.18	30	55.4	3.45
3-wo-30-30	12	D	2	0.054	0.025	0.250	0.313	1.97	1.18	30	55.4	3.14
1-wo-40-5/8	12	D	1	0.054	0.025	0.375	0.438	1.97	1.57	-	55.4	1.63
2-wo-40-5/8	12	D	1	0.054	0.025	0.375	0.438	1.97	1.57	-	55.4	1.69
3-wo-40-5/8	12	D	1	0.054	0.025	0.375	0.438	1.97	1.57	-	55.4	1.72
1-wo-30-5/16	12	D	1	0.054	0.025	0.313	0.375	1.97	1.18	-	55.4	1.76
2-wo-30-5/16	12	D	1	0.054	0.025	0.313	0.375	1.97	1.18	-	55.4	1.48
3-wo-30-5/16	12	D	1	0.054	0.025	0.313	0.375	1.97	1.18	-	55.4	1.57
1-wo-ss-5/16	12	S	1	0.025	0.025	0.313	0.375	1.97	1.18	-	55.4	0.73
2-wo-ss-5/16	12	S	1	0.025	0.025	0.313	0.375	1.97	1.18	-	55.4	0.73
3-wo-ss-5/16	12	S	1	0.025	0.025	0.313	0.375	1.97	1.18	-	55.4	0.76
1-wo-sst-5/16	12	S	1	0.054	0.054	0.313	0.375	1.97	1.18	-	55.4	2.05
2-wo-sst-5/16	12	S	1	0.054	0.054	0.313	0.375	1.97	1.18	-	55.4	1.91
3-wo-sst-5/16	12	S	1	0.054	0.054	0.313	0.375	1.97	1.18	-	55.4	1.86
1-wo-sst-1/4	12	S	1	0.054	0.054	0.250	0.313	1.97	1.18	-	55.4	2.06
2-wo-sst-1/4	12	S	1	0.054	0.054	0.250	0.313	1.97	1.18	-	55.4	2.00
3-wo-sst-1/4	12	S	1	0.054	0.054	0.250	0.313	1.97	1.18	-	55.4	2.03
1-wo-mix-1/4	12	S	1	0.054	0.025	0.250	0.313	1.97	1.18	-	55.4	0.79
2-wo-mix-1/4	12	S	1	0.054	0.025	0.250	0.313	1.97	1.18	-	55.4	0.78
3-wo-mix-1/4	12	S	1	0.054	0.025	0.250	0.313	1.97	1.18	-	55.4	0.84
1-wo-ss-1/4	12	S	1	0.025	0.025	0.250	0.313	1.97	1.18	-	55.4	0.73
2-wo-ss-1/4	12	S	1	0.025	0.025	0.250	0.313	1.97	1.18	-	55.4	0.74
1-wo-50-1/2	12	D	1	0.054	0.025	0.500	0.563	1.97	1.97	-	55.4	2.20
2-wo-50-1/2	12	D	1	0.054	0.025	0.500	0.563	1.97	1.97	-	55.4	2.16
3-wo-50-1/2	12	D	1	0.054	0.025	0.500	0.563	1.97	1.97	-	55.4	2.06
1-wo-ss-1/2	12	S	1	0.054	0.025	0.500	0.563	1.97	1.97	-	55.4	0.95
2-wo-ss-1/2	12	S	1	0.054	0.025	0.500	0.563	1.97	1.97	-	55.4	1.00
3-wo-ss-1/2	12	S	1	0.054	0.025	0.500	0.563	1.97	1.97	-	55.4	0.90
1-wo-50-5/8	12	D	1	0.054	0.025	0.625	0.688	1.97	1.97	-	55.4	2.32
2-wo-50-5/8	12	D	1	0.054	0.025	0.625	0.688	1.97	1.97	-	55.4	2.32
3-wo-50-5/8	12	D	1	0.054	0.025	0.625	0.688	1.97	1.97	-	55.4	2.31
1-wo-ss-5/8	12	S	1	0.054	0.025	0.625	0.688	1.97	1.97	-	55.4	1.23
2-wo-ss-5/8	12	S	1	0.054	0.025	0.625	0.688	1.97	1.97	-	55.4	1.22
3-wo-ss-5/8	12	S	1	0.054	0.025	0.625	0.688	1.97	1.97	-	55.4	1.22

**Table B3: Geometric Properties and Test Loads of Inside Sheet of Double Shear Bolted Specimens With and Without Washers**

Specimen Notation	Source	Double /Single Shear	Washer Y/N	Number of Bolts Used	t-1 (in.)	t-2 (in.)	d (in.)	h (in.)	s (in.)	e (in.)	F <sub>u</sub> (ksi)	P <sub>t</sub> (kip)
20A41DS	3	D	Y	1	0.036	0.036	0.250	0.281	10.0 0	1.13	41.9	1.86
16C403DS	3	D	Y	1	0.059	0.059	0.500	0.563	10.0 0	2.00	44.0	6.62
16C503DS	3	D	Y	1	0.059	0.059	0.500	0.563	10.0 0	2.50	44.0	7.20
14E35DS	4	D	Y	1	0.078	0.078	0.750	0.813	10.0 0	2.63	70.4	14.22
10E36DS	4	D	Y	1	0.143	0.143	1.000	1.063	10.0 0	3.50	71.9	28.51
10E46DS	4	D	Y	1	0.143	0.143	1.000	1.063	10.0 0	4.50	71.9	28.81
16FAX-L15	5	D	Y	1	0.062	0.062	0.500	0.563	10.0 0	1.75	45.9	5.02



16FAX-L17	5	D	Y	1	0.062	0.062	0.500	0.563	10.0	1.75	45.9	4.22
12FAX-L20	5	D	Y	1	0.106	0.106	0.500	0.563	10.0	1.75	44.1	8.44
12FAX-L21	5	D	Y	1	0.106	0.106	0.500	0.563	10.0	1.75	44.1	9.46
1205X-L7	5	D	Y	1	0.106	0.106	0.750	0.813	10.0	2.63	81.6	20.03
1205X-L8	5	D	Y	1	0.106	0.106	0.750	0.813	10.0	2.63	81.6	18.76
1205X-L9	5	D	Y	1	0.106	0.106	0.875	0.938	10.0	3.06	81.6	22.45
7Y-L32	5	D	Y	1	0.183	0.183	0.625	0.688	10.0	2.19	81.6	28.25
DS1-1	6	D	Y	1	0.116	0.116	0.875	0.938	10.0	3.06	49.4	16.40
DS1-2	6	D	Y	1	0.116	0.116	0.875	0.938	10.0	3.06	49.4	15.10
DS2-1	6	D	Y	1	0.115	0.115	1.000	1.063	10.0	3.50	49.4	16.00
DS2-2	6	D	Y	1	0.116	0.116	1.000	1.063	10.0	3.50	49.4	16.60
DS3-1	6	D	Y	1	0.181	0.181	0.875	0.938	10.0	3.06	62.1	33.25
DS3-2	6	D	Y	1	0.180	0.180	0.875	0.938	10.0	3.06	62.1	30.89
DS4-1	6	D	Y	1	0.182	0.182	1.000	1.063	10.0	3.50	62.1	41.70
DS4-2	6	D	Y	1	0.181	0.181	1.000	1.063	10.0	3.50	62.1	40.50
B-0-21-1-0-DS	8	D	N	1	0.036	0.036	0.250	0.281	3.25	0.84	48.9	1.88
B-0-21-2-0-DS	8	D	N	1	0.036	0.036	0.250	0.281	3.25	0.88	48.9	1.90
B-0-21-3-L-DS	8	D	N	1	0.036	0.036	0.250	0.281	3.25	0.89	48.9	1.90
B-0-21-4-L-DS	8	D	N	1	0.036	0.036	0.250	0.281	3.25	0.88	48.9	1.92
B-0-21-5-0-DS	8	D	N	1	0.036	0.036	0.250	0.281	3.25	0.88	48.9	1.94
B-0-21-6-0-DS	8	D	N	1	0.036	0.036	0.250	0.281	3.25	0.91	48.9	2.03
B-0-21-7-L-DS	8	D	N	1	0.036	0.036	0.250	0.281	3.25	0.28	48.9	2.18
B-0-21-8-L-DS	8	D	N	1	0.036	0.036	0.250	0.281	3.25	0.88	48.9	2.05
B-0-21-9-H-DS	8	D	N	1	0.036	0.036	0.250	0.281	3.25	0.88	48.9	2.24
B-0-21-10-H-DS	8	D	N	1	0.036	0.036	0.250	0.281	3.25	0.88	48.9	2.00
B-0-22-1-0-DS	8	D	N	1	0.036	0.036	0.500	0.563	6.25	1.75	48.9	2.56
B-0-22-2-0-DS	8	D	N	1	0.036	0.036	0.500	0.563	6.25	1.75	48.9	2.49
B-0-22-3-L-DS	8	D	N	1	0.036	0.036	0.500	0.563	6.25	1.75	48.9	2.88
B-0-22-4-L-DS	8	D	N	1	0.036	0.036	0.500	0.563	6.25	1.75	48.9	2.43
B-0-22-7-L-DS	8	D	N	1	0.036	0.036	0.500	0.563	6.25	1.75	48.9	2.70
B-0-22-8-L-DS	8	D	N	1	0.036	0.036	0.500	0.563	6.25	1.75	48.9	2.72
B-0-22-9-H-DS	8	D	N	1	0.036	0.036	0.500	0.563	6.25	1.75	48.9	2.65
B-0-22-10-H-DS	8	D	N	1	0.036	0.036	0.500	0.563	6.25	1.78	48.9	2.86
B-0-49-1-0-DS	8	D	N	1	0.071	0.071	0.500	0.563	6.70	1.78	69.3	9.58
B-0-49-2-0-DS	8	D	N	1	0.071	0.071	0.500	0.563	6.70	1.81	69.3	8.40
B-0-49-3-L-DS	8	D	N	1	0.071	0.071	0.500	0.563	6.70	1.78	69.3	8.82
B-0-49-4-L-DS	8	D	N	1	0.071	0.071	0.500	0.563	6.70	1.78	69.3	8.95
B-0-49-5-H-DS	8	D	N	1	0.071	0.071	0.500	0.563	6.70	1.78	69.3	9.20
B-0-49-6-H-DS	8	D	N	1	0.071	0.071	0.500	0.563	6.70	1.78	69.3	9.50
B-0-50-1-0-DS	8	D	N	1	0.071	0.071	0.750	0.813	10.0	2.63	69.3	12.25
B-0-50-2-0-DS	8	D	N	1	0.071	0.071	0.750	0.813	10.0	2.63	69.3	11.90

**Table B3: Continued**

Specimen Notation	Source	Double /Single Shear	Washer Y/N	Number of Bolts Used	t-1 (in.)	t-2 (in.)	d (in.)	h (in.)	s (in.)	e (in.)	F <sub>u</sub> (ksi)	P <sub>t</sub> (kip)
B-0-50-3-L-DS	8	D	N	1	0.071	0.071	0.750	0.813	10.0	2.63	69.3	12.45
B-0-50-4-L-DS	8	D	N	1	0.071	0.071	0.750	0.813	10.0	2.63	69.3	11.65
B-0-50-5-0-DS	8	D	N	1	0.071	0.071	0.750	0.813	10.0	2.63	69.3	11.35
B-0-50-6-0-DS	8	D	N	1	0.071	0.071	0.750	0.813	10.0	2.63	69.3	10.85
B-0-50-7-L-DS	8	D	N	1	0.071	0.071	0.750	0.813	10.0	2.63	69.3	12.00
B-0-50-8-L-DS	8	D	N	1	0.071	0.071	0.750	0.813	10.0	2.63	69.3	10.08
B-0-50-9-H-DS	8	D	N	1	0.071	0.071	0.750	0.813	10.0	2.63	69.3	14.00
B-0-50-10-H-DS	8	D	N	1	0.071	0.071	0.750	0.813	10.0	2.63	69.3	12.03
B-0-53-1-0-DS	8	D	N	1	0.184	0.184	0.750	0.813	10.0	2.63	70.7	35.50
B-0-53-2-0-DS	8	D	N	1	0.184	0.184	0.750	0.813	10.0	2.69	70.7	34.90
B-0-53-3-L-DS	8	D	N	1	0.184	0.184	0.750	0.813	10.0	2.63	70.7	36.40
B-0-53-4-L-DS	8	D	N	1	0.184	0.184	0.750	0.813	10.0	2.66	70.7	36.15
B-0-53-5-H-DS	8	D	N	1	0.184	0.184	0.750	0.813	10.0	2.56	70.7	36.10
B-1-19-1-O-DS	8	D	Y	1	0.036	0.036	0.250	0.281	3.25	0.88	48.9	1.92
B-1-19-2-O-DS	8	D	Y	1	0.036	0.036	0.250	0.281	3.25	0.89	48.9	1.82
B-1-19-3-L-DS	8	D	Y	1	0.036	0.036	0.250	0.281	3.25	0.88	48.9	2.12
B-1-19-4-L-DS	8	D	Y	1	0.036	0.036	0.250	0.281	3.25	0.88	48.9	2.09
B-1-19-5-O-DS	8	D	Y	1	0.036	0.036	0.250	0.281	3.25	0.89	48.9	1.96
B-1-19-6-O-DS	8	D	Y	1	0.036	0.036	0.250	0.281	3.25	0.88	48.9	1.55
B-1-19-7-L-DS	8	D	Y	1	0.036	0.036	0.250	0.281	3.25	0.88	48.9	1.98
B-1-19-8-L-DS	8	D	Y	1	0.036	0.036	0.250	0.281	3.25	0.88	48.9	2.17
B-1-19-9-H-DS	8	D	Y	1	0.036	0.036	0.250	0.281	3.25	0.88	48.9	2.44
B-1-19-10-H-DS	8	D	Y	1	0.036	0.036	0.250	0.281	3.25	0.88	48.9	2.33
B-1-20-1-O-DS	8	D	Y	1	0.036	0.036	0.500	0.563	6.25	1.75	48.9	3.04
B-1-20-2-O-DS	8	D	Y	1	0.036	0.036	0.500	0.563	6.25	1.75	48.9	2.94
B-1-20-3-L-DS	8	D	Y	1	0.036	0.036	0.500	0.563	6.25	1.75	48.9	3.86
B-1-20-4-L-DS	8	D	Y	1	0.036	0.036	0.500	0.563	6.25	1.75	48.9	3.74
B-1-20-5-O-DS	8	D	Y	1	0.036	0.036	0.500	0.563	6.25	1.81	48.9	2.89
B-1-20-6-O-DS	8	D	Y	1	0.036	0.036	0.500	0.563	6.25	1.75	48.9	3.38
B-1-20-8-L-DS	8	D	Y	1	0.036	0.036	0.500	0.563	6.25	1.75	48.9	4.11
B-1-20-9-H-DS	8	D	Y	1	0.036	0.036	0.500	0.563	6.25	1.78	48.9	4.42
B-1-20-10-H-DS	8	D	Y	1	0.036	0.036	0.500	0.563	6.25	1.75	48.9	4.47
B-1-27-1-O-DS	8	D	Y	1	0.074	0.074	0.500	0.563	6.50	1.88	53.7	7.28
B-1-27-2-O-DS	8	D	Y	1	0.074	0.074	0.500	0.563	6.50	1.81	53.7	7.48
B-1-27-3-L-DS	8	D	Y	1	0.074	0.074	0.500	0.563	6.50	1.88	53.7	10.55
B-1-27-4-L-DS	8	D	Y	1	0.074	0.074	0.500	0.563	6.50	1.91	53.7	10.25
B-1-27-5-O-DS	8	D	Y	1	0.074	0.074	0.500	0.563	6.50	1.81	53.7	7.20
B-1-27-6-O-DS	8	D	Y	1	0.074	0.074	0.500	0.563	6.50	1.81	53.7	7.63

B-1-27-7-L-DS	8	D	Y	1	0.074	0.074	0.500	0.563	6.50	1.81	53.7	10.75
B-1-27-8-L-DS	8	D	Y	1	0.074	0.074	0.500	0.563	6.50	1.78	53.7	9.75
B-1-27-9-H-DS	8	D	Y	1	0.074	0.074	0.500	0.563	6.50	1.84	53.7	10.35
B-1-27-10-H-DS	8	D	Y	1	0.074	0.074	0.500	0.563	6.50	1.88	53.7	9.65
B-1-28-1-O-DS	8	D	Y	1	0.074	0.074	0.750	0.813	10.0	2.47	53.7	10.85
B-1-28-2-O-DS	8	D	Y	1	0.074	0.074	0.750	0.813	10.0	2.56	53.7	13.30
B-1-28-3-L-DS	8	D	Y	1	0.074	0.074	0.750	0.813	10.0	2.50	53.7	13.45
B-1-28-4-L-DS	8	D	Y	1	0.074	0.074	0.750	0.813	10.0	2.47	53.7	14.30
B-1-28-5-O-DS	8	D	Y	1	0.074	0.074	0.750	0.813	10.0	2.63	53.7	10.75
B-1-28-6-O-DS	8	D	Y	1	0.074	0.074	0.750	0.813	10.0	2.66	53.7	11.95

**Table B3: Continued**

Specimen Notation	Source	Double /Single Shear	Washer Y/N	Number of Bolts Used	t-1 (in.)	t-2 (in.)	d (in.)	h (in.)	s (in.)	e (in.)	F <sub>u</sub> (ksi)	P <sub>t</sub> (kip)
B-1-28-7-L-DS	8	D	Y	1	0.074	0.074	0.750	0.813	10.0	2.63	53.7	13.85
B-1-28-8-L-DS	8	D	Y	1	0.074	0.074	0.750	0.813	10.0	2.56	53.7	12.95
B-1-28-9-H-DS	8	D	Y	1	0.074	0.074	0.750	0.813	10.0	2.63	53.7	15.70
B-1-28-10-H-DS	8	D	Y	1	0.074	0.074	0.750	0.813	10.0	2.66	53.7	13.65
B-1-40-1-O-DS	8	D	Y	1	0.031	0.031	0.500	0.563	6.50	1.75	74.5	2.76
B-1-40-2-O-DS	8	D	Y	1	0.031	0.031	0.500	0.563	6.50	1.75	74.5	2.83
B-1-40-3-L-DS	8	D	Y	1	0.031	0.031	0.500	0.563	6.50	1.75	74.5	4.07
B-1-40-4-L-DS	8	D	Y	1	0.031	0.031	0.500	0.563	6.50	1.75	74.5	3.95
B-1-40-5-O-DS	8	D	Y	1	0.031	0.031	0.500	0.563	6.50	1.75	74.5	2.80
B-1-40-6-O-DS	8	D	Y	1	0.031	0.031	0.500	0.563	6.50	1.75	74.5	2.83
B-1-40-7-L-DS	8	D	Y	1	0.031	0.031	0.500	0.563	6.50	1.75	74.5	4.09
B-1-40-8-L-DS	8	D	Y	1	0.031	0.031	0.500	0.563	6.50	1.75	74.5	4.04
B-1-40-9-H-DS	8	D	Y	1	0.031	0.031	0.500	0.563	6.50	1.75	74.5	4.48
B-1-40-10-H-DS	8	D	Y	1	0.031	0.031	0.500	0.563	6.50	1.75	74.5	4.63
B-1-39-1-O-DS	8	D	Y	1	0.031	0.031	0.250	0.281	3.25	0.88	74.5	1.70
B-1-39-2-O-DS	8	D	Y	1	0.031	0.031	0.250	0.281	3.25	0.88	74.5	1.75
B-1-39-3-L-DS	8	D	Y	1	0.031	0.031	0.250	0.281	3.25	0.88	74.5	2.50
B-1-39-4-L-DS	8	D	Y	1	0.031	0.031	0.250	0.281	3.25	0.88	74.5	2.49
B-1-39-5-H-DS	8	D	Y	1	0.031	0.031	0.250	0.281	3.25	0.88	74.5	2.41
B-1-47-1-O-DS	8	D	Y	1	0.071	0.071	0.500	0.563	6.88	1.81	69.3	10.10
B-1-47-2-O-DS	8	D	Y	1	0.071	0.071	0.500	0.563	6.88	1.81	69.3	10.00
B-1-47-3-L-DS	8	D	Y	1	0.071	0.071	0.500	0.563	6.70	1.75	69.3	10.10
B-1-47-4-L-DS	8	D	Y	1	0.071	0.071	0.500	0.563	6.70	1.78	69.3	10.58
B-1-47-5-H-DS	8	D	Y	1	0.071	0.071	0.500	0.563	6.70	1.81	69.3	11.43
B-1-48-1-O-DS	8	D	Y	1	0.071	0.071	0.750	0.813	10.0	2.63	69.3	11.75
B-1-48-2-O-DS	8	D	Y	1	0.071	0.071	0.750	0.813	10.0	2.63	69.3	12.35
B-1-48-3-L-DS	8	D	Y	1	0.071	0.071	0.750	0.813	10.0	2.63	69.3	14.68
B-1-48-4-L-DS	8	D	Y	1	0.071	0.071	0.750	0.813	10.0	2.63	69.3	14.25

B-1-48-5-O-DS	8	D	Y	1	0.071	0.071	0.750	0.813	10.0	2.63	69.3	12.45
B-1-48-6-O-DS	8	D	Y	1	0.071	0.071	0.750	0.813	0	2.63	69.3	13.15
B-1-48-7-L-DS	8	D	Y	1	0.071	0.071	0.750	0.813	0	2.63	69.3	12.92
B-1-48-8-L-DS	8	D	Y	1	0.071	0.071	0.750	0.813	0	2.63	69.3	13.85
B-1-48-9-H-DS	8	D	Y	1	0.071	0.071	0.750	0.813	0	2.63	69.3	15.68
B-1-48-10-H-DS	8	D	Y	1	0.071	0.071	0.750	0.813	0	2.63	69.3	13.50

## Appendix C – Calculations and Comparisons

**Table C1: Comparisons of Single Shear and Outside Sheets of Double Shear Bolted Specimens With Washers**

Specimen Notation	Source	$P_t$ (kip)	$P_c$ (AISI-96) (kip)	$P_t/P_c$	$P_c$ (S136-94) (kip)	$P_t/P_c$	$P_c$ (Proposed AISI Ballot) (kip)	$P_t/P_c$
ay22-1	1	5.80	5.67	1.02	5.67	1.02	5.67	1.02
ay22-2	1	5.73	5.51	1.04	5.51	1.04	5.51	1.04
ay23-1	1	5.96	5.51	1.08	5.51	1.08	5.51	1.08
ay23-3	1	6.00	5.51	1.09	5.51	1.09	5.51	1.09
by13-1	1	4.85	7.04	0.69	5.91	0.82	6.59	0.74
by13-2	1	5.08	7.20	0.71	6.19	0.82	6.81	0.75
by13-3	1	4.79	7.37	0.65	6.49	0.74	7.04	0.68
ay12-1	1	2.45	3.52	0.70	2.96	0.83	3.29	0.74
ay12-2	1	2.42	3.60	0.67	3.10	0.78	3.41	0.71
by12-1	1	5.37	7.54	0.71	6.78	0.79	7.26	0.74
by12-2	1	5.13	7.54	0.68	6.78	0.76	7.26	0.71
by12-3	1	5.33	7.04	0.76	5.91	0.90	6.59	0.81
by22-1	1	9.63	11.18	0.86	11.18	0.86	11.18	0.86
by22-2	1	9.53	11.02	0.86	11.02	0.86	11.02	0.86
by22-3	1	9.53	11.02	0.86	11.02	0.86	11.02	0.86
20A41SS	3	1.87	1.13	1.66	1.13	1.66	1.13	1.66
14A43SS	3	7.10	5.21	1.36	5.21	1.36	5.21	1.36
12Y-L8	3	9.74	8.68	1.12	8.68	1.12	8.68	1.12
12Y-L9	3	14.15	11.58	1.22	11.58	1.22	11.58	1.22
12Y-L16	3	11.18	11.58	0.97	11.58	0.97	11.58	0.97
12Y-L18	3	12.16	17.36	0.70	17.36	0.70	17.36	0.70
20ZT12	3	1.85	2.14	0.86	2.14	0.86	2.14	0.86
20A24SS	3	2.82	2.82	1.00	1.88	1.50	2.13	1.32
IOE36SS	4	24.63	32.96	0.75	32.96	0.75	32.96	0.75
14E25SS	4	10.00	12.36	0.81	12.36	0.81	12.36	0.81
16FAXL17	5	4.28	4.27	1.00	4.27	1.00	4.27	1.00
12Y-L7	5	12.67	11.58	1.09	11.58	1.09	11.58	1.09
12Y-L11	5	8.59	8.68	0.99	8.68	0.99	8.68	0.99
12Y-L10	5	13.52	14.47	0.93	14.47	0.93	14.47	0.93
7Y-T5	5	25.53	37.59	0.68	37.59	0.68	37.59	0.68
16FAX-L16	5	4.80	4.27	1.12	4.27	1.12	4.27	1.12
12Y-L12	5	11.18	11.58	0.97	11.58	0.97	11.58	0.97
12Y-L15	5	7.71	8.68	0.89	8.68	0.89	8.68	0.89
7Y-L6	5	42.14	34.50	1.22	34.50	1.22	34.50	1.22
16FAX-L16	5	4.72	4.27	1.11	4.27	1.11	4.27	1.11
12Y-L12	5	11.12	11.36	0.98	11.36	0.98	11.36	0.98
12Y-L14	5	22.90	17.04	1.34	17.04	1.34	17.04	1.34
7Y-L6	5	42.47	34.22	1.24	34.22	1.24	34.22	1.24
20Z-T11	5	3.04	5.52	0.55	4.31	0.71	5.00	0.61
12Y-L18	5	12.10	16.94	0.71	16.94	0.71	16.94	0.71
SS2	6	16.09	15.05	1.07	15.05	1.07	15.05	1.07
SS2-1	6	12.31	15.05	0.82	15.05	0.82	15.05	0.82
SS3	6	15.15	15.05	1.01	15.05	1.01	15.05	1.01
SS5	6	15.53	17.21	0.90	17.21	0.90	17.21	0.90

**Table C1: Continued**

Specimen Notation	Source	P <sub>t</sub> (kip)	P <sub>c</sub> (AISI-96) (kip)	P <sub>t</sub> /P <sub>c</sub>	P <sub>c</sub> (S136-94) (kip)	P <sub>t</sub> /P <sub>c</sub>	P <sub>c</sub> (Proposed AISI Ballot) (kip)	P <sub>t</sub> /P <sub>c</sub>
SS5-1	6	13.64	17.21	0.79	17.21	0.79	17.21	0.79
SS6	6	15.34	17.21	0.89	17.21	0.89	17.21	0.89
SS8	6	33.00	29.50	1.12	29.50	1.12	29.50	1.12
SS8-1	6	24.80	29.50	0.84	29.50	0.84	29.50	0.84
SS9	6	32.75	30.15	1.09	30.15	1.09	30.15	1.09
SS11	6	36.80	34.27	1.07	34.27	1.07	34.27	1.07
SS11-1	6	30.30	34.27	0.88	34.27	0.88	34.27	0.88
SS12	6	35.30	34.27	1.03	34.27	1.03	34.27	1.03
1	7	3.70	3.27	1.13	2.42	1.53	2.89	1.28
2	7	3.66	3.27	1.12	2.42	1.51	2.89	1.27
5	7	2.12	2.04	1.04	2.04	1.04	2.04	1.04
6	7	2.20	2.04	1.08	2.04	1.08	2.04	1.08
8	7	3.24	3.27	0.99	2.42	1.34	2.89	1.12
10	7	3.84	3.27	1.17	2.42	1.59	2.89	1.33
12	7	4.05	3.83	1.06	3.83	1.06	3.83	1.06
13	7	4.23	3.83	1.10	3.83	1.10	3.83	1.10
21	7	5.28	6.78	0.78	6.78	0.78	6.78	0.78
22	7	5.12	6.78	0.76	6.78	0.76	6.78	0.76
23	7	12.30	13.56	0.91	13.56	0.91	13.56	0.91
11	7	3.97	3.27	1.21	2.42	1.64	2.89	1.38
B-1-15-1-O-SS	8	1.55	1.32	1.18	1.32	1.18	1.32	1.18
B-1-15-2-O-SS	8	1.55	1.32	1.18	1.32	1.18	1.32	1.18
B-1-15-3-L-SS	8	1.79	1.32	1.36	1.32	1.36	1.32	1.36
B-1-15-4-L-SS	8	1.67	1.32	1.27	1.32	1.27	1.32	1.27
B-1-15-5-H-SS	8	1.83	1.32	1.39	1.32	1.39	1.32	1.39
B-1-15-6-H-SS	8	1.85	1.32	1.40	1.32	1.40	1.32	1.40
B-1-24-1-O-SS	8	9.00	8.94	1.01	8.82	1.02	8.90	1.01
B-1-24-2-O-SS	8	9.28	8.94	1.04	8.82	1.05	8.90	1.04
B-1-24-4-L-SS	8	10.75	8.94	1.20	8.82	1.22	8.90	1.21
B-1-35-1-O-SS	8	1.88	1.73	1.09	1.73	1.09	1.73	1.09
B-1-35-2-O-SS	8	2.00	1.73	1.15	1.73	1.15	1.73	1.15
B-1-35-3-L-SS	8	2.05	1.73	1.18	1.73	1.18	1.73	1.18
B-1-35-4-L-SS	8	1.83	1.73	1.06	1.73	1.06	1.73	1.06
B-1-35-5-H-SS	8	2.07	1.73	1.19	1.73	1.19	1.73	1.19
B-1-35-6-H-SS	8	2.03	1.73	1.17	1.73	1.17	1.73	1.17
B-1-44-1-O-SS	8	11.10	11.07	1.00	10.48	1.06	10.86	1.02
B-1-44-3-O-SS	8	12.20	11.07	1.10	10.48	1.16	10.86	1.12
B-1-16-1-0-SS	8	3.37	2.64	1.28	1.90	1.77	2.30	1.47
B-1-16-2-0-SS	8	3.21	2.64	1.22	1.90	1.69	2.30	1.40
B-1-16-3-L-SS	8	2.64	2.64	1.00	1.90	1.39	2.30	1.15
B-1-16-4-L-SS	8	2.80	2.64	1.06	1.90	1.47	2.30	1.22
B-1-24-5-0-SS	8	7.20	8.94	0.81	8.82	0.82	8.90	0.81
B-1-24-6-0-SS	8	7.15	8.94	0.80	8.82	0.81	8.90	0.80
B-1-24-7-L-SS	8	7.55	8.94	0.84	8.82	0.86	8.90	0.85
B-1-24-8-L-SS	8	6.80	8.94	0.76	8.82	0.77	8.90	0.76
B-1-24-9-H-SS	8	8.70	8.94	0.97	8.82	0.99	8.90	0.98
B-1-24-10-H-SS	8	8.00	8.94	0.89	8.82	0.91	8.90	0.90
B-1-36-1-0-SS	8	2.60	3.46	0.75	2.31	1.13	2.76	0.94

**Table C1: Continued**

Specimen Notation	Source	P <sub>t</sub> (kip)	P <sub>c</sub> (AISI-96) (kip)	P <sub>t</sub> /P <sub>c</sub>	P <sub>c</sub> (S136-94) (kip)	P <sub>t</sub> /P <sub>c</sub>	P <sub>c</sub> (Proposed AISI Ballot)	P <sub>t</sub> /P <sub>c</sub>
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							(kip)	
B-1-36-2-0-SS	8	2.49	3.46	0.72	2.31	1.08	2.76	0.90
B-1-36-3-L-SS	8	2.94	3.46	0.85	2.31	1.27	2.76	1.07
B-1-36-4-L-SS	8	2.96	3.46	0.85	2.31	1.28	2.76	1.07
B-1-36-5-0-SS	8	2.37	3.46	0.68	2.31	1.03	2.76	0.86
B-1-36-6-0-SS	8	2.29	3.46	0.66	2.31	0.99	2.76	0.83
B-1-36-7-L-SS	8	2.46	3.46	0.71	2.31	1.07	2.76	0.89
B-1-36-8-L-SS	8	2.36	3.46	0.68	2.31	1.02	2.76	0.86
B-1-36-10-H-SS	8	3.32	3.46	0.96	2.31	1.44	2.76	1.20
B-1-43-1-0-SS	8	6.58	7.38	0.89	7.38	0.89	7.38	0.89
B-1-44-4-L-SS	8	11.55	11.07	1.04	10.48	1.10	10.86	1.06
B-1-44-5-0-SS	8	8.25	11.07	0.75	10.48	0.79	10.86	0.76
B-1-44-8-L-SS	8	8.15	11.07	0.74	10.48	0.78	10.86	0.75
B-1-44-9-H-SS	8	8.50	11.07	0.77	10.48	0.81	10.86	0.78
B-1-8-3-1-SS	9	1.37	1.46	0.94	0.98	1.41	1.22	1.12
B-1-3-3-T-SS	9	1.22	1.46	0.83	0.98	1.25	1.22	1.00
B-1-9-1-T-SS	9	1.44	1.40	1.03	0.94	1.54	1.14	1.26
B-1-9-2-T-SS	9	1.24	1.40	0.88	0.94	1.32	1.14	1.09
B-1-9-3-T-SS	9	1.71	1.40	1.22	0.94	1.83	1.14	1.50
1W	9	2.41	2.49	0.97	1.74	1.38	2.13	1.13
2W	9	1.82	1.87	0.98	1.74	1.04	1.82	1.00
3W	9	7.24	7.68	0.94	7.68	0.94	7.68	0.94
4W	9	9.30	9.60	0.97	9.60	0.97	9.60	0.97
080-G550-B1-48X75-M12-ILc	10	4.07	4.27	0.95	2.85	1.43	3.53	1.15
080-G550-B1-48X75-M12-ITc	10	4.02	4.65	0.86	3.10	1.30	3.85	1.05
080-G550-B1-48X75-M12-IDc	10	3.98	4.32	0.92	2.88	1.38	3.57	1.11
100-G550-B1-48X75-M12-ILc	10	5.15	5.10	1.01	4.20	1.22	4.74	1.09
100-G550-B1-48X75-M12-ITc	10	5.04	5.59	0.90	4.61	1.09	5.20	0.97
100-G550-B1-48X75-M12-IDc	10	4.20	5.22	0.80	4.31	0.98	4.85	0.87
080-G300-B1-48X75-M12-ILc	10	3.19	2.62	1.22	1.75	1.83	2.17	1.47
080-G300-B1-48X75-M12-ITc	10	3.06	2.64	1.16	1.76	1.74	2.18	1.40
080-G300-B1-48X75-M12-IDc	10	3.26	2.70	1.21	1.80	1.81	2.23	1.46
042-G550-B1-36x75-M12-CL	10	1.35	2.39	0.57	1.59	0.85	1.43	0.94
042-G550-B1-36x75-M12-IL	10	1.66	2.39	0.70	1.59	1.04	1.43	1.16
042-G550-B1-48x75-M12-CL	10	1.63	2.39	0.68	1.59	1.03	1.43	1.14
042-G550-B1-48x75-M12-IL	10	1.74	2.39	0.73	1.59	1.10	1.43	1.22
042-G550-B1-60x75-M12-CL	10	1.48	2.39	0.62	1.59	0.93	1.43	1.03
042-G550-B1-60x75-M12-IL	10	1.67	2.39	0.70	1.59	1.05	1.43	1.17
042-G550-B1-36x75-M12-CT	10	1.41	2.71	0.52	1.81	0.78	1.63	0.87
042-G550-B1-36x75-M12-IT	10	1.77	2.71	0.65	1.81	0.98	1.63	1.09
042-G550-B1-48x75-M12-CT	10	1.75	2.71	0.65	1.81	0.97	1.63	1.08
042-G550-B1-48x75-M12-IT	10	1.78	2.71	0.66	1.81	0.99	1.63	1.10
042-G550-B1-60x75-M12-CT	10	1.51	2.71	0.56	1.81	0.84	1.63	0.93
042-G550-B1-60x75-M12-IT	10	1.60	2.71	0.59	1.81	0.88	1.63	0.98
042-G550-B1-36x75-M12-CD	10	1.72	2.43	0.71	1.62	1.06	1.46	1.18
042-G550-B1-36x75-M12-ID	10	1.47	2.43	0.61	1.62	0.91	1.46	1.01
042-G550-B1-48x75-M12-CD	10	1.62	2.43	0.67	1.62	1.00	1.46	1.11
042-G550-B1-48x75-M12-ID	10	1.61	2.43	0.66	1.62	0.99	1.46	1.10
042-G550-B1-60x75-M12-CD	10	1.28	2.43	0.53	1.62	0.79	1.46	0.88

**Table C1: Continued**

Specimen Notation	Source	$P_t$ (kip)	$P_c$ (AISI-96) (kip)	$P_t/P_c$	$P_c$ (S136-94) (kip)	$P_t/P_c$	$P_c$ (Proposed AISI Ballot) (kip)	$P_t/P_c$
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042-G550-B1-60x75-M12-ID	10	1.66	2.43	0.69	1.62	1.03	1.46	1.14
060-G550-B1-36x75-M12-IL	10	2.25	3.36	0.67	2.24	1.00	2.20	1.02
060-G550-B1-48x75-M12-IL	10	2.21	3.36	0.66	2.24	0.99	2.20	1.00
060-G550-B1-60x75-M12-IL	10	2.50	3.36	0.74	2.24	1.12	2.20	1.13
060-G550-B1-36x75-M12-IT	10	2.27	3.75	0.61	2.50	0.91	2.46	0.92
060-G550-B1-48x75-M12-IT	10	2.47	3.75	0.66	2.50	0.99	2.46	1.01
060-G550-B1-60x75-M12-IT	10	2.14	3.75	0.57	2.50	0.86	2.46	0.87
060-G550-B1-36x75-M12-ID	10	2.36	3.38	0.70	2.25	1.05	2.21	1.07
060-G550-B1-48x75-M12-ID	10	2.17	3.38	0.64	2.25	0.97	2.21	0.98
060-G550-B1-60x75-M12-ID	10	2.07	3.38	0.61	2.25	0.92	2.21	0.94
060-G300-B1-36x75-M12-IL	10	1.39	2.02	0.69	1.35	1.03	1.30	1.07
060-G300-B1-48x75-M12-IL	10	1.43	2.02	0.71	1.35	1.06	1.30	1.10
060-G300-B1-60x75-M12-IL	10	1.44	2.02	0.71	1.35	1.07	1.30	1.10
060-G300-B1-36x75-M12-IT	10	1.36	2.01	0.68	1.34	1.02	1.29	1.05
060-G300-B1-48x75-M12-IT	10	1.39	2.01	0.69	1.34	1.04	1.29	1.07
060-G300-B1-60x75-M12-IT	10	1.41	2.01	0.70	1.34	1.05	1.29	1.09
060-G300-B1-36x75-M12-ID	10	1.49	2.05	0.73	1.37	1.09	1.32	1.13
060-G300-B1-48x75-M12-ID	10	1.50	2.05	0.73	1.37	1.10	1.32	1.14
060-G300-B1-60x75-M12-ID	10	1.46	2.05	0.71	1.37	1.07	1.32	1.11
042-G550-B1W-36x75-M12-CL	10	1.46	2.39	0.61	1.59	0.92	1.43	1.02
042-G550-B1W-36x75-M12-IL	10	1.69	2.39	0.71	1.59	1.06	1.43	1.18
042-G550-B1W-48x75-M12-CL	10	1.66	2.39	0.70	1.59	1.05	1.43	1.16
042-G550-B1W-48x75-M12-IL	10	1.70	2.39	0.71	1.59	1.07	1.43	1.19
042-G550-B1W-36x75-M12-CT	10	1.47	2.71	0.54	1.81	0.82	1.63	0.91
042-G550-B1W-36x75-M12-IT	10	1.74	2.71	0.64	1.81	0.96	1.63	1.07
042-G550-B1W-48x75-M12-CT	10	1.52	2.71	0.56	1.81	0.84	1.63	0.93
042-G550-B1W-48x75-M12-IT	10	1.61	2.71	0.59	1.81	0.89	1.63	0.99
042-G550-B1W-36x75-M12-CD	10	1.45	2.43	0.60	1.62	0.90	1.46	0.99
042-G550-B1W-36x75-M12-ID	10	1.55	2.43	0.64	1.62	0.96	1.46	1.06
042-G550-B1W-48x75-M12-CD	10	1.57	2.43	0.65	1.62	0.97	1.46	1.08
042-G550-B1W-48x75-M12-ID	10	1.57	2.43	0.65	1.62	0.97	1.46	1.08
060-G550-B1W-36x75-M12-IL	10	2.59	3.36	0.77	2.24	1.16	2.20	1.18
060-G550-B1W-48x75-M12-IL	10	2.45	3.36	0.73	2.24	1.09	2.20	1.11
060-G550-B1W-36x75-M12-IT	10	2.52	3.75	0.67	2.50	1.01	2.46	1.02
060-G550-B1W-48x75-M12-IT	10	2.41	3.75	0.64	2.50	0.96	2.46	0.98
060-G550-B1W-36x75-M12-ID	10	2.19	3.38	0.65	2.25	0.97	2.21	0.99
060-G550-B1W-48x75-M12-ID	10	2.72	3.38	0.81	2.25	1.21	2.21	1.23
060-G300-B1W-36x75-M12-IL	10	1.65	2.02	0.82	1.35	1.23	1.30	1.27
060-G300-B1W-48x75-M12-IL	10	2.04	2.02	1.01	1.35	1.51	1.30	1.57
060-G300-B1W-36x75-M12-IT	10	1.76	2.01	0.88	1.34	1.31	1.29	1.36
060-G300-B1W-48x75-M12-IT	10	2.03	2.01	1.01	1.34	1.52	1.29	1.57
060-G300-B1W-36x75-M12-ID	10	1.94	2.05	0.95	1.37	1.42	1.32	1.47
060-G300-B1W-48x75-M12-ID	10	2.16	2.05	1.05	1.37	1.58	1.32	1.64
060-G550-B1W-36x75-M12-IT-E4	10	2.27	3.75	0.61	2.50	0.91	2.46	0.92

**Table C1: Continued**

Specimen Notation	Source	$P_t$ (kip)	$P_c$ (AISI-96) (kip)	$P_t/P_c$	$P_c$ (S136-94) (kip)	$P_t/P_c$	$P_c$ (Proposed AISI Ballot) (kip)	$P_t/P_c$
060-G550-B1W-48x75-M12-IT-E6	10	2.38	3.75	0.64	2.50	0.95	2.46	0.97
060-G550-B1W-36x75-M12-ID-E4	10	2.22	3.38	0.66	2.25	0.99	2.21	1.00



060-G550-B1W-48x75-M12-ID-E6	10	2.61	3.38	0.77	2.25	1.16	2.21	1.18
080-G550-B2-48x95-M12-ILc	10	7.19	8.54	0.84	5.69	1.26	7.06	1.02
080-G550-B2-48x95-M12-ITc	10	7.04	9.31	0.76	6.21	1.13	7.70	0.91
080-G550-B2-48x95-M12-IDc	10	6.43	8.63	0.74	5.75	1.12	7.14	0.90
100-G550-B2-48x95-M12-ILc	10	8.77	10.19	0.86	8.41	1.04	9.47	0.93
100-G550-B2-48x95-M12-ITc	10	7.94	11.19	0.71	9.23	0.86	10.39	0.76
100-G550-B2-48x95-M12-IDc	10	9.28	10.45	0.89	8.62	1.08	9.71	0.96
080-G300-B2-48x95-M12-ILc	10	5.04	5.24	0.96	3.50	1.44	4.34	1.16
080-G300-B2-48x95-M12-ITc	10	4.77	5.28	0.90	3.52	1.35	4.37	1.09
080-G300-B2-48x95-M12-IDc	10	5.22	5.40	0.97	3.60	1.45	4.46	1.17
042-G550-B2-48x75-M12-CL	10	2.92	4.77	0.61	3.18	0.92	2.86	1.02
042-G550-B2-48x75-M12-IL	10	3.03	4.77	0.64	3.18	0.95	2.86	1.06
042-G550-B2-48x95-M12-CL	10	3.03	4.77	0.64	3.18	0.95	2.86	1.06
042-G550-B2-48x95-M12-IL	10	3.08	4.77	0.65	3.18	0.97	2.86	1.08
042-G550-B2-48x75-M12-CT	10	2.83	5.42	0.52	3.61	0.78	3.25	0.87
042-G550-B2-48x75-M12-IT	10	3.44	5.42	0.63	3.61	0.95	3.25	1.06
042-G550-B2-48x95-M12-CT	10	3.06	5.42	0.56	3.61	0.85	3.25	0.94
042-G550-B2-48x95-M12-IT	10	3.24	5.42	0.60	3.61	0.90	3.25	1.00
042-G550-B2-48x75-M12-CD	10	2.81	4.85	0.58	3.23	0.87	2.91	0.97
042-G550-B2-48x75-M12-ID	10	3.01	4.85	0.62	3.23	0.93	2.91	1.03
042-G550-B2-48x95-M12-CD	10	2.50	4.85	0.51	3.23	0.77	2.91	0.86
042-G550-B2-48x95-M12-ID	10	2.92	4.85	0.60	3.23	0.90	2.91	1.00
060-G550-B2-48x75-M12-ILc	10	4.59	6.71	0.68	4.48	1.02	4.40	1.04
060-G550-B2-48x95-M12-ILc	10	5.17	6.71	0.77	4.48	1.16	4.40	1.18
060-G550-B2-48x75-M12-IL-E10c	10	4.97	6.71	0.74	4.48	1.11	4.40	1.13
060-G550-B2-48x75-M12-ITc	10	4.97	7.50	0.66	5.00	0.99	4.91	1.01
060-G550-B2-48x95-M12-ITc	10	5.01	7.50	0.67	5.00	1.00	4.91	1.02
060-G550-B2-48x75-M12-IT-E15c	10	4.92	7.50	0.66	5.00	0.99	4.91	1.00
060-G550-B2-48x75-M12-IDc	10	4.97	6.75	0.74	4.50	1.10	4.42	1.12
060-G550-B2-48x95-M12-IDc	10	4.72	6.75	0.70	4.50	1.05	4.42	1.07
060-G550-B2-48x75-M12-ID-E20c	10	5.17	6.75	0.77	4.50	1.15	4.42	1.17
060-G300-B2-48x95-M12-ILc	10	3.46	4.05	0.86	2.70	1.28	2.60	1.33
060-G300-B2-48x95-M12-ITc	10	3.46	4.02	0.86	2.68	1.29	2.59	1.34
060-G300-B2-48x95-M12-IDc	10	3.62	4.10	0.88	2.74	1.32	2.64	1.37
-----	11	4.05	3.83	1.06	3.83	1.06	3.83	1.06
-----	11	4.23	3.83	1.10	3.83	1.10	3.83	1.10
-----	11	6.15	6.78	0.91	6.78	0.91	6.78	0.91
-----	11	3.70	3.27	1.13	2.42	1.53	2.89	1.28

**Table C1: Continued**

Specimen Notation	Source	$P_t$ (kip)	$P_c$ (AISI-96) (kip)	$P_t/P_c$	$P_c$ (S136-94) (kip)	$P_t/P_c$	$P_c$ (Proposed AISI Ballot) (kip)	$P_t/P_c$
-----	11	3.66	3.27	1.12	2.42	1.51	2.89	1.27
-----	11	2.26	2.18	1.04	2.18	1.04	2.18	1.04
-----	11	2.35	2.18	1.08	2.18	1.08	2.18	1.08
-----	11	3.84	3.27	1.17	2.42	1.59	2.89	1.33
-----	11	3.97	3.27	1.21	2.42	1.64	2.89	1.38
1-ww-50	12	1.96	1.98	0.99	1.98	0.99	1.98	0.99
2-ww-50	12	1.88	1.98	0.95	1.98	0.95	1.98	0.95
3-ww-50	12	1.84	1.98	0.93	1.98	0.93	1.98	0.93
1-ww-40	12	1.83	1.98	0.93	1.98	0.93	1.98	0.93
2-ww-40	12	2.25	1.98	1.13	1.98	1.13	1.98	1.13
3-ww-40	12	2.18	1.98	1.10	1.98	1.10	1.98	1.10
1-ww-30	12	1.85	1.98	0.94	1.98	0.94	1.98	0.94
2-ww-30	12	1.87	1.98	0.95	1.98	0.95	1.98	0.95
3-ww-30	12	2.33	1.98	1.18	1.98	1.18	1.98	1.18
1-ww-20	12	1.91	1.98	0.96	1.98	0.96	1.98	0.96
2-ww-20	12	2.02	1.98	1.02	1.98	1.02	1.98	1.02
3-ww-20	12	1.93	1.98	0.98	1.98	0.98	1.98	0.98
1-ww-20-t5	12	2.04	1.98	1.03	1.98	1.03	1.98	1.03
2-ww-20-t5	12	1.91	1.98	0.97	1.98	0.97	1.98	0.97
3-ww-20-t5	12	1.88	1.98	0.95	1.98	0.95	1.98	0.95
1-ww-20-t15	12	1.98	1.98	1.00	1.98	1.00	1.98	1.00
2-ww-20-t15	12	2.29	1.98	1.16	1.98	1.16	1.98	1.16
3-ww-20-t15	12	2.08	1.98	1.05	1.98	1.05	1.98	1.05
1-ww-30-50	12	4.12	3.96	1.04	3.96	1.04	3.96	1.04
2-ww-30-50	12	4.15	3.96	1.05	3.96	1.05	3.96	1.05
3-ww-30-50	12	4.19	3.96	1.06	3.96	1.06	3.96	1.06
1-ww-30-40	12	4.15	3.96	1.05	3.96	1.05	3.96	1.05
2-ww-30-40	12	4.26	3.96	1.08	3.96	1.08	3.96	1.08
3-ww-30-40	12	4.11	3.96	1.04	3.96	1.04	3.96	1.04
1-ww-30-30	12	4.06	3.96	1.03	3.96	1.03	3.96	1.03
2-ww-30-30	12	4.29	3.96	1.08	3.96	1.08	3.96	1.08
3-ww-30-30	12	4.25	3.96	1.07	3.96	1.07	3.96	1.07
1-ww-40-5/8	12	2.17	2.97	0.73	1.99	1.09	2.49	0.87
2-ww-40-5/8	12	2.15	2.97	0.72	1.99	1.08	2.49	0.86
3-ww-40-5/8	12	2.28	2.97	0.77	1.99	1.14	2.49	0.92
1-ww-30-5/16	12	1.87	2.47	0.76	1.99	0.94	2.28	0.82
2-ww-30-5/16	12	2.36	2.47	0.95	1.99	1.18	2.28	1.04
3-ww-30-5/16	12	2.38	2.47	0.96	1.99	1.19	2.28	1.04
1-ww-ss-5/16	12	1.07	1.31	0.82	1.06	1.02	1.20	0.89
2-ww-ss-5/16	12	1.17	1.31	0.89	1.06	1.11	1.20	0.97
3-ww-ss-5/16	12	1.07	1.31	0.81	1.06	1.01	1.20	0.88
1-ww-sst-5/16	12	3.29	2.67	1.24	2.67	1.24	2.67	1.24
2-ww-sst-5/16	12	2.82	2.67	1.06	2.67	1.06	2.67	1.06
3-ww-sst-5/16	12	2.78	2.67	1.04	2.67	1.04	2.67	1.04
1-ww-sst-1/4	12	2.74	2.13	1.29	2.13	1.29	2.13	1.29
2-ww-sst-1/4	12	2.74	2.13	1.28	2.13	1.28	2.13	1.28
3-ww-sst-1/4	12	2.67	2.13	1.25	2.13	1.25	2.13	1.25
1-ww-mix-1/4	12	1.07	0.99	1.09	0.99	1.09	0.99	1.09

**Table C1: Continued**

Specimen Notation	Source	P <sub>t</sub> (kip)	P <sub>c</sub> (AISI-96) (kip)	P <sub>t</sub> /P <sub>c</sub>	P <sub>c</sub> (S136-94) (kip)	P <sub>t</sub> /P <sub>c</sub>	P <sub>c</sub> (Proposed AISI Ballot) (kip)	P <sub>t</sub> /P <sub>c</sub>
2-ww-mix-1/4	12	1.02	0.99	1.03	0.99	1.03	0.99	1.03
3-ww-mix-1/4	12	0.95	0.99	0.96	0.99	0.96	0.99	0.96
1-ww-ss-1/4	12	1.01	1.05	0.96	1.05	0.96	1.05	0.96
2-ww-ss-1/4	12	0.91	1.05	0.87	1.05	0.87	1.05	0.87
3-ww-ss-1/4	12	1.02	1.05	0.97	1.05	0.97	1.05	0.97
1-ww-50-1/2	12	3.30	3.96	0.83	2.64	1.25	2.66	1.24
2-ww-50-1/2	12	3.42	3.96	0.86	2.64	1.29	2.66	1.28
3-ww-50-1/2	12	2.87	3.96	0.73	2.64	1.09	2.66	1.08
1-ww-ss-1/2	12	1.42	1.98	0.72	1.32	1.08	1.33	1.07
2-ww-ss-1/2	12	1.43	1.98	0.72	1.32	1.08	1.33	1.08
3-ww-ss-1/2	12	1.35	1.98	0.68	1.32	1.02	1.33	1.01
1-ww-50-5/8	12	3.12	4.95	0.63	3.30	0.95	2.97	1.05
2-ww-50-5/8	12	3.15	4.95	0.64	3.30	0.95	2.97	1.06
3-ww-50-5/8	12	3.09	4.95	0.62	3.30	0.94	2.97	1.04
1-ww-ss-5/8	12	1.50	2.47	0.61	1.65	0.91	1.48	1.01
2-ww-ss-5/8	12	1.59	2.47	0.64	1.65	0.96	1.48	1.07
3-ww-ss-5/8	12	1.47	2.47	0.60	1.65	0.89	1.48	0.99

<b>Count :</b>	<b>289</b>	<b>289</b>	<b>289</b>
<b>Mean :</b>	<b>0.879</b>	<b>1.076</b>	<b>1.052</b>
<b>S.D. :</b>	<b>0.212</b>	<b>0.219</b>	<b>0.175</b>
<b>C.O.V. :</b>	<b>0.241</b>	<b>0.203</b>	<b>0.167</b>

**Table C2: Comparisons of Single Shear and Outside Sheets of Double Shear Bolted Specimens Without Washers**

Specimen Notation	Source	P <sub>t</sub> (kip)	P <sub>c</sub> (AISI-96) (kip)	P <sub>t</sub> /P <sub>c</sub>	P <sub>c</sub> (S136-94) (kip)	P <sub>t</sub> /P <sub>c</sub>	P <sub>c</sub> (Proposed AISI Ballot) (kip)	P <sub>t</sub> /P <sub>c</sub>
an32-1	1	8.09	6.94	1.16	9.38	0.86	7.04	1.15
an32-2	1	8.20	6.83	1.20	9.23	0.89	6.92	1.19
an33-1	1	9.00	6.94	1.30	9.38	0.96	7.04	1.28
an33-2	1	8.95	7.06	1.27	9.54	0.94	7.16	1.25
bn33-1	1	14.60	14.01	1.04	18.93	0.77	14.20	1.03
bn33-2	1	14.38	14.01	1.03	18.93	0.76	14.20	1.01
dn12-2	1	4.74	5.33	0.89	6.19	0.77	5.11	0.93
dn12-3	1	4.74	5.21	0.91	5.91	0.80	4.94	0.96
dn22-1	1	8.43	8.15	1.03	11.02	0.77	8.26	1.02
dn22-2	1	8.50	8.27	1.03	11.18	0.76	8.38	1.01
bn32-1	1	14.46	13.89	1.04	18.77	0.77	14.08	1.03
bn32-2	1	14.69	13.77	1.07	18.61	0.79	13.96	1.05
dn32-1	1	15.75	14.12	1.12	19.09	0.83	14.32	1.10
dn32-2	1	16.08	13.89	1.16	18.77	0.86	14.08	1.14
en12-1	1	8.65	10.66	0.81	12.39	0.70	10.22	0.85
en12-2	1	8.70	10.66	0.82	12.39	0.70	10.22	0.85
en22-1	1	15.77	16.54	0.95	22.35	0.71	16.76	0.94
en22-2	1	15.74	16.77	0.94	22.67	0.69	17.00	0.93

**Table C2: Continued**

Specimen Notation	Source	P <sub>t</sub> (kip)	P <sub>c</sub> (AISI-96)	P <sub>t</sub> /P <sub>c</sub>	P <sub>c</sub> (S136-94)	P <sub>t</sub> /P <sub>c</sub>	P <sub>c</sub> (Proposed)	P <sub>t</sub> /P <sub>c</sub>
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			(kip)		(kip)		AISI Ballot (kip)	
en32-1	1	28.83	27.78	1.04	37.54	0.77	28.15	1.02
en32-2	1	29.00	27.54	1.05	37.22	0.78	27.92	1.04
24	7	2.46	2.42	1.02	2.42	1.02	2.16	1.14
25	7	1.83	1.51	1.21	2.04	0.90	1.53	1.19
26	7	1.60	1.51	1.06	2.04	0.78	1.53	1.04
29	7	2.39	2.42	0.99	2.42	0.99	2.16	1.10
32	7	2.26	2.42	0.93	2.42	0.93	2.16	1.04
34	7	2.31	2.42	0.95	2.42	0.95	2.16	1.07
36	7	2.36	2.42	0.98	2.42	0.98	2.16	1.09
55	7	2.89	2.84	1.02	3.83	0.75	2.87	1.01
56	7	2.98	2.84	1.05	3.83	0.78	2.87	1.04
57	7	2.94	2.84	1.04	3.83	0.77	2.87	1.02
75	7	8.60	8.67	0.99	11.71	0.73	8.79	0.98
76	7	8.15	8.67	0.94	11.71	0.70	8.79	0.93
77	7	9.17	8.67	1.06	11.71	0.78	8.79	1.04
78	7	12.50	12.23	1.02	16.52	0.76	12.39	1.01
60	7	5.57	5.67	0.98	7.67	0.73	5.75	0.97
63	7	8.98	8.39	1.07	11.34	0.79	8.50	1.06
58	7	5.24	5.32	0.99	7.19	0.73	5.39	0.97
59	7	5.39	5.32	1.01	7.19	0.75	5.39	1.00
52	7	4.32	4.84	0.89	4.84	0.89	4.33	1.00
66	7	13.10	9.13	1.43	9.13	1.43	8.17	1.60
67	7	13.50	9.13	1.48	9.13	1.48	8.17	1.65
B-0-32-9-H-SS	8	0.81	0.67	1.20	0.61	1.34	0.53	1.53
B-0-32-9-H-SS	8	0.65	0.67	0.97	0.61	1.07	0.53	1.23
B-0-7-1-T-SS	9	2.86	2.85	1.01	3.54	0.81	2.80	1.02
B-0-7-2-T-SS	9	3.19	2.85	1.12	3.54	0.90	2.80	1.14
B-0-7-3-T-SS	9	4.51	2.91	1.55	3.69	1.22	2.88	1.56
B-0-7-4-T-SS	9	3.87	2.91	1.33	3.69	1.05	2.88	1.34
1	9	1.33	1.86	0.72	1.76	0.76	1.61	0.82
2	9	0.98	1.39	0.70	1.76	0.56	1.38	0.71
3	9	3.86	5.68	0.68	7.68	0.50	5.76	0.67
4	9	4.99	7.10	0.70	9.60	0.52	7.20	0.69
C-M/17-1	11	2.89	2.84	1.02	3.83	0.75	2.87	1.01
C-M/17-2	11	2.98	2.84	1.05	3.83	0.78	2.87	1.04
C-M/17-3	11	2.94	2.84	1.04	3.83	0.77	2.87	1.02
C-M/17-4	11	1.75	1.77	0.99	2.40	0.73	1.80	0.97
C-M/17-5	11	1.80	1.77	1.01	2.40	0.75	1.80	1.00
C-M/17-6	11	2.79	2.84	0.98	3.83	0.73	2.87	0.97
C-M/16-7	11	4.49	5.02	0.89	6.78	0.66	5.09	0.88
C-M/14-8	11	8.60	8.67	0.99	11.71	0.73	8.79	0.98
C-M/14-9	11	8.15	8.67	0.94	11.71	0.70	8.79	0.93
C-M/14-10	11	9.17	8.67	1.06	11.71	0.78	8.79	1.04
C-M/12-11	11	12.50	12.23	1.02	16.52	0.76	12.39	1.01
C-M/17-12	11	2.86	2.84	1.01	3.83	0.75	2.87	1.00
C-M/17-13	11	2.90	2.84	1.02	3.83	0.76	2.87	1.01

**Table C2: Continued**

Specimen Notation	Source	$P_t$ (kip)	$P_c$ (AISI-96) (kip)	$P_t/P_c$	$P_c$ (S136-94) (kip)	$P_t/P_c$	$P_c$ (Proposed AISI Ballot) (kip)	$P_t/P_c$
1-wo-50	12	1.41	1.55	0.91	2.09	0.68	1.57	0.90

2-wo-50	12	1.56	1.55	1.01	2.09	0.75	1.57	0.99
3-wo-50	12	1.47	1.55	0.95	2.09	0.70	1.57	0.94
1-wo-40	12	1.49	1.55	0.96	2.09	0.71	1.57	0.95
2-wo-40	12	1.38	1.55	0.89	2.09	0.66	1.57	0.88
3-wo-40	12	1.51	1.55	0.97	2.09	0.72	1.57	0.96
1-wo-30	12	1.43	1.55	0.93	2.09	0.68	1.57	0.91
2-wo-30	12	1.44	1.55	0.93	2.09	0.69	1.57	0.92
3-wo-50	12	1.40	1.55	0.91	2.09	0.67	1.57	0.89
1-wo-20	12	1.32	1.55	0.85	2.09	0.63	1.57	0.84
2-wo-20	12	1.39	1.55	0.90	2.09	0.67	1.57	0.89
3-wo-20	12	1.48	1.55	0.96	2.09	0.71	1.57	0.95
1-wo-20-t5	12	1.63	1.55	1.05	2.09	0.78	1.57	1.04
2-wo-20-t5	12	1.49	1.55	0.96	2.09	0.71	1.57	0.95
3-wo-20-t5	12	1.45	1.55	0.94	2.09	0.69	1.57	0.92
1-wo-20-t15	12	1.60	1.55	1.03	2.09	0.76	1.57	1.02
2-wo-20-t15	12	1.46	1.55	0.94	2.09	0.70	1.57	0.93
3-wo-20-t15	12	1.73	1.55	1.12	2.09	0.83	1.57	1.10
1-wo-30-50	12	3.25	3.10	1.05	4.19	0.78	3.14	1.03
2-wo-30-50	12	3.44	3.10	1.11	4.19	0.82	3.14	1.09
3-wo-30-50	12	3.18	3.10	1.03	4.19	0.76	3.14	1.01
1-wo-30-40	12	3.18	3.10	1.03	4.19	0.76	3.14	1.01
2-wo-30-40	12	3.27	3.10	1.06	4.19	0.78	3.14	1.04
3-wo-30-40	12	3.19	3.10	1.03	4.19	0.76	3.14	1.01
1-wo-30-30	12	3.40	3.10	1.10	4.19	0.81	3.14	1.08
2-wo-30-30	12	3.45	3.10	1.11	4.19	0.82	3.14	1.10
3-wo-30-30	12	3.14	3.10	1.01	4.19	0.75	3.14	1.00
1-wo-40-5/8	12	1.63	2.32	0.70	2.11	0.77	1.97	0.83
2-wo-40-5/8	12	1.69	2.32	0.73	2.11	0.80	1.97	0.86
3-wo-40-5/8	12	1.72	2.32	0.74	2.11	0.82	1.97	0.87
1-wo-30-5/16	12	1.76	1.94	0.91	2.11	0.83	1.81	0.97
2-wo-30-5/16	12	1.48	1.94	0.76	2.11	0.70	1.81	0.82
3-wo-30-5/16	12	1.57	1.94	0.81	2.11	0.74	1.81	0.87
1-wo-ss-5/16	12	0.73	0.97	0.75	1.06	0.69	0.90	0.80
2-wo-ss-5/16	12	0.73	0.97	0.76	1.06	0.70	0.90	0.81
3-wo-ss-5/16	12	0.76	0.97	0.79	1.06	0.72	0.90	0.85
1-wo-sst-5/16	12	2.05	2.09	0.98	2.82	0.73	2.12	0.97
2-wo-sst-5/16	12	1.91	2.09	0.92	2.82	0.68	2.12	0.90
3-wo-sst-5/16	12	1.86	2.09	0.89	2.82	0.66	2.12	0.88
1-wo-sst-1/4	12	2.06	1.67	1.23	2.26	0.91	1.69	1.22
2-wo-sst-1/4	12	2.00	1.67	1.20	2.26	0.89	1.69	1.18
3-wo-sst-1/4	12	2.03	1.67	1.21	2.26	0.90	1.69	1.20
1-wo-mix-1/4	12	0.79	0.77	1.02	1.05	0.76	0.79	1.01
2-wo-mix-1/4	12	0.78	0.77	1.01	1.05	0.75	0.79	0.99
3-wo-mix-1/4	12	0.84	0.77	1.08	1.05	0.80	0.79	1.07
1-wo-ss-1/4	12	0.73	0.77	0.95	1.05	0.70	0.79	0.94
2-wo-ss-1/4	12	0.74	0.77	0.96	1.05	0.71	0.79	0.94
1-wo-50-1/2	12	2.20	3.10	0.71	2.79	0.79	2.11	1.04

**Table C2: Continued**

Specimen Notation	Source	$P_t$ (kip)	$P_c$ (AISI-96) (kip)	$P_t/P_c$	$P_c$ (S136-94) (kip)	$P_t/P_c$	$P_c$ (Proposed AISI Ballot) (kip)	$P_t/P_c$
2-wo-50-1/2	12	2.16	3.10	0.70	2.79	0.77	2.11	1.03
3-wo-50-1/2	12	2.06	3.10	0.66	2.79	0.74	2.11	0.98
1-wo-ss-1/2	12	0.95	1.55	0.62	1.40	0.68	1.06	0.90
2-wo-ss-1/2	12	1.00	1.55	0.64	1.40	0.71	1.06	0.94

3-wo-ss-1/2	12	0.90	1.55	0.58	1.40	0.64	1.06	0.85
1-wo-50-5/8	12	2.32	3.87	0.60	3.49	0.66	2.36	0.98
2-wo-50-5/8	12	2.32	3.87	0.60	3.49	0.67	2.36	0.99
3-wo-50-5/8	12	2.31	3.87	0.60	3.49	0.66	2.36	0.98
1-wo-ss-5/8	12	1.23	1.94	0.63	1.75	0.70	1.18	1.04
2-wo-ss-5/8	12	1.22	1.94	0.63	1.75	0.70	1.18	1.04
3-wo-ss-5/8	12	1.22	1.94	0.63	1.75	0.70	1.18	1.03

<b>Count :</b>	<b>123</b>	<b>123</b>	<b>123</b>
<b>Mean :</b>	<b>0.965</b>	<b>0.783</b>	<b>1.012</b>
<b>S. D. :</b>	<b>0.182</b>	<b>0.144</b>	<b>0.153</b>
<b>C.O.V. :</b>	<b>0.188</b>	<b>0.183</b>	<b>0.151</b>

**Table C3: Comparisons of Inside Sheet of Double Shear Bolted Specimens  
With and Without Washers**

Specimen Notation	Source	$P_t$ (kip)	$P_c$ (AISI-96) (kip)	$P_t/P_c$	$P_c$ (S136-94) (kip)	$P_t/P_c$	$P_c$ (Proposed AISI Ballot) (kip)	$P_t/P_c$
20A41DS	3	1.86	1.13	1.64	1.13	1.64	1.50	1.24
16C403DS	3	6.62	3.89	1.70	3.89	1.70	5.17	1.28
16C503DS	3	7.20	3.89	1.85	3.89	1.85	5.17	1.39
14E35DS	4	14.22	12.36	1.15	12.36	1.15	16.43	0.87
10E36DS	4	28.51	30.82	0.92	30.82	0.92	41.00	0.70
10E46DS	4	28.81	30.82	0.93	30.82	0.93	41.00	0.70
16FAX-L15	5	5.02	4.27	1.18	4.27	1.18	5.68	0.88
16FAX-L17	5	4.22	4.27	0.99	4.27	0.99	5.68	0.74
12FAX-L20	5	8.44	7.01	1.20	7.01	1.20	9.33	0.90
12FAX-L21	5	9.46	7.01	1.35	7.01	1.35	9.33	1.01
1205X-L7	5	20.03	19.46	1.03	19.46	1.03	25.88	0.77
1205X-L8	5	18.76	19.46	0.96	19.46	0.96	25.88	0.72
1205X-L9	5	22.45	22.71	0.99	22.71	0.99	30.20	0.74
7Y-L32	5	28.25	28.00	1.01	28.00	1.01	37.24	0.76
DS1-1	6	16.40	15.05	1.09	15.05	1.09	20.02	0.82
DS1-2	6	15.10	15.05	1.00	15.05	1.00	20.02	0.75
DS2-1	6	16.00	17.06	0.94	17.06	0.94	22.69	0.71
DS2-2	6	16.60	17.21	0.96	17.21	0.96	22.88	0.73
DS3-1	6	33.25	29.50	1.13	29.50	1.13	39.23	0.85
DS3-2	6	30.89	29.33	1.05	29.33	1.05	39.01	0.79
DS4-1	6	41.70	33.90	1.23	33.90	1.23	45.08	0.92
DS4-2	6	40.50	33.71	1.20	33.71	1.20	44.83	0.90

**Table C3: Continued**

Specimen Notation	Source	$P_t$ (kip)	$P_c$ (AISI-96) (kip)	$P_t/P_c$	$P_c$ (S136-94) (kip)	$P_t/P_c$	$P_c$ (Proposed AISI Ballot) (kip)	$P_t/P_c$
B-0-21-1-0-DS	8	1.88	1.32	1.43	1.32	1.43	1.75	1.07
B-0-21-2-0-DS	8	1.90	1.32	1.44	1.32	1.44	1.75	1.08
B-0-21-3-L-DS	8	1.90	1.32	1.44	1.32	1.44	1.75	1.08
B-0-21-4-L-DS	8	1.92	1.32	1.46	1.32	1.46	1.75	1.09
B-0-21-5-0-DS	8	1.94	1.32	1.47	1.32	1.47	1.75	1.11
B-0-21-6-0-DS	8	2.03	1.32	1.54	1.32	1.54	1.75	1.16
B-0-21-7-L-DS	8	2.18	1.32	1.65	1.32	1.65	1.75	1.24

B-0-21-8-L-DS	8	2.05	1.32	1.55	1.32	1.55	1.75	1.17
B-0-21-9-H-DS	8	2.24	1.32	1.70	1.32	1.70	1.75	1.28
B-0-21-10-H-DS	8	2.00	1.32	1.52	1.32	1.52	1.75	1.14
B-0-22-1-0-DS	8	2.56	2.64	0.97	1.90	1.35	3.05	0.84
B-0-22-2-0-DS	8	2.49	2.64	0.94	1.90	1.31	3.05	0.82
B-0-22-3-L-DS	8	2.88	2.64	1.09	1.90	1.52	3.05	0.94
B-0-22-4-L-DS	8	2.43	2.64	0.92	1.90	1.28	3.05	0.80
B-0-22-7-L-DS	8	2.70	2.64	1.02	1.90	1.42	3.05	0.88
B-0-22-8-L-DS	8	2.72	2.64	1.03	1.90	1.43	3.05	0.89
B-0-22-9-H-DS	8	2.65	2.64	1.00	1.90	1.40	3.05	0.87
B-0-22-10-H-DS	8	2.86	2.64	1.08	1.90	1.51	3.05	0.94
B-0-49-1-0-DS	8	9.58	7.38	1.30	7.38	1.30	9.81	0.98
B-0-49-2-0-DS	8	8.40	7.38	1.14	7.38	1.14	9.81	0.86
B-0-49-3-L-DS	8	8.82	7.38	1.20	7.38	1.20	9.81	0.90
B-0-49-4-L-DS	8	8.95	7.38	1.21	7.38	1.21	9.81	0.91
B-0-49-5-H-DS	8	9.20	7.38	1.25	7.38	1.25	9.81	0.94
B-0-49-6-H-DS	8	9.50	7.38	1.29	7.38	1.29	9.81	0.97
B-0-50-1-0-DS	8	12.25	11.07	1.11	10.48	1.17	14.44	0.85
B-0-50-2-0-DS	8	11.90	11.07	1.08	10.48	1.14	14.44	0.82
B-0-50-3-L-DS	8	12.45	11.07	1.12	10.48	1.19	14.44	0.86
B-0-50-4-L-DS	8	11.65	11.07	1.05	10.48	1.11	14.44	0.81
B-0-50-5-0-DS	8	11.35	11.07	1.03	10.48	1.08	14.44	0.79
B-0-50-6-0-DS	8	10.85	11.07	0.98	10.48	1.04	14.44	0.75
B-0-50-7-L-DS	8	12.00	11.07	1.08	10.48	1.15	14.44	0.83
B-0-50-8-L-DS	8	10.08	11.07	0.91	10.48	0.96	14.44	0.70
B-0-50-9-H-DS	8	14.00	11.07	1.26	10.48	1.34	14.44	0.97
B-0-50-10-H-DS	8	12.03	11.07	1.09	10.48	1.15	14.44	0.83
B-0-53-1-0-DS	8	35.50	29.27	1.21	29.27	1.21	38.92	0.91
B-0-53-2-0-DS	8	34.90	29.27	1.19	29.27	1.19	38.92	0.90
B-0-53-3-L-DS	8	36.40	29.27	1.24	29.27	1.24	38.92	0.94
B-0-53-4-L-DS	8	36.15	29.27	1.24	29.27	1.24	38.92	0.93
B-0-53-5-H-DS	8	36.10	29.27	1.23	29.27	1.23	38.92	0.93
B-1-19-1-O-DS	8	1.92	1.32	1.46	1.32	1.46	1.75	1.09
B-1-19-2-O-DS	8	1.82	1.32	1.38	1.32	1.38	1.75	1.04
B-1-19-3-L-DS	8	2.12	1.32	1.61	1.32	1.61	1.75	1.21
B-1-19-4-L-DS	8	2.09	1.32	1.58	1.32	1.58	1.75	1.19
B-1-19-5-O-DS	8	1.96	1.32	1.49	1.32	1.49	1.75	1.12
B-1-19-6-O-DS	8	1.55	1.32	1.18	1.32	1.18	1.75	0.88
B-1-19-7-L-DS	8	1.98	1.32	1.50	1.32	1.50	1.75	1.13
B-1-19-8-L-DS	8	2.17	1.32	1.65	1.32	1.65	1.75	1.24
B-1-19-9-H-DS	8	2.44	1.32	1.85	1.32	1.85	1.75	1.39

**Table C3: Continued**

Specimen Notation	Source	$P_t$ (kip)	$P_c$ (AISI-96) (kip)	$P_t/P_c$	$P_c$ (S136-94) (kip)	$P_t/P_c$	$P_c$ (Proposed AISI Ballot) (kip)	$P_t/P_c$
B-1-19-10-H-DS	8	2.33	1.32	1.77	1.32	1.77	1.75	1.33
B-1-20-1-O-DS	8	3.04	2.64	1.15	1.90	1.60	3.05	1.00
B-1-20-2-O-DS	8	2.94	2.64	1.11	1.90	1.55	3.05	0.96
B-1-20-3-L-DS	8	3.86	2.64	1.46	1.90	2.03	3.05	1.26
B-1-20-4-L-DS	8	3.74	2.64	1.42	1.90	1.97	3.05	1.22
B-1-20-5-O-DS	8	2.89	2.64	1.10	1.90	1.52	3.05	0.95
B-1-20-6-O-DS	8	3.38	2.64	1.28	1.90	1.78	3.05	1.11
B-1-20-8-L-DS	8	4.11	2.64	1.56	1.90	2.16	3.05	1.35
B-1-20-9-H-DS	8	4.42	2.64	1.68	1.90	2.33	3.05	1.45
B-1-20-10-H-DS	8	4.47	2.64	1.69	1.90	2.35	3.05	1.46

B-1-27-1-O-DS	8	7.28	5.96	1.22	5.96	1.22	7.93	0.92
B-1-27-2-O-DS	8	7.48	5.96	1.25	5.96	1.25	7.93	0.94
B-1-27-3-L-DS	8	10.55	5.96	1.77	5.96	1.77	7.93	1.33
B-1-27-4-L-DS	8	10.25	5.96	1.72	5.96	1.72	7.93	1.29
B-1-27-5-O-DS	8	7.20	5.96	1.21	5.96	1.21	7.93	0.91
B-1-27-6-O-DS	8	7.63	5.96	1.28	5.96	1.28	7.93	0.96
B-1-27-7-L-DS	8	10.75	5.96	1.80	5.96	1.80	7.93	1.36
B-1-27-8-L-DS	8	9.75	5.96	1.64	5.96	1.64	7.93	1.23
B-1-27-9-H-DS	8	10.35	5.96	1.74	5.96	1.74	7.93	1.31
B-1-27-10-H-DS	8	9.65	5.96	1.62	5.96	1.62	7.93	1.22
B-1-28-1-O-DS	8	10.85	8.94	1.21	8.82	1.23	11.84	0.92
B-1-28-2-O-DS	8	13.30	8.94	1.49	8.82	1.51	11.84	1.12
B-1-28-3-L-DS	8	13.45	8.94	1.50	8.82	1.52	11.84	1.14
B-1-28-4-L-DS	8	14.30	8.94	1.60	8.82	1.62	11.84	1.21
B-1-28-5-O-DS	8	10.75	8.94	1.20	8.82	1.22	11.84	0.91
B-1-28-6-O-DS	8	11.95	8.94	1.34	8.82	1.35	11.84	1.01
B-1-28-7-L-DS	8	13.85	8.94	1.55	8.82	1.57	11.84	1.17
B-1-28-8-L-DS	8	12.95	8.94	1.45	8.82	1.47	11.84	1.09
B-1-28-9-H-DS	8	15.70	8.94	1.76	8.82	1.78	11.84	1.33
B-1-28-10-H-DS	8	13.65	8.94	1.53	8.82	1.55	11.84	1.15
B-1-40-1-O-DS	8	2.76	3.46	0.80	2.31	1.19	3.67	0.75
B-1-40-2-O-DS	8	2.83	3.46	0.82	2.31	1.23	3.67	0.77
B-1-40-3-L-DS	8	4.07	3.46	1.17	2.31	1.76	3.67	1.11
B-1-40-4-L-DS	8	3.95	3.46	1.14	2.31	1.71	3.67	1.08
B-1-40-5-O-DS	8	2.80	3.46	0.81	2.31	1.21	3.67	0.76
B-1-40-6-O-DS	8	2.83	3.46	0.82	2.31	1.23	3.67	0.77
B-1-40-7-L-DS	8	4.09	3.46	1.18	2.31	1.77	3.67	1.12
B-1-40-8-L-DS	8	4.04	3.46	1.17	2.31	1.75	3.67	1.10
B-1-40-9-H-DS	8	4.48	3.46	1.29	2.31	1.94	3.67	1.22
B-1-40-10-H-DS	8	4.63	3.46	1.34	2.31	2.00	3.67	1.26
B-1-39-1-O-DS	8	1.70	1.73	0.98	1.73	0.98	2.30	0.74
B-1-39-2-O-DS	8	1.75	1.73	1.01	1.73	1.01	2.30	0.76
B-1-39-3-L-DS	8	2.50	1.73	1.44	1.73	1.44	2.30	1.09
B-1-39-4-L-DS	8	2.49	1.73	1.44	1.73	1.44	2.30	1.08
B-1-39-5-H-DS	8	2.41	1.73	1.39	1.73	1.39	2.30	1.05
B-1-47-1-O-DS	8	10.10	7.38	1.37	7.38	1.37	9.81	1.03
B-1-47-2-O-DS	8	10.00	7.38	1.36	7.38	1.36	9.81	1.02
B-1-47-3-L-DS	8	10.10	7.38	1.37	7.38	1.37	9.81	1.03

**Table C3: Continued**

Specimen Notation	Source	$P_t$ (kip)	$P_c$ (AISI-96) (kip)	$P_t/P_c$	$P_c$ (S136-94) (kip)	$P_t/P_c$	$P_c$ (Proposed AISI Ballot) (kip)	$P_t/P_c$
B-1-47-4-L-DS	8	10.58	7.38	1.43	7.38	1.43	9.81	1.08
B-1-47-5-H-DS	8	11.43	7.38	1.55	7.38	1.55	9.81	1.16
B-1-48-1-O-DS	8	11.75	11.07	1.06	10.48	1.12	14.44	0.81
B-1-48-2-O-DS	8	12.35	11.07	1.12	10.48	1.18	14.44	0.86
B-1-48-3-L-DS	8	14.68	11.07	1.33	10.48	1.40	14.44	1.02
B-1-48-4-L-DS	8	14.25	11.07	1.29	10.48	1.36	14.44	0.99
B-1-48-5-O-DS	8	12.45	11.07	1.12	10.48	1.19	14.44	0.86
B-1-48-6-O-DS	8	13.15	11.07	1.19	10.48	1.26	14.44	0.91
B-1-48-7-L-DS	8	12.92	11.07	1.17	10.48	1.23	14.44	0.89
B-1-48-8-L-DS	8	13.85	11.07	1.25	10.48	1.32	14.44	0.96
B-1-48-9-H-DS	8	15.68	11.07	1.42	10.48	1.50	14.44	1.09
B-1-48-10-H-DS	8	13.50	11.07	1.22	10.48	1.29	14.44	0.93



<b>Count :</b>	<b>130</b>	<b>130</b>	<b>130</b>
<b>Mean :</b>	<b>1.283</b>	<b>1.396</b>	<b>1.001</b>
<b>S. D. :</b>	<b>0.254</b>	<b>0.291</b>	<b>0.189</b>
<b>C.O.V. :</b>	<b>0.198</b>	<b>0.208</b>	<b>0.188</b>