



**WOOD I-JOIST MANUFACTURERS ASSOCIATION**

MEMBER - ENGINEERED WOOD PRODUCTS ASSOCIATION

2402 Daniels Street, Madison, WI 53704

## **Establishing Reaction Capacities for Prefabricated Wood I-Joists**

Prepared: January 2003

Revised: October 2005

### **1.0 Scope**

- 1.1 This specification provides clarification to Section 6.6.2 of ASTM D 5055 for reaction qualification of prefabricated wood I-joists. It is intended for use by prefabricated wood I-joist manufacturers, qualified inspection agencies (certification organizations), and regulatory and evaluation agencies. The specification applies to prefabricated wood I-joists, which comply with the requirements of ASTM D 5055 or CSA O86-01. Requirements of ASTM D 5055 or CSA O86-01 are not superseded by the requirements in this specification.
- 1.2 This specification pertains to the empirical methods of determining reaction capacity. Derivation by an analytical model is beyond the scope of this specification.
- 1.3 Explanations of the statistics used in the empirical analysis of test results, with examples, are given in Appendices X1 and X2.
- 1.4 This specification does not preclude the development of alternative reaction qualification procedures meeting the intent of this document. Documentation showing equivalency to, and addressing each of the qualification requirements in this document, must be provided and agreed upon with the manufacturer's qualified agency.
- 1.5 This specification was developed in light of currently manufactured products, produced from materials defined in Section 5 of ASTM D 5055 or Clause 13.2.2 of CSA O86-01. New materials may require new or revised guidelines that provide comparable levels of safety and performance.

### **2.0 Definitions**

- 2.1 *Qualified Agency*, Either :-
  - (a) a qualified agency as defined in Section 8 of ASTM D 5055 or
  - (b) a certification organization as defined in CSA O86-01.
- 2.2 *Reaction Capacity*, The numeric result of certain calculations specified in this specification.
- 2.3 *Flange Compression Capacity*, The numeric product of the allowable flange compression perpendicular to grain strength times the bearing area.
- 2.4 *Design Reaction*, The smaller of the *Reaction Capacity* and the *Flange Compression Capacity*
- 2.5 *Published Design Reaction*, The numeric value published by the manufacturer as appropriate for use in structural analysis.

### 3.0 Referenced Documents

- 3.1 *ASTM Standards:*  
D 5055 - Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists
- 3.2 *Other Standards:* CSA Standard O86-01 - Engineering Design in Wood (Limit States Design)
- 3.3 *Other Documents:* NDS – 2005 National Design Specification.

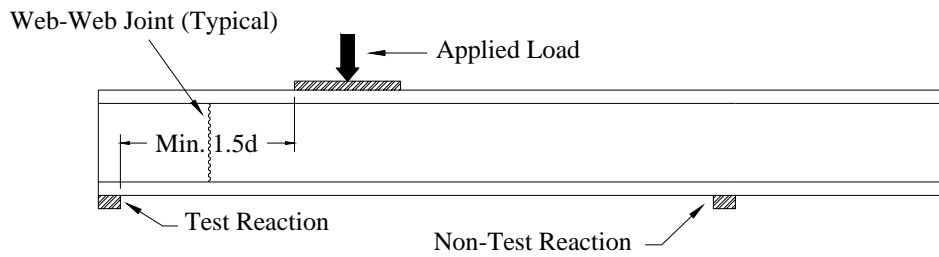
Note 1: *Where applicable this document is based on the standards referenced above. It is intended that the most current editions of these standards be used for application of this document.*

### 4.0 Wood I-Joist Reaction Capacity Qualification

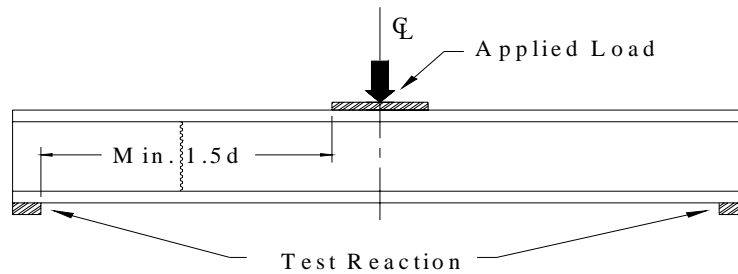
- 4.1 Factors that influence reaction capacity include bearing length, web (type, orientation, thickness, web-web joint configuration, and grade), rout geometry, adhesive type, joist depth, and flange (type, size, species and grade). Each combination of these factors should be tested separately according to 5.1 and 5.2, unless the critical combination is first established by test. Joists with structural composite flanges must be tested and analyzed separately from joists with sawn lumber flanges.
- 4.2 Minimum specimen temperature at the time of test shall be 40°F (4°C). Capacities developed in this specification are applicable to joists used under dry conditions such as in most covered structures. Specimens shall be tested in an as-received condition.
- 4.3 *Sampling*, Qualification joists for both end and intermediate reaction shall represent the minimum and maximum depth (a minimum of five from each depth). Bearing lengths less than 1.5 in. are not recommended due to concerns regarding construction tolerances and building code requirements.
- 4.3.1 *Data Regressed Across Bearing Length*, Manufacturers demonstrating a progression of reaction capacity with increased bearing length may linearly regress data as a function of bearing length per 6.1.1. Testing shall include a minimum of five specimens per depth (see sampling of 4.3) at each bearing length tested. Regression of data is not permitted when less than three bearing lengths are tested. Tested bearing lengths for regression analysis must include the minimum, maximum, and an intermediate bearing length.
- 4.3.2 *Individual Data Analysis*, Manufacturers qualifying reaction capacity at a single bearing length shall analyze data individually per 6.1.3. Interpolation of reaction capacities between individually analyzed bearing lengths shall be permitted. Sampling across joist depth shall follow Section 4.3.

### 5.0 Test Methods

- 5.1 *End Reaction*, Specimens may be tested according to either Figure 1 or Figure 2. The test span shall be that which usually produces end reaction failures. Figure 1 allows for one overhang no longer than ½ the test span. A single concentrated load may be placed off-center toward the test reaction. This set up allows the joist to be turned end-for-end to perform a second test, with the failed end as the overhang for the second test. In Figure 2, the load shall be applied at the center of the test span as either a single concentrated load as shown, or as two point loads placed symmetrically about the center of the test span. Figure 2 allows for only one test per specimen. For both Figures 1 and 2, the applied load shall have a clear distance of at least 1.5 times the joist depth,  $d$ , between the inside face of bearing and the edge of the load pad. A vertical web-web joint shall be located 12 in. from the inside face of bearing and at least 12 in. from the edge of the load pad or, if not possible, ½ the distance between the inside face of bearing and the edge of the load pad. The load shall be applied via a steel load pad at a uniform rate so that anticipated failure will not occur in less than one minute. Bearings shall consist of steel blocks representing the tested end bearing length. The load pad shall be of sufficient length to prevent local failure under the load point. Additional reinforcement may be installed, when required, to prevent failure at a load point or non-test reaction. Such reinforcement shall not be wider than the length of the load pad or bearing surface. Load cells shall record the test reaction (half the total applied load is appropriate for set-up shown in Figure 2). Perforated knockouts (1½ in. maximum diameter) may be randomly located within the joist specimen, as they would occur in application.

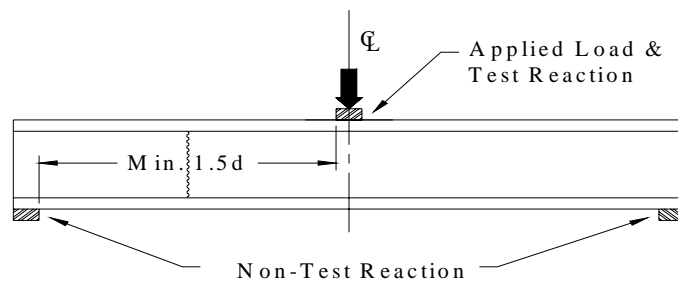


**Figure 1: End Reaction Test Set-up (non-symmetric set-up allows for 2 end bearing tests per specimen)**

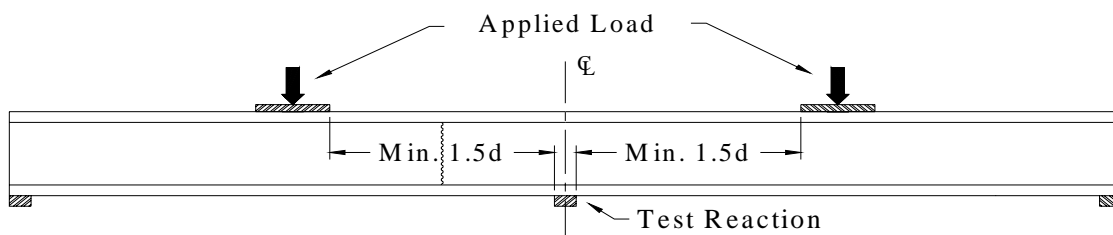


**Figure 2: End Reaction Test Set-up (symmetric set-up allows for 1 end bearing test per specimen)**

5.2 *Intermediate Reaction*, Specimens may be tested according to either Figure 3 or Figure 4. The test span(s) shall be that which usually produces intermediate reaction failures. In Figure 3, the load must be applied at the center of the test span through a steel load pad representing the tested intermediate bearing length. In Figure 4, the loads shall be applied symmetrically about the test reaction through steel load pads of sufficient length to prevent local failure under load points. For both Figures 3 and 4, the applied load(s) shall have a clear distance of at least 1.5 times the joist depth,  $d$ , between the inside face of bearing and the edge of the load pad. A vertical web-web joint shall be located 12 in. from the inside face of bearing and at least 12 in. from the edge of the load pad or, if not possible,  $\frac{1}{2}$  the distance between the inside face of bearing and the edge of the load pad. The load shall be applied at a uniform rate so that anticipated failure will not occur in less than one minute. Additional reinforcement may be installed, when required, to prevent failure at a load point or non-test reaction. Such reinforcement shall not be wider than the length of the load pad or bearing surface. Load cells shall record the test reaction (the sum of both reactions is appropriate for setup shown in Figure 3). Perforated knockouts ( $\frac{1}{2}$  in. maximum diameter) may be randomly located within the joist specimen, as they would occur in application.



**Figure 3: 3-Point Intermediate Reaction Test Set-up**



**Figure 4: 5-Point Intermediate Reaction Test Set-up**

- 5.3 Ultimate loads and modes of failure shall be recorded. Bending failures may be excluded from the data set. Shear failures may be excluded from the data set only if shear is independently characterized in accordance with Section 6.2 of ASTM D 5055. Web buckling in wood I-joist reaction tests often coincides with flange splitting or knifing. Data where web buckling occurred may be included in the analysis and a duration of load adjustment is applicable. (DOL adjustments are typically not applicable to buckling failures, but this is accounted for within the adjustment factor of Equation 4).

## 6.0 Data Analysis

- 6.1 The procedure for analyzing reaction capacity regressed across bearing lengths for each joist depth tested is shown in Section 6.1.1; analysis at an individual bearing length shall begin at Section 6.1.3.

- 6.1.1 Any linear regression analysis across bearing length shall have a coefficient of determination ( $r^2$ ) of at least 0.9. The regression equation below provides the expected mean bearing strength ( $P_e$ ) for bearing length ( $b_i$ ):

$$P_e = A + Bb_i \quad (\text{Equation 1})$$

where:

A = equation intercept

B = equation slope

- 6.1.2 The mean and standard deviation of the data from each bearing length tested are ( $P_i$ ) and ( $S_i$ ). The coefficient of variation is:

$$v_i = \frac{S_i}{P_i} \quad (\text{Equation 2})$$

Let  $n_i$  be the number of tests for each bearing length ( $b_i$ ) tested and included in the regression analysis. Then the coefficient of variation in the combined data sets is:

$$v = \sqrt{\frac{\sum[(n_i - 1)v_i^2]}{\sum n_i - J}} \geq v_{\min} \quad (\text{Equation 3})$$

Where J is the number of bearing lengths included in the regression analysis and the summation is from  $i = 1$  to J.

- 6.1.3 The equation used to predict reaction capacity for a joist is as follows:

$$P_B = \frac{C \cdot P_e(1 - Kv)}{2.37} \leq \frac{C \cdot P_e(1 - Kv_{\min})}{2.37} \quad (\text{Equation 4})$$

where:

$P_B$  = design reaction capacity at bearing length  $b_i$

$P_e$  = mean bearing strength at bearing length  $b_i$  for individual test sets or the equation predicting mean strength (Equation 1) for regressed data

$v$  = coefficient of variation;  $v$  shall not be less than  $v_{\min}$

$v_{\min}$  = minimum coefficient of variation = 0.1 for end reaction or 0.08 for intermediate reaction

$K = 2.048$  for  $n = n_{\text{total}} - J = (12)$ , when evaluating regressed data per 6.1.1

$= 2.464$  for  $n = 5$ , when evaluating individual test sets (See ASTM D 5055 Table X4.3 for K values)

C = product of appropriate special use reduction factors from Appendix X6 of ASTM D 5055

Note 2: Due to the limited qualification samples and lack of ongoing quality assurance requirements, the specified minimum coefficients of variation ( $v_{\min}$ ) are intended to provide a rational coefficient of variation for I-joist reaction capacities and were established based on committee judgments.

- 6.1.4 Two (2) methods may be used to establish reaction:
- 6.1.4.1. The reaction capacity at each tested bearing length is established as the lesser of the capacities determined from testing at extreme depths.
  - 6.1.4.2. Alternatively, the manufacturer may choose to linearly interpolate between the reaction capacities at extreme depths determined per 6.1 to establish capacities for intermediate joist depths.
- 6.2 *Compression Perpendicular to Grain*, The compression perpendicular to grain strength of the flange material can limit reaction capacity determined in accordance with 6.1 and must be analyzed separately. Wane and edge easing of flange material must be considered in the analysis. The compression perpendicular to grain strength of the supporting material may also limit reaction capacity determined in accordance with 6.1. Consideration of support material compressive strength as a factor limiting joist reaction capacity is not required since this may alternatively be accounted for in design. Duration of load adjustments are not applicable to compression perpendicular to grain calculations.
- 6.3 *Web Stiffeners*, Allowable reaction capacity may be increased by the use of web reinforcement (may not apply to some failure modes, e.g. compression perpendicular to grain). If a manufacturer wishes to establish reinforced reaction capacities, testing shall follow the sampling, test methods, and data analysis detailed in Sections 4.0, 5.0 and 6.0. Data analysis is to be conducted independently of that for unreinforced reaction capacity. Web reinforcement material and installation (fastener, size, and quantity) must be clearly identified and reinforcement permitted in application shall be equivalent to that which was qualified.

APPENDICES

(Non-mandatory Information)

X1.0 EXAMPLE OF REACTION CAPACITY ANALYSIS

This example demonstrates regression across bearing length (Section 4.3.1) using the lesser value from depths tested at a given bearing length (Section 6.1.4.1).

X1.1 *Evaluation of Reaction Capacity*—Section 4.3 permits combining of reaction test data for a joist depth tested at different bearing lengths. Combining data gives a better estimate of variability from the larger sample size. ASTM D 5055 may be referenced for justification of statistics used in this specification.

X1.1.1 *Nomenclature*—This section uses the following nomenclature.

- $n_i$  = number of specimens for sample group,
- $S_i$  = standard deviation of reaction data for bearing length ( $b_i$ ),
- $P_i$  = mean ultimate reaction for bearing length ( $b_i$ ),
- $v_i$  = coefficient of variation for bearing length ( $b_i$ ),
- A = intercept of linear regression,
- B = slope of linear regression,
- $P_B$  = design reaction capacity at bearing length  $b_i$ ,
- C = product of appropriate special use reduction factors (C=1 for this example),
- $P_e$  =  $B(b_i) + A$ ,
- K = 2.048 for  $n=12$  (K is assumed for  $n_{total} - J$  specimens),
- J = number of bearing lengths to be included in regression analysis.

X1.1.2 *Joist Description:*

Depths available: 9.5 in., 11.875 in., 14 in., 16 in.  
 Flange: Laminated Veneer Lumber (LVL), 1.75 in. wide, 1.5 in. thick  
 Web: 3/8 in. OSB.

X1.1.3 *Compile Test Data:*

**TABLE X1.1 Sample End Reaction Test Data**

Tested End Bearing Lengths: minimum 1.75 in intermediate 2.25 in maximum 3.5 in

Joist Depth (in)	Specimen No.	Ult. Load (lbs)	Joist Depth (in)	Specimen No.	Ult. Load (lbs)	Joist Depth (in)	Specimen No.	Ult. Load (lbs)
9.5	1	2915	9.5	1	3605	9.5	1	3783
9.5	2	2958	9.5	2	3403	9.5	2	4045
9.5	3	3350	9.5	3	3390	9.5	3	4404
9.5	4	2845	9.5	4	3605	9.5	4	4210
9.5	5	3080	9.5	5	3135	9.5	5	4495
		min 2845			min 3135			min 3783
		max 3350			max 3605			max 4495
		mean 3030			mean 3428			mean 4187
		sd 198			sd 194			sd 285
		COV 6.55%			COV 5.66%			COV 6.82%

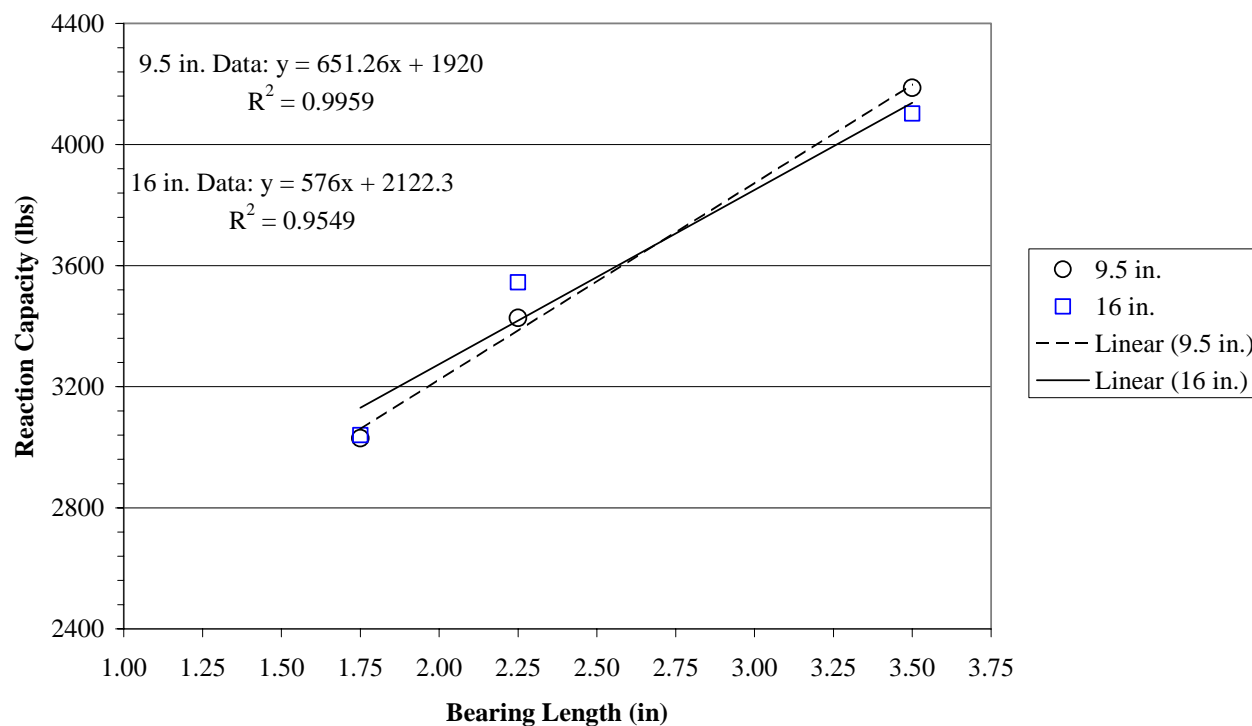
  

Tested End Bearing Lengths: minimum 1.75 in intermediate 2.25 in maximum 3.5 in

Joist Depth (in)	Specimen No.	Ult. Load (lbs)	Joist Depth (in)	Specimen No.	Ult. Load (lbs)	Joist Depth (in)	Specimen No.	Ult. Load (lbs)
16	1	3045	16	1	3842	16	1	3923
16	2	3085	16	2	3729	16	2	4233
16	3	2735	16	3	3134	16	3	4155
16	4	3030	16	4	3707	16	4	4379
16	5	3305	16	5	3312	16	5	3821
		min 2735			min 3134			min 3821
		max 3305			max 3842			max 4379
		mean 3040			mean 3545			mean 4102
		sd 203			sd 305			sd 228
		COV 6.69%			COV 8.60%			COV 5.55%

**TABLE X1.2 Basic Reaction Statistics of Sample Data**

9.5 in. Depth					16 in. Depth				
$b_i$	$n_i$	$P_i$	$S_i$	$v_i$ (%)	$b_i$	$n_i$	$P_i$	$S_i$	$v_i$ (%)
1.75	5	3030	198	6.55	1.75	5	3040	203	6.69
2.25	5	3428	194	5.66	2.25	5	3545	305	8.60
3.5	5	4187	285	6.82	3.5	5	4102	228	5.55

**FIG X1.1 Mean Reaction Capacities**

With the resultant coefficient of determination  $r^2 > 0.9$  for both data sets, regression analysis is allowed.

9.5 in. Depth:  $A = 1920$ ,  $B = 651$

16 in. Depth:  $A = 2122$ ,  $B = 576$

X1.1.4

*Coefficient of Variation*—Determine the combined coefficient of variation for each data set.

$$v = \sqrt{\frac{\sum [(n_i - 1)v_i^2]}{\sum n_i - J}}$$

where:

$$J = 3 \text{ bearing lengths}$$

Therefore,

9.5 in. Depth:  $v = \text{sqrt}((0.04856)/(15-3)) = 6.36\%$  which is less than the 10% minimum, use  $v_{\min} = 10\%$

16 in. Depth:  $v = \text{sqrt}((0.05981)/(15-3)) = 7.06\%$  which is less than the 10% minimum, use  $v_{\min} = 10\%$

X1.1.5

*Reaction Capacity*—Determine capacity for desired bearing lengths from data regression.

$$P_B = \frac{C \cdot P_e(1 - Kv)}{2.37}$$

Therefore;

9.5 in. Depth:  $P_e = 651(b_i) + 1920$ ;  $P_B = 1 \cdot (651 \cdot (b_i) + 1920) \cdot (1 - 2.048 \cdot 0.10) / 2.37 = 219 \cdot (b_i) + 644$

16 in. Depth:  $P_e = 576(b_i) + 2122$ ;  $P_B = 1 \cdot (576 \cdot (b_i) + 2122) \cdot (1 - 2.048 \cdot 0.10) / 2.37 = 193 \cdot (b_i) + 712$

**TABLE X1.3 Reaction Capacity (based on regression analysis)**

Bearing Length, $b_i$ (in.)	9.5 in. Reaction Capacity (lbs.)	16 in. Reaction Capacity (lbs.)	Reaction Capacity for ALL Depths by DOL (lbs.)		
			100%	115%	125%
1.75	1027	1050	1027	1181	1284
2.25	1136	1147	1136	1306	1420
3.5	1409	1389	1389	1597	1736

In this example, the lesser of the reaction capacities for each bearing length is used per 6.1.4.1

X1.1.6

*Compression Perpendicular to Grain*—Calculate the reaction capacity based on flange compression perpendicular to grain ( $F_{C_{perp}}$ ) in accordance with section 6.2. Note that consideration of the supporting material compression is accounted for during design and is excluded from this example.

Analysis of reaction capacity with an adjustment for edge easing is shown in Table X1.4. A 1 3/4 in. wide LVL flange (plank orientation) is assumed with  $F_{C_{perp}} = 425$  psi.

**TABLE X1.4 Flange Compression Capacity**

Bearing Length, $b_i$ (in.)	Flange Compression Capacity (lbs.)
1.75	1190
2.25	1530
3.5	2380

1) Flange Compression Capacity = Flange  $F_{C_{perp}} \times (b_i) \times (\text{flange width} - 0.15)$

2) Capacities may not be increased by DOL

X1.1.7

*Design Reaction*—Select the smaller of the reaction capacity from Table X1.3 and the flange compression capacity from Table X1.4

**TABLE X1.5 Design Reactions**

Bearing Length, $b_i$ (in.)	Design Reaction (lbs.)		
	100%	115%	125%
1.75	1027	1181	1190
2.25	1136	1306	1420
3.5	1389	1597	1736

Linear interpolation of these design values is permitted between the bearing lengths shown. Manufacturers that choose to publish only minimum and maximum (1.75 in. and 3.5 in. for this example) may also linearly interpolate between these points.

The reaction capacities shown in Table X1.5 apply to all joist depths between 9.5 in. and 16 in.

X1.1.8

*Published Design Reactions*—Manufacturers may publish a design reaction for each DOL as shown in Table X1.5 or a single design reaction with notes stating whether or not DOL may be applied

X2.0 EXAMPLE OF REACTION CAPACITY ANALYSIS

This example demonstrates regression across bearing length (Section 4.3.1) and interpolation across joist depth at a given bearing length (Section 6.1.4.2).

X2.1 *Evaluation of Reaction Capacity*—Section 4.3 permits combining of reaction test data for a joist depth tested at different bearing lengths. Combining data gives a better estimate of variability from the larger sample size. ASTM D 5055 may be referenced for justification of statistics used in this specification.

X2.1.1 *Nomenclature*—This section uses the following nomenclature.

- $n_i$  = number of specimens for sample group,
- $S_i$  = standard deviation of reaction data for bearing length ( $b_i$ ),
- $P_i$  = mean ultimate reaction for bearing length ( $b_i$ ),
- $v_i$  = coefficient of variation for bearing length ( $b_i$ ),
- A = intercept of linear regression,
- B = slope of linear regression,
- $P_B$  = design reaction capacity at bearing length  $b_i$ ,
- C = product of appropriate special use reduction factors (C=1 for this example),
- $P_e$  =  $B(b_i) + A$ ,
- K = 2.048 for  $n=12$  (K is assumed for  $n_{total} - J$  specimens),
- J = number of bearing lengths to be included in regression analysis.

X2.1.2 *Joist Description:*

Depths available: 9.5 in., 11.875 in., 14 in., 16 in.  
 Flange: Laminated Veneer Lumber (LVL), 1.75 in. wide, 1.5 in. thick  
 Web: 3/8 in. OSB.

X2.1.3 *Compile Test Data:*

**TABLE X2.1 Sample End Reaction Test Data**

Tested End Bearing Lengths:			intermediate <span style="border: 1px solid black; padding: 2px;">2.25</span> in			maximum <span style="border: 1px solid black; padding: 2px;">3.5</span> in																																																																																															
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TABLE X2.2 Basic Reaction Statistics of Sample Data

9.5 in. Depth					16 in. Depth				
$b_i$	$n_i$	$P_i$	$S_i$	$v_i$ (%)	$b_i$	$n_i$	$P_i$	$S_i$	$v_i$ (%)
1.75	5	3030	198	6.55	1.75	5	3540	203	5.74
2.25	5	3428	194	5.66	2.25	5	4045	305	7.53
3.5	5	4187	285	6.82	3.5	5	4602	228	4.95

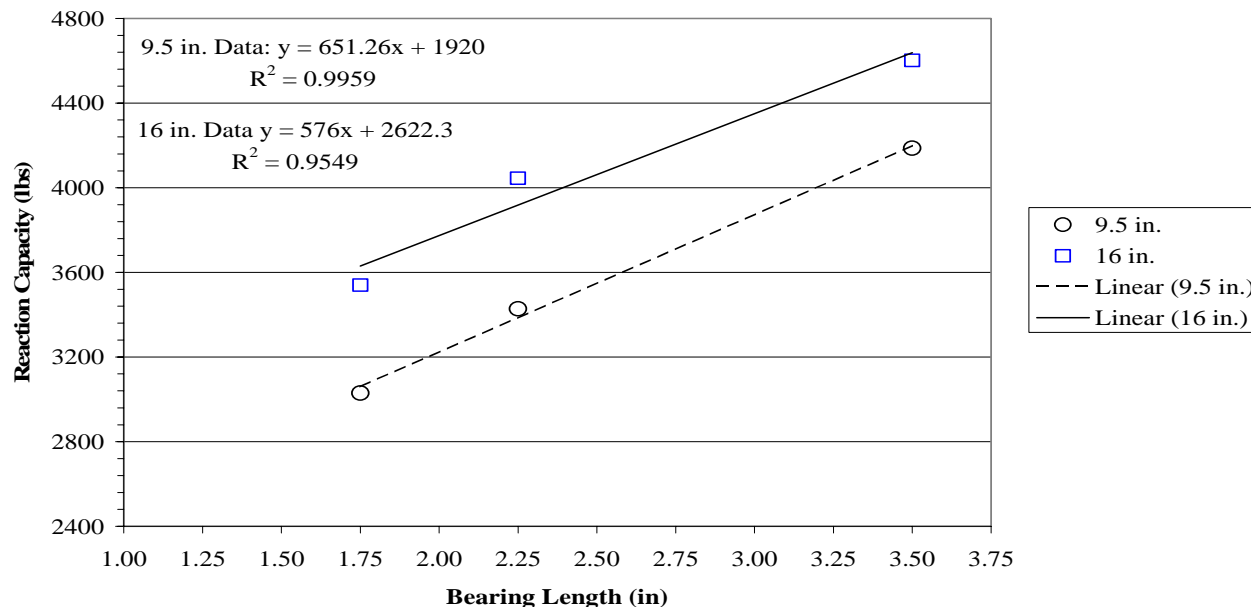


FIG X2.1 Mean Reaction Capacities

With the resultant coefficient of determination  $r^2 > 0.9$  for both data sets, regression analysis is allowed.

9.5 in. Depth: A = 1920, B = 651

16 in. Depth: A = 2622, B = 576

X2.1.4 *Coefficient of Variation*—Determine the combined coefficient of variation for each data set.

$$v = \sqrt{\frac{\sum [(n_i - 1)v_i^2]}{\sum n_i - J}}$$

where:

J = 3 bearing lengths

Therefore,

9.5 in. Depth:  $v = \sqrt{(0.04856)/(15-3)} = 6.36\%$  which is less than the 10% minimum, use  $v_{\min} = 10\%$

16 in. Depth:  $v = \sqrt{(0.04571)/(15-3)} = 6.17\%$  which is less than the 10% minimum, use  $v_{\min} = 10\%$

X2.1.5 *Reaction Capacity*—Determine capacity for desired bearing lengths from data regression.

$$P_B = \frac{C \cdot P_e (1 - Kv)}{2.37}$$

Therefore;

9.5 in. Depth:  $P_e = 651(b_i) + 1920$ ;  $P_B = 1 \cdot (651 \cdot (b_i) + 1920) \cdot (1 - 2.048 \cdot 0.10) / 2.37 = 219 \cdot (b_i) + 644$

16 in. Depth:  $P_e = 576(b_i) + 2622$ ;  $P_B = 1 \cdot (576 \cdot (b_i) + 2622) \cdot (1 - 2.048 \cdot 0.10) / 2.37 = 193 \cdot (b_i) + 880$

**TABLE X2.3 Reaction Capacity (based on regression analysis)**

Bearing Length, $b_i$ (in.)	9.5 in. Reaction Capacity (lbs.)	16 in. Reaction Capacity (lbs.)
1.75	1027	1218
2.25	1136	1315
3.5	1409	1556

In this example, linear interpolation is used to establish reaction capacities for depths between 9.5 in. and 16 in. for each bearing length per 6.1.4.2. Table X2.4 presents the reaction capacities for 100% DOL.

**TABLE X2.4 Interpolated Reaction Capacity**

Bearing Length, $b_i$ (in.)	9.5 in. Reaction Capacity (lbs.)	11.875 in. Reaction Capacity (lbs.)	14 in. Reaction Capacity (lbs.)	16 in. Reaction Capacity (lbs.)
1.75	1027	1097	1159	1218
2.25	1136	1201	1260	1315
3.5	1409	1463	1511	1556

X2.1.6

*Compression Perpendicular to Grain*—Calculate the reaction capacity based on flange compression perpendicular to grain ( $F_{c_{perp}}$ ) in accordance with section 6.2. Note that consideration of the supporting material compression is accounted for during design and is excluded from this example.

Analysis of reaction capacity with an adjustment for edge easing is shown in Table X2.5. A 1 ¾ in. wide LVL flange (plank orientation) is assumed with  $F_{c_{perp}} = 425$  psi.

**TABLE X2.5 Flange Compression Capacity**

Bearing Length, $b_i$ (in.)	Flange Compression Capacity (lbs.)
1.75	1190
2.25	1530
3.5	2380

- 1) Flange Compression Capacity= Flange  $F_{c_{perp}} \times (b_i) \times (\text{flange width} - 0.15)$   
 2) Capacities may not be increased by DOL

X2.1.7

*Design Reaction*—Select the smaller of the reaction capacity from Table X2.4, multiplied by a DOL adjustment if desired, and the flange compression capacity from Table X2.5 for each depth and bearing length combination.

**TABLE X2.6 Design Reactions**

Bearing Length, $b_i$ (in.)	9.5 in. Design Reaction (lbs.)			11.875 in. Design Reaction (lbs.)			14 in. Design Reaction (lbs.)			16 in. Design Reaction (lbs.)		
	100%	115%	125%	100%	115%	125%	100%	115%	125%	100%	115%	125%
1.75	1027	1181	1190	1097	1190	1190	1159	1190	1190	1190	1190	1190
2.25	1136	1306	1420	1201	1381	1501	1260	1449	1530	1315	1512	1530
3.5	1409	1620	1761	1463	1682	1829	1511	1738	1889	1556	1789	1945

Linear interpolation of these design values is permitted between the bearing lengths shown. Manufacturers that choose to publish only minimum and maximum (1.75 in. and 3.5 in. for this example) may also linearly interpolate between these points.

X2.1.8 *Published Design Reactions*

Manufacturers may publish a design reaction for each DOL as shown in Table X2.6 or a single design reaction with notes stating whether or not DOL may be applied.