

BR Brick Bracket Testing

Off-center 9/16" bolt hole allows for staggered bolt pattern per IRC

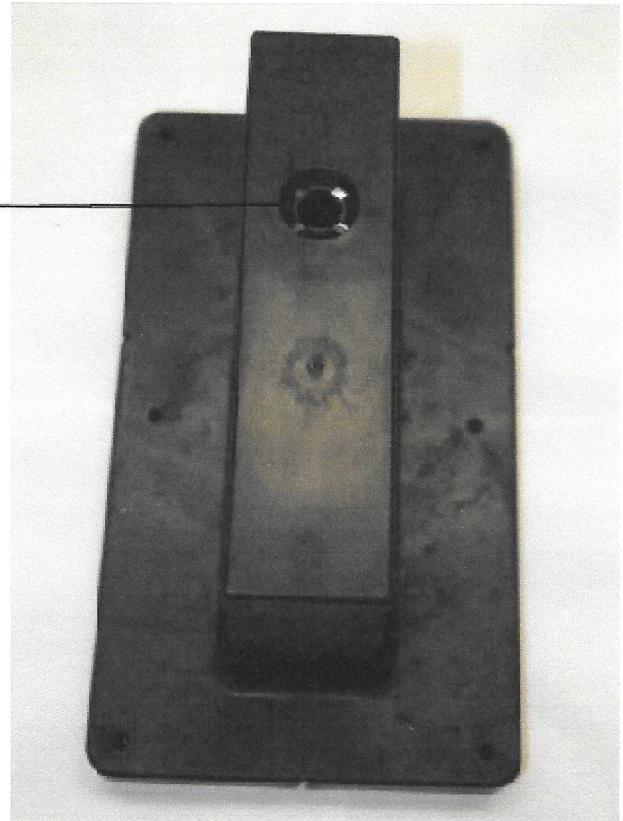


Fig.1

Test Methods

Ledger testing was conducted utilizing methods previously used for similar testing at Washington State University (Carradine et al. 2007). While there is an alternate method for test rim boards, specifically APA Standard PRR-401 performance standards for APA EWS Rim Boards (APA, 2002), the methods prescribed by Carradine et al. (2007) were judged to provide more conservative results. PRR-401 recommends that the siding (OSB) and the rim board bear directly on the reaction support and that SPF be used for the ledger (with no requirement for MC control). Based on the methods utilized by Carradine et al. (2007), testing was conducted such that the rim board was the only portion of the ledger assembly that had bearing on the reaction support. Because decks are typically exposed to weather, ledger material was PPT lumber and was tested in wet condition, at or above the fiber saturation point. Wood is weakest at moisture contents at and above the fiber saturation point; therefore this was considered the most conservative condition under which to test the ledgers. In the NTA test reports the test method is referred to as, customer test procedures as requested by client, specific test procedures, per client request, etc. The NTA test report states and shows the above Carradine et al. (2007) procedures were in fact the Test Parameters used. See page 2 of the NTA test report, Table 1: Test parameters.

The bracket was designed to be installed with the bolt either toward the top or the bottom of the bracket. The off-center bolt hole location allows for a staggered bolt pattern, per IRC requirements. To establish worst-case loading condition, all tests were performed with the bolt in the lower (down) position. This orientation was considered to be the most conservative installation technique.



**TESTING
LISTING
EVALUATION**

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**NTA 15-03,
LEDGER-TO-RIM BOARD BRACKET TEST:
ASSEMBLIES CONSTRUCTED WITH BRICK BRACKETS AND
(4) COMBINATIONS OF RIM AND LEDGER BOARDS**

Prepared for:
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Test Report: BRBB111815-38
Issued: January 8, 2016

Prepared By:
Brad Wear
Test Engineer

Reviewed By:
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Test Engineer

This report contains only findings and results arrived at after employing the specific test procedures listed herein. It does not constitute a recommendation for, endorsement of, or certification of the product or material tested. NTA, Inc. makes no warranty, expressed or implied, except that the test has been performed, and a report prepared, based upon the specimen furnished by the client. Extrapolation of data, from the test data provided herein, to the batch or lot from which the specimens were obtained may not correlate and should be interpreted with extreme caution. NTA, Inc. assumes no responsibility for variations in quality, composition, appearance, performance, or other features of similar materials produced by the client, other persons, or under conditions over which NTA, Inc. has no control. NTA, Inc. has issued this report for the exclusive use of the client to whom it is addressed. Any use or duplication of this report shall not be made without their consent. This report shall only be reproduced in its entirety.

1. INTRODUCTION

BR Brick Bracket retained NTA, Inc. to perform testing on assemblies with their Brick Brackets in accordance with custom procedures described herein. All testing herein was performed at the NTA lab facility located in Nappanee, Indiana. Parameters for testing are provided in Table 1, below.

Table 1: Test Parameters

Parameter	Value
Load Rate	0.5 inches/minute
Test Setup	Load applied across the tops of (2) simulated deck joists by means of a 4 in. wide fixture. Load application at the joists was located at mid-span of the simulated deck joists. Two pieces of polyethylene film were placed between each joist and the load fixture to reduce friction.
Brick Bracket Orientation	Bolt hole oriented toward the bottom of all assemblies (in the orientation that placed it furthest away from the load application).
Joist Spacing	16 in.
Pre-Test Conditioning of Wood	Client requested that all lumber be constructed and tested as received to simulate an "in-use" condition with the only requirement that upon receipt all materials are to be stored inside out of the elements.
Adjustment Factors	Per the client's request data includes the following adjustment factors: Safety Factor = 3.0 Duration of Load Factor = 1.6

2. TEST PROGRAM

2.1. DEVIATIONS FROM TEST STANDARD

The testing detailed herein was performed with no modifications to the test standard(s).

2.2. DESCRIPTION OF TEST SPECIMENS

The client provided Brick Brackets, bolts, washers, nails, joist hangers, screws, and lumber for construction of test assemblies. A summary of the materials and fastening is provided in Tables 2 and 3 and photographs of materials received are shown in Figures 3 through 9. Additionally, Figures 10 through 13 provide photographs of specimens during the construction process.

It must be noted that NTA did not oversee or verify the sampling procedure used by the client when selecting the sample material(s).

As necessary, NTA, Inc. provided commonly available construction materials and assembled each specimen to the client's specifications.

Table 2: Materials

Configuration	Rim Board	Ledger	Simulated Joist	Joist Hanger
1	Un-Treated 2x10 #2 SYP	PPT 2x10 #2 SYP	2x8 #1 Non-Treated SYP	Simpson Strong-Tie HUS 28
2	1-1/8 in. x 11-7/8 in. Engineered Wood OSB, Exposure 1, PRR-410	PPT 2x10 #2 SYP		
3	Un-Treated 2x10 #2 SYP	PPT 2x8 #2 SYP		
4	1-1/8 in. x 11-7/8 in. Engineered Wood OSB, Exposure 1, PRR-410	PPT 2x8 #2 SYP		
Notes: Not every piece of lumber received from the client contained a grade stamp. See Figure 2 for test setup and construction schematics for the tested configurations.				

PPT = Preservative Pressure Treated Lumber

Table 3: Fastening Schedule

Connection	Fastener	Quantity or Spacing
Deck Ledger-to-Brick Bracket-to-Rim Board	1/2-13 x 10 in. Bolt (307A JG Head Stamp) with a Nut and (2) 1-3/8 in. O.D., 9/16 in. I.D. Galvanized Washers (1 between the nut and rim board and 1 between the head and ledger board), washers were 0.106 in. thick (all dimensions are from average measurements), Stated by the client as being hot-dipped galvanized Bolt was installed through a pre-drilled 9/16 in. diameter hole through the wood members. The bolt head/washer were located at the ledger and the nut/washer were located at the interior face (opposite the bracket) of the rim board.	1
Brick Bracket-to-Rim Board	0.149 in. x 3 in. Smooth Shank Nail with 0.310 in. head diameter (all dimensions are from average measurements), Stated by the client as being hot-dipped galvanized	4
Deck Joist-to-Deck Ledger or Support Board	Simpson Strong-Tie HUS 28 Joist Hanger Attached as specified by the client to the Deck Ledger with (8) #10-8.5 x 1-1/2 in. Simpson Strong-Tie SD Structural Connector Screws, Galvanized, Model #SD10112R100 Attached to the joist with (22) #10-8.5 x 2 in. Simpson Strong-Tie SD Structural Screws, Galvanized, Model #S1021R100	-- 1 joist hanger per Joist End

^a Given as edge / field spacing.

2.3. TEST PROCEDURE

Testing was performed in accordance with custom test procedures, as requested by the client. Test parameters are summarized in Table 1.

Five specimens were assembled for testing per the construction details herein. Each assembly was individually placed into the test machine and dial gauges were placed as shown in the photographs in Figures 14 and 16 and the schematic in Figure 2. For this testing dial gauges were located at the following places: mid-span and mid-width of the top face of the Brick Bracket, mid-span and mid-width of the ledger board, and at mid-width of the rim board near the support fixture. The rim board was bolted to a support fixture and supported under its bottom surface, while the support board at the opposite end of the joists was under its bottom surface. Schematics of the test setups for each configuration are provided in Figure 2.

Load was applied through a 4 in. wide steel I-beam at the mid-span of the two joists, as shown in Figures 14 through 16. Two pieces of polyethylene were placed between the I-beam and each joist to help reduce friction during the test. Load was applied at a rate of 0.50 inches per minute until ultimate load occurred. Throughout the test dial gauge readings were logged and deflection data was reported for loads specified by the client. At ultimate the failure mode was observed and recorded.

Post-test each assembly had specimens cut from its ledger and rim board components for the determination of moisture content and specific gravity via ASTM D4442¹ and ASTM D2395² testing, respectively.

3. TEST RESULTS

Results for each test are summarized in Tables 4 through 6, below. The formula for the calculation of adjusted ultimate loads, as requested by the client, is given in Equation 1. Photographs of assemblies at ultimate load and of Brick Bracket and bolt components after testing are provided in Figures 17 through 19. Additional test data is provided in the Appendix.

$$U_{Adj} = U \div SF \div DL \quad (\text{Equation 1})$$

Where:

U_{Adj} = Adjusted Ultimate Load (lbf)

U = Ultimate Load (lbf)

SF = Safety Factor, Supplied by the Client (unitless)

DL = Duration of Load Factor, Supplied by the Client (unitless)

Table 4: Test Results

Config.	Specimen Number	Ultimate Load ¹ (lbf)	Adjusted Ultimate Load ² (lbf)	Failure Mode
1	78937	4,796	999	<i>Bolt bending and wood crushing (between washer and ledger)</i>
	78938	7,110	1,481	<i>Bolt bending and wood crushing (between washer and ledger)</i>
	78939	7,189	1,498	<i>Bolt bending and wood crushing (between washer and ledger)</i>
	78940	5,875	1,224	<i>Bolt bending and wood crushing (between washer and ledger)</i>
	78941	5,579	1,162	<i>Bolt bending and wood crushing (between washer and ledger)</i>
2	78942	4,505	938	<i>Bolt bending and wood crushing (between washer and ledger)</i>
	78943	4,721	983	<i>Bolt bending and wood crushing (between washer and ledger)</i>
	78944	3,582	746	<i>Bolt bending and wood crushing (between washer and ledger)</i>
	78945	5,349	1,114	<i>Bolt bending and wood crushing (between washer and ledger)</i>
	78946	5,459	1,137	<i>Bolt bending and wood crushing (between washer and ledger)</i>
3	78947	7,389	1,539	<i>Bolt bending and wood crushing (between washer and ledger)</i>
	78948	7,809	1,627	<i>Bolt bending and wood crushing (between washer and ledger)</i>
	78949	4,390	915	<i>Bolt bending and wood crushing (between washer and ledger)</i>
	78950	7,890	1,644	<i>Bolt bending and wood crushing (between washer and ledger)</i>
	78951	7,454	1,553	<i>Bolt bending and wood crushing (between washer and ledger)</i>
4	78952	6124	1276	<i>Bolt bending and wood crushing (between washer and ledger)</i>
	78953	6311	1315	<i>Bolt bending and wood crushing (between washer and ledger)</i>
	78954	5007	1043	<i>Bolt bending and wood crushing (between washer and ledger)</i>
	78955	6431	1340	<i>Bolt bending and wood crushing (between washer and ledger)</i>
	78956	5454	1136	<i>Support wood splitting at metal bracket and bolt bending</i>

¹ Ultimate load shown is ½ of the total load applied to the assembly; this provides the load applied to the ledger.

² Ultimate load divided by the factors, as shown in equation 1, and as requested by the client.

Table 5: Additional Test Results (Deflections)

Config.	Specimen Number	Net Deflections ¹ at Various Loads (in.)					
		Ledger			Bracket		
		Adj. Ult.	300 lbf	600 lbf	Adj. Ult.	300 lbf	600 lbf
1	78937	0.1035	0.0349	0.0693	0.0338	0.0137	0.0216
	78938	0.1609	0.0491	0.0966	0.0445	0.0138	0.0235
	78939	0.1129	0.0101	0.0439	0.0351	0.0043	0.0090
	78940	0.1095	0.0324	0.0637	0.0276	0.0035	0.0110
	78941	0.1378	0.0165	0.0684	0.0332	0.0058	0.0116
	Average	0.1249	0.0286	0.0683	0.0348	0.0082	0.0153
2	78942	0.1290	0.0355	0.0823	0.0281	0.0045	0.0131
	78943	0.0974	0.0241	0.0685	0.0186	0.0046	0.0083
	78944	0.0913	0.0222	0.0773	0.0220	0.0079	0.0176
	78945	0.1114	0.0121	0.0526	0.0245	0.0051	0.0076
	78946	0.1154	0.0297	0.0655	0.0249	0.0042	0.0076
	Average	0.1089	0.0247	0.0692	0.0236	0.0052	0.0108
3	78947	0.1275	0.0211	0.0698	0.0443	0.0111	0.0223
	78948	0.1370	0.0117	0.0573	0.0330	0.0051	0.0101
	78949	0.0645	0.0128	0.0261	0.0254	0.0061	0.0144
	78950	0.1202	0.0147	0.0432	0.0429	0.0072	0.0122
	78951	0.0719	0.0136	0.0242	0.0060	0.0060	0.0109
	Average	0.01042	0.0148	0.0441	0.0303	0.0071	0.0140
4	78952	0.1579	0.0496	0.0923	0.0529	0.0138	0.0253
	78953	0.1344	0.0299	0.0761	0.0349	0.0040	0.0144
	78954	0.1385	0.0580	0.0952	0.0362	0.0143	0.0241
	78955	0.1237	0.0142	0.0528	0.0269	0.0050	0.0092
	78956	0.1152	0.0286	0.0746	0.0259	0.0045	0.0097
	Average	0.1339	0.0360	0.0782	0.0353	0.0083	0.0165

¹ Net deflections are the deflection measured at the top of the ledger or bracket minus the deflection measured at the top of the rim joist.

Table 6: Additional Test Results (Moisture Content and Specific Gravity)

Config.	Specimen Number	Moisture Content (%)		Specific Gravity (Unitless)	
		Rim Board	Ledger	Rim Board	Ledger
1	78937	15.3	29.5	0.50	0.53
	78938	15.6	24.8	0.48	0.44
	78939	11.9	21.2	0.61	0.55
	78940	13.5	33.6	0.57	0.52
	78941	13.9	29.2	0.44	0.55
	Average	14.0	27.7	0.52	0.52
2	78942	6.6	32.5	0.63	0.42
	78943	7.0	21.5	0.83	0.55
	78944	6.8	35.9	0.62	0.55
	78945	6.7	26.4	0.60	0.59
	78946	6.8	43.7	0.60	0.56
	Average	6.8	32.0	0.66	0.53
3	78947	14.8	17.3	0.56	0.50
	78948	13.0	18.6	0.57	0.43
	78949	12.9	19.5	0.55	0.45
	78950	13.6	19.8	0.58	0.43
	78951	13.6	13.5	0.56	0.48
	Average	13.6	17.7	0.56	0.46
4	78952	6.7	13.5	0.55	0.53
	78953	6.1	20.6	0.62	0.48
	78954	7.0	18.1	0.56	0.70
	78955	6.4	17.2	0.60	0.58
	78956	6.6	13.3	0.60	0.64
	Average	6.6	16.5	0.59	0.59

4. CONCLUSION

BR Brick Bracket retained NTA, Inc. to perform testing on assemblies with Brick Brackets in accordance with custom test procedures described herein. Conclusions from this testing are provided in Table 6 below.

It must be noted that the data provided herein applies only to the samples tested and may not be extrapolated beyond these samples to a larger population.

Table 6: Conclusion Summary

Configuration	Specimen	Average Ultimate Load (lbf)	Average Adjusted Ultimate Load (lbf)
1	Brick Bracket Assembly with 2x10 #1 SYP Rim Board and 2x10 #2 SYP Ledger, constructed as detailed herein	6,110	1,273
2	Brick Bracket Assembly with 1-1/8 in. x 11-7/8 in. EWP OSB Exposure 1, PRR-410 Rim Board and 2x10 #2 SYP Ledger, constructed as detailed herein	4,723	984
3	Brick Bracket Assembly with 2x10 #1 SYP Rim Board and 2x8 #2 SYP Ledger, constructed as detailed herein	6,986	1,455
4	Brick Bracket Assembly with 1-1/8 in. x 11-7/8 in. EWP OSB Exposure 1, PRR-410 Rim Board and 2x8 #2 SYP Ledger, constructed as detailed herein	5,866	1,222

PREPARED BY:



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Test Engineer

01-08-16

Date

REVIEWED BY:



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Test Engineer

01-08-16

Date

REFERENCES



1. ASTM D4442-07, *Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials*. ASTM International, West Conshohocken, PA, 2007, www.astm.org.
2. ASTM D2395-14^{e1}, *Standard Test Methods for Density and Specific Gravity (Relative Density) of Wood and Wood-Based Materials*. ASTM International, West Conshohocken, PA, 2014, www.astm.org.

FIGURES

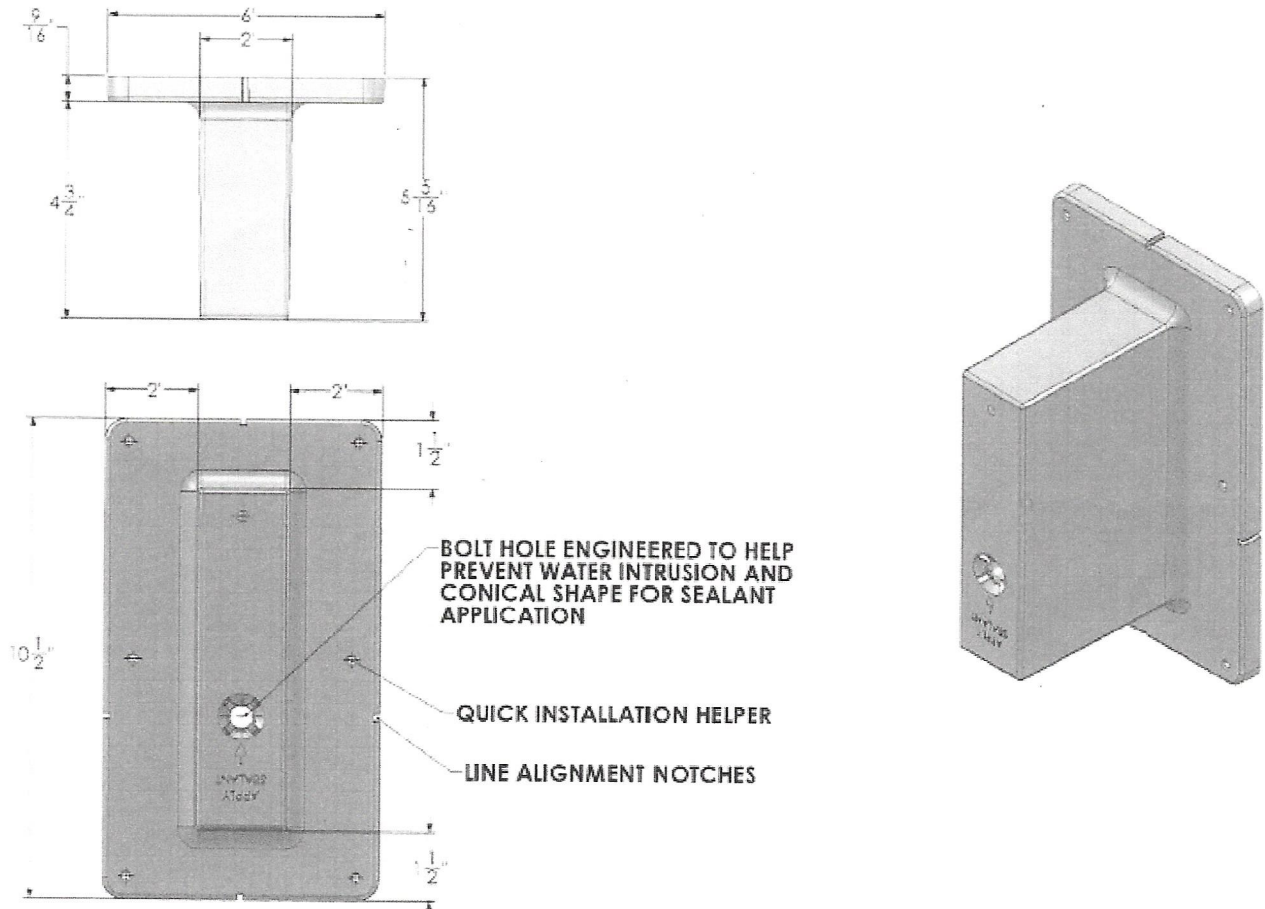


Figure 1: Brick Bracket Dimensions, Drawing Supplied by Client
Note: NTA did NOT evaluate the Bolt Hole for Water Intrusion or Sealability

FIGURES

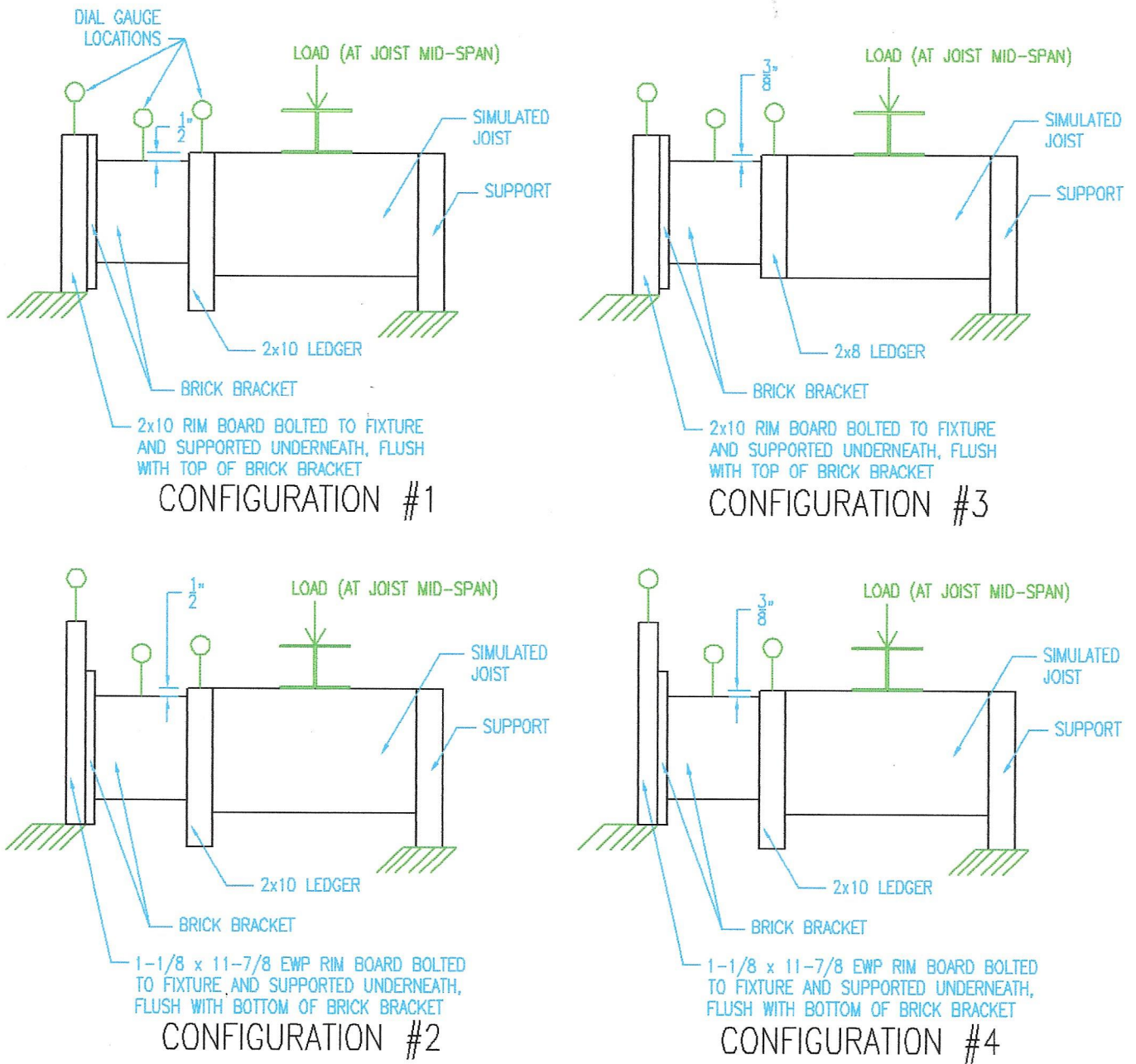


Figure 2: Test Construction / Setup Schematics for Each Configuration

FIGURES



Figure 3: Materials Received from Client



Figure 4: Nails Received from Client



Figure 5: Example of a Bolt, Washer, and Nut Received from the Client

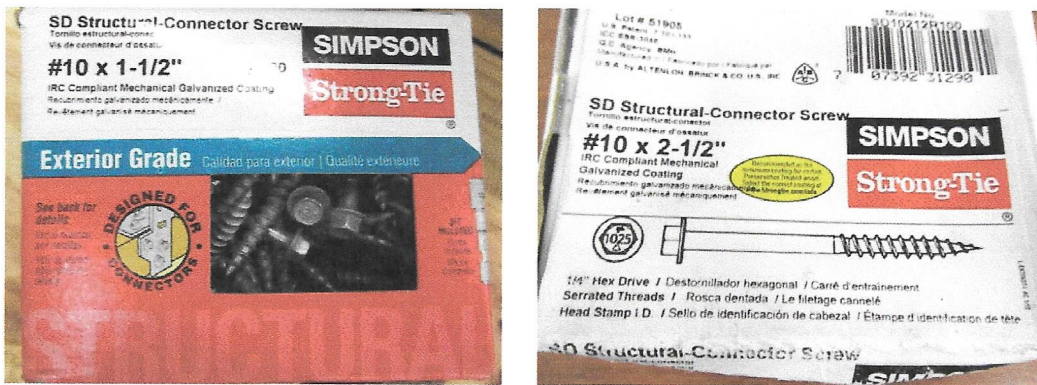


Figure 6: Simpson Joist Hanger Screws (1-1/2 in. Screws used into Ledger and 2-1/2 in. Screws used through Joists and into Ledger) Received from the Client



Figure 7: Joist Hangers Received from the Client

FIGURES



Figure 8: Brick Brackets Received from the Client



Figure 9: Lumber Received from the Client
Note: Not every piece contained a grade stamp.

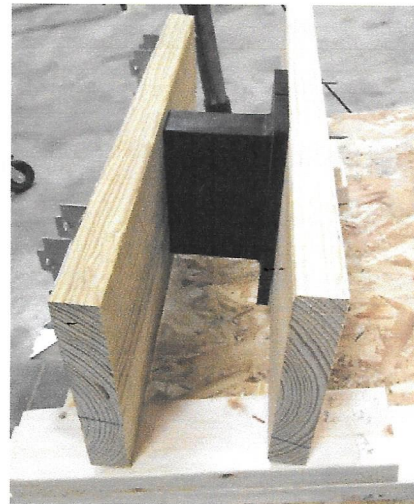


Figure 10: Constructing a Configuration 1 Specimen

FIGURES

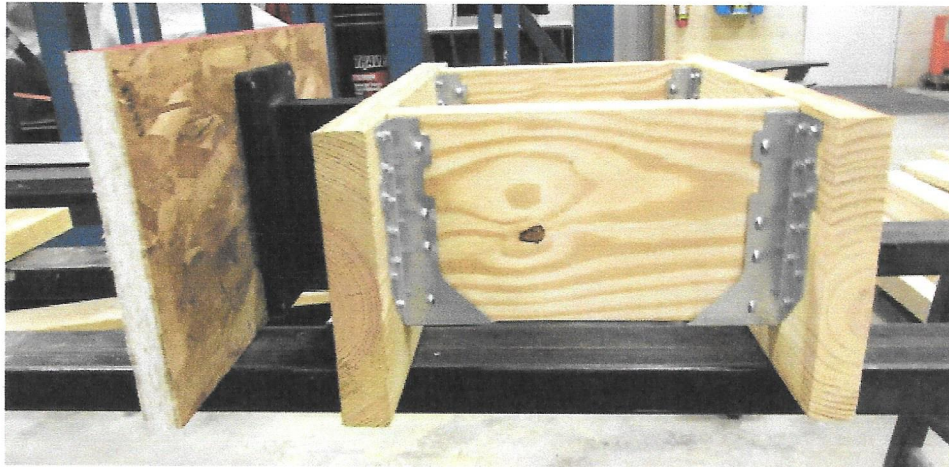


Figure 11: Constructing a Configuration 2 Specimen



Figure 12: Constructing a Configuration 3 Specimen



Figure 13: Constructing a Configuration 4 Specimen

FIGURES



Figure 14: Test Setup Viewed from the Rim Board Side



Figure 15: Test Setup Viewed from the Support Side and Showing the Load Application Beam

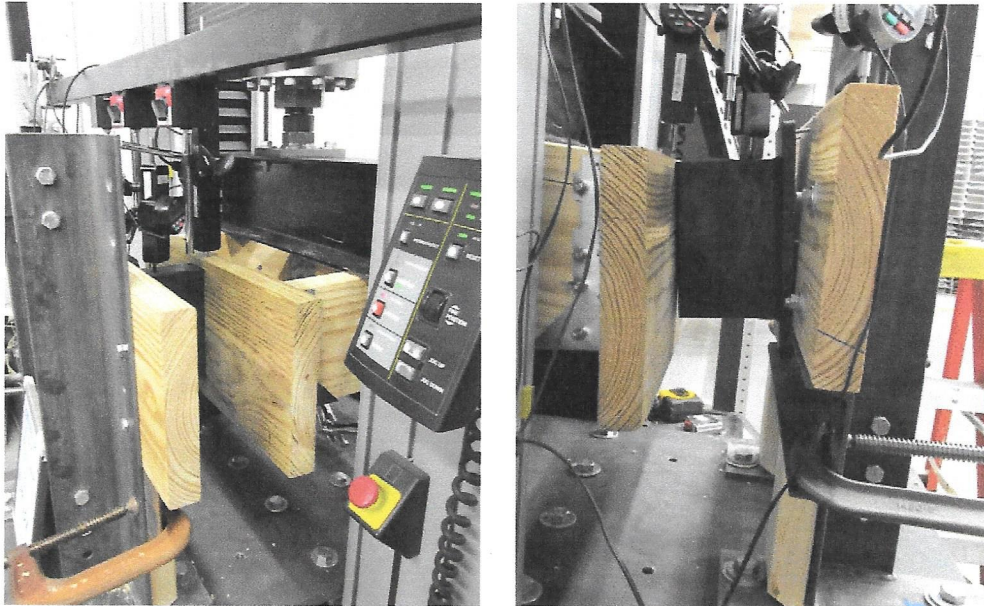


Figure 16: Additional Test Setup Views showing Dial Gauge Placements (Left and Right) and a Test In-Progress (Right)



Figure 17: Test Specimens at Ultimate Load

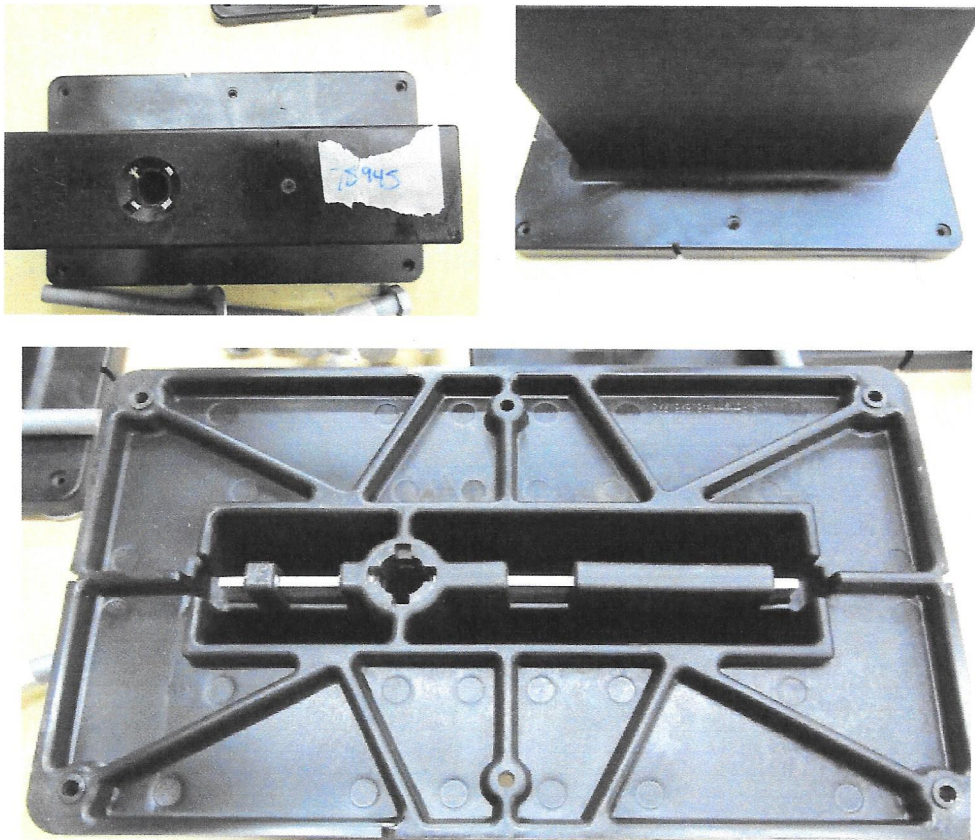


Figure 18: Brick Brackets after Testing
(No Visual Damage was Observed on any Brackets after Testing)

FIGURES



Figure 19: Examples of Bent Bolts Removed from Assemblies after Testing

APPENDIX



BRBB11815-38, NTA 15-03 BR Brick Bracket (Config 1) (FINAL)
Summary Out Data

NTA, Inc.

SUMMARY DATA

NTA 15-03

Ledger-to-Rim Board Bracket Test

Client: BR Brick Bracket
Job Number: BRBB11815-38
Test Location: *NTA, Inc.*
Nappanee, Indiana

Performed By: Melissa Johnson
Witnessed By: Bradley Wear

General:

Date Received: 12/3/2015
Construction Date: 12/15/2015
Constructed By: Todd Ferguson
Test Date: 12/18/2015
Test Variable: Untreated 2x10 #1 SYP Rim Board, treated 2x10 #2 SYP Ledger,
Untreated 2x8 #1 SYP Deck Joists and Simpson Strong-Tie HUS 28

Apparatus:

	Asset No.
Dial Gauge (Rim Board):	00569
Dial Gauge (Bracket):	00590
Dial Gauge (Ledger):	00057
Load Frame:	00140
Load Cell:	00151
Load Fixture:	00298
Support Fixture:	01416

Procedure Modification: N/A - custom procedure

Product Description (Ledger-to-Rim Board Bracket):

Manufacturer: BR Brick Bracket
Trade Name/Designation: Brick Bracket
Material Description: Molded Polymer with Aluminum Insert, 6-in. wide x 10.5-in. long x 5.3125-in. thick

Assembly Description:

Framing	Size	Grade	Species	Quantity	Spacing
Rim Board	2 x 10	#1	SYP	1	--
Deck Ledger	2 x 10	#2	SYP	1	--
Joists	2 x 8	#1	SYP	1	16 in. oc
Support ^a	2 x 10	#1	SYP	1	--

Connection	Fastener Type	Quantity	Spacing
Bracket-to-Rim Board	.149 x 3-in. Smooth Shank Hot-Dipped Galvanized Nail	4	5 in. oc
Bracket-to-Ledger-to Rim Board	1/2 x 10-in. Hot Dipped Galvanized Bolt (307A JG Head Stamp) with 1 3/8-in OD Washer, 9/16-in. ID	1	--
Joist-to-Ledger and Support	#10 x 1-1/2-in. Simpson Strong-Tie SD Connector Screw Class 55 Mechanical Coating (1/4-in. Hex Drive with #1015 Head Stamp)	22/hanger	--
Joist Hanger	Simpson Joist Hanger #HUS28	2/joist	16 in. oc

Joist Span: 12 in.

Joist On-Center Spacing: 16 in.

Gap Between Rim Board and Ledger Board: 5.25 in.

Additional assembly construction details: Top surface of the Brick Bracket was flush with the top surface of the 2 x 10 Rim Board. The top surface of the 2 x 10 Ledger was 1/2-in. above surface of the brick bracket. Brick bracket bolt hole oriented toward bottom of all assemblies.

Conditioning: N/A - Per client request no conditioning was performed on components prior to construction of assemblies.

This summary contains only data arrived at after employing the specific test procedures listed herein. This summary data might not include all reporting requirements of the test standard. The data herein does not constitute a recommendation for, endorsement of, or certification of the product or material tested. NTA, Inc. makes no warranty, expressed or implied, except that the test has been performed, and data prepared, based upon the specimen furnished by the client. Extrapolation of data, from the test data provided herein, to the batch or lot from which the specimens were obtained may not correlate and should be interpreted with extreme caution. NTA, Inc. assumes no responsibility for variations in quality, composition, appearance, performance, or other features of similar materials produced by the client, other persons, or under conditions over which NTA, Inc. has no control. NTA Inc. has issued this data summary for the exclusive use of the client to whom it is addressed. Any use or duplication of this summary shall not be made without their consent. This summary shall only be reproduced in its entirety.

APPENDIX



BRBB111815-38, NTA 15-03 BR Brick Bracket (Config 1) (FINAL)
Summary Out Data

NTA, Inc.

Test Data:

Load Rate: 0.5 in./minute
Adjustment Factors: *Adjustment factors were specified by the client*
Safety Factor: 3.0
Duration of Load: 1.6

Ambient Conditions:

Ambient Temp.: 72.3° F
Ambient R.H.: 52.8% R.H.
Sensor Asset No.: 00578

	Specimen Number	Ultimate	Adjusted	Failure Mode
		Load ¹ (lbf)	Ultimate Load ² (lbf)	
1	78937	4,796	999	Bolt Bending and wood crushing between washer and ledger board
2	78938	7,110	1,481	Bolt Bending and wood crushing between washer and ledger board
3	78939	7,189	1,498	Bolt Bending and wood crushing between washer and ledger board
4	78940	5,875	1,224	Bolt Bending and wood crushing between washer and ledger board
5	78941	5,579	1,162	Bolt Bending and wood crushing between washer and ledger board

Average: 6,110 1,273 ¹ Ultimate load provided is 1/2 the total load applied, which provides the load at the ledger.
Standard Deviation: 1,028 214 ² Ultimate load divided by the safety factor and duration of load factor, as applicable.
COV: 0.2 0.2

Specimen Number	Measured Deflections at given loads, measured at top, mid-span, and mid-width of members (in.)									
	Rim Joist			Ledger			Bracket			
	Adj. Ult.	300 lbf	600 lbf	Adj. Ult.	300 lbf	600 lbf	Adj. Ult.	300 lbf	600 lbf	
1	78937	0.0062	0.0021	0.0039	0.1096	0.0370	0.0731	0.0399	0.0158	0.0254
2	78938	0.0103	0.0023	0.0041	0.1711	0.0514	0.1007	0.0547	0.0161	0.0276
3	78939	0.0075	0.0013	0.0028	0.1204	0.0113	0.0466	0.0426	0.0055	0.0117
4	78940	0.0051	0.0015	0.0028	0.1145	0.0338	0.0664	0.0326	0.0049	0.0137
5	78941	0.0042	0.0013	0.0025	0.1419	0.0178	0.0708	0.0373	0.0071	0.0140
Average:		0.0066	0.0017	0.0032	0.1315	0.0303	0.0715	0.0414	0.0099	0.0185

Specimen Number	Net Deflection (in.)						
	(Ledger - Rim Joist)			(Bracket - Rim Joist)			
	Adj. Ult.	300 lbf	600 lbf	Adj. Ult.	300 lbf	600 lbf	
1	78937	0.1035	0.0349	0.0693	0.0338	0.0137	0.0216
2	78938	0.1609	0.0491	0.0966	0.0445	0.0138	0.0235
3	78939	0.1129	0.0101	0.0439	0.0351	0.0043	0.0090
4	78940	0.1095	0.0324	0.0637	0.0276	0.0035	0.0110
5	78941	0.1378	0.0165	0.0684	0.0332	0.0058	0.0116
Average:		0.1249	0.0286	0.0683	0.0348	0.0082	0.0153
Standard Deviation:		0.0240	0.0155	0.0188	0.0061	0.0051	0.0067
COV:		0.2	0.5	0.3	0.2	0.6	0.4

Specimen Number	Moisture Content (%) (From ASTM D4442 Testing)		Specific Gravity (unitless) (From ASTM D2395)		
	Rim Board	Ledger	Rim Board	Ledger	
	1	78937	15.3%	29.5%	0.50
2	78938	15.6%	24.8%	0.48	0.44
3	78939	11.9%	21.2%	0.61	0.55
4	78940	13.5%	33.6%	0.57	0.52
5	78941	13.9%	29.2%	0.44	0.55
Average:		14.0%	27.7%	0.52	0.52

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APPENDIX



BRBB111815-38, NTA 15-03 BR Brick Bracket (Config 2) (FINAL)
Summary Out Data

NTA, Inc.

SUMMARY DATA

NTA 15-03

Ledger-to-Rim Board Bracket Test

Client: BR Brick Bracket
Job Number: BRBB111815-38
Test Location: *NTA, Inc.*
Nappanee, Indiana

Performed By: Melissa Johnson
Witnessed By: Bradley Wear

General:

Date Received: 12/3/2015
Construction Date: 12/15/2015
Constructed By: Todd Ferguson
Test Date: 12/18/2015
Test Variable: 1-1/8"x 11-7/8" Engineered Wood Rim Board, treated 2x10 #2 SYP
Ledger, Untreated 2x8 #1 SYP Deck Joists and Simpson Strong-Tie HUS 28
Procedure Modification: N/A - custom procedure

Apparatus: Asset No.
Dial Gauge (Rim Board): 00569
Dial Gauge (Bracket): 00590
Dial Gauge (Ledger): 00057
Load Frame: 00140
Load Cell: 00151
Load Fixture: 00298
Support Fixture: 01416

Product Description (Ledger-to-Rim Board Bracket):

Manufacturer: BR Brick Bracket
Trade Name/Designation: Brick Bracket
Material Description: Molded Polymer with Aluminum Insert, 6-in. wide x 10.5-in. long x 5.3125-in. thick

Assembly Description:

Framing	Size	Grade	Species	Quantity	Spacing
Rim Board	1-1/8x11-7/8	Exposure 1, PRR-410	OSB	1	--
Deck Ledger	2 x 10	#2	SYP	1	--
Joists	2 x 8	#1	SYP	1	16 in. oc
Support ^a	2 x 10	#1	SYP	1	--

Connection	Fastener Type	Quantity	Spacing
Bracket-to-Rim Board	0.149 x 3-in. Smooth Shank Hot-Dipped Galvanized Nail	4	5 in. oc
Bracket-to-Ledger-to Rim Board	1/2 x 10-in. Hot Dipped Galvanized Bolt (307A JG Head Stamp) with 1 3/8-in OD Washer, 9/16-in. ID	1	--
Joist-to-Ledger and Support	#10 x 1-1/2-in. Simpson Strong-Tie SD Connector Screw Class 55 Mechanical Coating (1/4-in. Hex Drive with #1015 Head Stamp)	22/hanger	--
Joist Hanger	Simpson Joist Hanger #HUS28	2/joist	16 in. oc

Joist Span: 12 in.

Joist On-Center Spacing: 16 in.

Gap Between Rim Board and Ledger Board: 5.25 in.

Additional assembly construction details: Bottom surface of the Brick Bracket was flush with the bottom surface of the 1-1/8 x 11-7/8 EWP Rim Board. The top surface of the 2 x 10 Ledger was 1/2-in. above surface of the brick bracket. Brick bracket bolt hole oriented toward bottom-of all assemblies.

Conditioning: N/A - Per client request no conditioning was performed on components prior to construction of assemblies.

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APPENDIX



BRBB111815-38, NTA 15-03 BR Brick Bracket (Config 2) (FINAL)
Summary Out Data

NTA, Inc.

Test Data:

Load Rate: 0.5 in./minute
Adjustment Factors: *Adjustment factors were specified by the client*
Safety Factor: 3.0
Duration of Load: 1.6

Ambient Conditions:

Ambient Temp.: 72.5° F
Ambient R.H.: 48.9% R.H.
Sensor Asset No.: 00578

Specimen Number	Ultimate Load ¹ (lbf)	Adjusted Ultimate Load ² (lbf)	Failure Mode
	1	78942	
2	78943	4,721	983
3	78944	3,582	746
4	78945	5,349	1,114
5	78946	5,459	1,137
Average:	4,723	984	
Standard Deviation:	755	157	
COV:	0.2	0.2	

¹ Ultimate load provided is 1/2 the total load applied, which provides the load at the ledger.
² Ultimate load divided by the safety factor and duration of load factor, as applicable.

Specimen Number	Measured Deflections at given loads, measured at top, mid-span, and mid-width of members (in.)									
	Rim Joist			Ledger			Bracket			
	Adj. Ult.	300 lbf	600 lbf	Adj. Ult.	300 lbf	600 lbf	Adj. Ult.	300 lbf	600 lbf	
1	78942	0.0032	0.0010	0.0017	0.1321	0.0364	0.0840	0.0312	0.0054	0.0148
2	78943	0.0034	0.0015	0.0025	0.1007	0.0256	0.0709	0.0219	0.0061	0.0107
3	78944	0.0025	0.0008	0.0018	0.0938	0.0229	0.0791	0.0245	0.0086	0.0194
4	78945	0.0046	0.0010	0.0024	0.1160	0.0130	0.0550	0.0291	0.0060	0.0100
5	78946	0.0047	0.0012	0.0022	0.1201	0.0309	0.0676	0.0296	0.0054	0.0097
Average:	0.0037	0.0011	0.0021	0.1125	0.0258	0.0713	0.0273	0.0063	0.0129	

Specimen Number	Net Deflection (in.)						
	(Ledger - Rim Joist)			(Bracket - Rim Joist)			
	Adj. Ult.	300 lbf	600 lbf	Adj. Ult.	300 lbf	600 lbf	
1	78942	0.1290	0.0355	0.0823	0.0281	0.0045	0.0131
2	78943	0.0974	0.0241	0.0685	0.0186	0.0046	0.0083
3	78944	0.0913	0.0222	0.0773	0.0220	0.0079	0.0176
4	78945	0.1114	0.0121	0.0526	0.0245	0.0051	0.0076
5	78946	0.1154	0.0297	0.0655	0.0249	0.0042	0.0076
Average:	0.1089	0.0247	0.0692	0.0236	0.0052	0.0108	
Standard Deviation:	0.0149	0.0088	0.0115	0.0035	0.0015	0.0044	
COV:	0.1	0.4	0.2	0.2	0.3	0.4	

Specimen Number	Moisture Content (%)		Specific Gravity (unitless)		
	(From ASTM D4442 Testing)		(From ASTM D2395)		
	Rim Board	Ledger	Rim Board	Ledger	
1	78942	6.6%	32.5%	0.63	0.42
2	78943	7.0%	21.5%	0.83	0.55
3	78944	6.8%	35.9%	0.62	0.55
4	78945	6.7%	26.4%	0.60	0.59
5	78946	6.8%	43.7%	0.60	0.56
Average:	6.8%	32.0%	-0.66	0.53	

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APPENDIX



BRBB111815-38, NTA 15-03 BR Brick Bracket (Config 3) (FINAL)
Summary Out Data

NTA, Inc.

SUMMARY DATA

NTA 15-03

Ledger-to-Rim Board Bracket Test

Client: BR Brick Bracket
Job Number: BRBB111815-38
Test Location: *NTA, Inc.*
Nappanee, Indiana

Performed By: Melissa Johnson
Witnessed By: Bradley Wear

General:

Date Received: 12/3/2015
Construction Date: 12/15/2015
Constructed By: Todd Ferguson
Test Date: 12/18/2015
Test Variable: Untreated 2x10 #1 SYP Rim Board, treated 2x8 #2 SYP Ledger,
Untreated 2x8 #1 SYP Deck Joists and Simpson Strong-Tie HUS 28

Apparatus: Asset No.
Dial Gauge (Rim Board): 00569
Dial Gauge (Bracket): 00590
Dial Gauge (Ledger): 00057
Load Frame: 00140
Load Cell: 00151
Load Fixture: 00298
Support Fixture: 01416

Procedure Modification: N/A - custom procedure

Product Description (Ledger-to-Rim Board Bracket):

Manufacturer: BR Brick Bracket
Trade Name/Designation: Brick Bracket
Material Description: Molded Polymer with Aluminum Insert, 6-in. wide x 10.5-in. long x 5.3125-in. thick

Assembly Description:

Framing	Size	Grade	Species	Quantity	Spacing
Rim Board	2 x 10	#1	SYP	1	--
Deck Ledger	2 x 8	#2	SYP	1	--
Joists	2 x 8	#1	SYP	1	16 in. oc
Support ^a	2 x 8	#1	SYP	1	--

Connection	Fastener Type	Quantity	Spacing
Bracket-to-Rim Board	0.149 x 3-in. Smooth Shank Hot-Dipped Galvanized Nail	4	5 in. oc
Bracket-to-Ledger-to Rim Board	1/2 x 10-in. Hot Dipped Galvanized Bolt (307A JG Head Stamp) with 1 3/8-in OD Washer, 9/16-in. ID	1	--
Joist-to-Ledger and Support	#10 x 1-1/2-in. Simpson Strong-Tie SD Connector Screw Class 55 Mechanical Coating (1/4-in. Hex Drive with #1015 Head Stamp)	22/hanger	--
Joist Hanger	Simpson Joist Hanger #HUS28	2/joist	16 in. oc

Joist Span: 12 in.

Joist On-Center Spacing: 16 in.

Gap Between Rim Board and Ledger Board: 5.25 in.

Additional assembly construction details: Top surface of the Brick Bracket was flush with the top surface of the 2 x 10 Rim Board. The top surface of the 2 x 8 Ledger was 3/8-in. above surface of the brick bracket. Brick bracket bolt hole oriented toward bottom of all assemblies.

Conditioning: N/A - Per client request no conditioning was performed on components prior to construction of assemblies.

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APPENDIX



BRBB111815-38, NTA 15-03 BR Brick Bracket (Config 3) (FINAL)
Summary Out Data

NTA, Inc.

Test Data:

Load Rate: 0.5 in./minute
Adjustment Factors: *Adjustment factors were specified by the client*
Safety Factor: 3.0
Duration of Load: 1.6

Ambient Conditions:

Ambient Temp.: 72.1° F
Ambient R.H.: 49.2% R.H.
Sensor Asset No.: 00578

Specimen Number	Ultimate Load ¹ (lbf)	Adjusted Ultimate Load ² (lbf)	Failure Mode
1 78947	7,389	1,539	Bolt Bending and wood crushing between washer and ledger board
2 78948	7,809	1,627	Bolt Bending and wood crushing between washer and ledger board
3 78949	4,390	915	Bolt Bending and wood crushing between washer and ledger board
4 78950	7,890	1,644	Bolt Bending and wood crushing between washer and ledger board
5 78951	7,454	1,553	Bolt Bending and wood crushing between washer and ledger board

Average: 6,986 1,455 ¹ Ultimate load provided is 1/2 the total load applied, which provides the load at the ledger.
Standard Deviation: 1,467 306 ² Ultimate load divided by the safety factor and duration of load factor, as applicable.
COV: 0.2 0.2

Specimen Number	Measured Deflections at given loads, measured at top, mid-span, and mid-width of members (in.)								
	Rim Joist			Ledger			Bracket		
	Adj. Ult.	300 lbf	600 lbf	Adj. Ult.	300 lbf	600 lbf	Adj. Ult.	300 lbf	600 lbf
1 78947	0.0064	0.0002	0.0025	0.1339	0.0213	0.0723	0.0507	0.0113	0.0248
2 78948	0.0096	0.0019	0.0042	0.1465	0.0136	0.0614	0.0425	0.0070	0.0142
3 78949	0.0038	0.0014	0.0019	0.0682	0.0142	0.0280	0.0291	0.0075	0.0163
4 78950	0.0080	0.0013	0.0037	0.1281	0.0159	0.0469	0.0508	0.0084	0.0159
5 78951	0.0545	0.0024	0.0068	0.1264	0.0159	0.0310	0.0605	0.0083	0.0177
Average:	0.0164	0.0014	0.0038	0.1206	0.0162	0.0479	0.0467	0.0085	0.0178

Specimen Number	Net Deflection (in.)					
	(Ledger - Rim Joist)			(Bracket - Rim Joist)		
	Adj. Ult.	300 lbf	600 lbf	Adj. Ult.	300 lbf	600 lbf
1 78947	0.1275	0.0211	0.0698	0.0443	0.0111	0.0223
2 78948	0.1370	0.0117	0.0573	0.0330	0.0051	0.0101
3 78949	0.0645	0.0128	0.0261	0.0254	0.0061	0.0144
4 78950	0.1202	0.0147	0.0432	0.0429	0.0072	0.0122
5 78951	0.0719	0.0136	0.0242	0.0060	0.0060	0.0109
Average:	0.1042	0.0148	0.0441	0.0303	0.0071	0.0140
Standard Deviation:	0.0335	0.0037	0.0197	0.0156	0.0024	0.0049
COV:	0.3	0.3	0.4	0.5	0.3	0.4

NOTE: The ledger dial gauge was stopped mid-way through the test for specimen #78951 due to a wood splinter which occurred after 300 lb, 600 lb, and adjusted ultimate.

Specimen Number	Moisture Content (%) (From ASTM D4442 Testing)		Specific Gravity (unitless) (From ASTM D2395)	
	Rim Board	Ledger	Rim Board	Ledger
1 78947	14.8%	17.3%	0.56	0.50
2 78948	13.0%	18.6%	0.57	0.43
3 78949	12.9%	19.5%	0.55	0.45
4 78950	13.6%	19.8%	0.58	0.43
5 78951	13.6%	13.5%	0.56	0.48
Average:	13.6%	17.7%	0.56	0.46

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APPENDIX



BRBB111815-38, NTA 15-03 BR Brick Bracket (Config 4) (FINAL)
Summary Out Data

NTA, Inc.

SUMMARY DATA

NTA 15-03

Ledger-to-Rim Board Bracket Test

Client: BR Brick Bracket
Job Number: BRBB111815-38
Test Location: *NTA, Inc.*
Nappanee, Indiana

Performed By: Melissa Johnson
Witnessed By: Bradley Wear

General:

Date Received: 12/3/2015
Construction Date: 12/15/2015
Constructed By: Todd Ferguson
Test Date: 12/18/2015
Test Variable: 1-1/8"x 11-7/8" Engineered Wood Rim Board, treated 2x8 #2 SYP Ledger,
Untreated 2x8 #1 SYP Deck Joists and Simpson Strong-Tie HUS 28

Apparatus: Asset No.
Dial Gauge (Rim Board): 00569
Dial Gauge (Bracket): 00590
Dial Gauge (Ledger): 00057
Load Frame: 00140
Load Cell: 00151
Load Fixture: 00298
Support Fixture: 01416

Procedure Modification: N/A - custom procedure

Product Description (Ledger-to-Rim Board Bracket):

Manufacturer: BR Brick Bracket
Trade Name/Designation: Brick Bracket
Material Description: Molded Polymer with Aluminum Insert, 6-in. wide x 10.5-in. long x 5.3125-in. thick

Assembly Description:

Framing	Size	Grade	Species	Quantity	Spacing
Rim Board	1-1/8x11-7/8	Exposure 1, PRR-410	OSB	1	--
Deck Ledger	2 x 8	#2	SYP	1	--
Joists	2 x 8	#1	SYP	1	16 in. oc
Support ^a	2 x 10	#1	SYP	1	--

Connection	Fastener Type	Quantity	Spacing
Bracket-to-Rim Board	0.149 x 3-in. Smooth Shank Hot-Dipped Galvanized Nail	4	5 in. oc
Bracket-to-Ledger-to Rim Board	1/2 x 10-in. Hot Dipped Galvanized Bolt (307A JG Head Stamp) with 1 3/8-in OD Washer, 9/16-in. ID	1	--
Joist-to-Ledger and Support	#10 x 1-1/2-in. Simpson Strong-Tie SD Connector Screw Class 55 Mechanical Coating (1/4-in. Hex Drive with #1015 Head Stamp)	22/hanger	--
Joist Hanger	Simpson Joist Hanger #HUS28	2/joist	16 in. oc

Joist Span: 12 in.

Joist On-Center Spacing: 16 in.

Gap Between Rim Board and Ledger Board: 5.25 in.

Additional assembly construction details: Bottom surface of the Brick Bracket was flush with the bottom surface of the 1-1/8 x 11-7/8 EWP Rim Board. The top surface of the 2 x 8 Ledger was 3/8-in. above surface of the brick bracket. Brick bracket bolt hole oriented toward bottom of all assemblies.

Conditioning: N/A - Per client request no conditioning was performed on components prior to construction of assemblies.

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APPENDIX



BRBB11815-38, NTA 15-03 BR Brick Bracket (Config 4) (FINAL)
Summary Out Data

NTA, Inc.

Test Data:

Load Rate: 0.5 in./minute
Adjustment Factors: *Adjustment factors were specified by the client*
Safety Factor: 3.0
Duration of Load: 1.6

Ambient Conditions:

Ambient Temp.: 72.8° F
Ambient R.H.: 49.6% R.H.
Sensor Asset No.: 00578

Specimen Number	Ultimate Load ¹ (lbf)	Adjusted Ultimate Load ² (lbf)	Failure Mode
1 78952	6,124	1,276	Bolt Bending and wood crushing between washer and ledger board
2 78953	6,311	1,315	Bolt Bending and wood crushing between washer and ledger board
3 78954	5,007	1,043	Bolt Bending and wood crushing between washer and ledger board
4 78955	6,431	1,340	Bolt Bending and wood crushing between washer and ledger board
5 78956	5,454	1,136	Support wood splitting at metal bracket and bolt bending
Average:	5,866	1,222	
Standard Deviation:	611	127	
COV:	0.1	0.1	

¹ Ultimate load provided is 1/2 the total load applied, which provides the load at the ledger.
² Ultimate load divided by the safety factor and duration of load factor, as applicable.

Specimen Number	Measured Deflections at given loads, measured at top, mid-span, and mid-width of members (in.)								
	Rim Joist			Ledger			Bracket		
	Adj. Ult.	300 lbf	600 lbf	Adj. Ult.	300 lbf	600 lbf	Adj. Ult.	300 lbf	600 lbf
1 78952	0.0067	0.0017	0.0035	0.1646	0.0512	0.0957	0.0596	0.0154	0.0287
2 78953	0.0077	0.0021	0.0039	0.1421	0.0320	0.0800	0.0426	0.0061	0.0183
3 78954	0.0063	0.0012	0.0032	0.1447	0.0591	0.0983	0.0424	0.0154	0.0272
4 78955	0.0073	0.0019	0.0038	0.1310	0.0161	0.0566	0.0342	0.0069	0.0130
5 78956	0.0065	0.0016	0.0035	0.1216	0.0302	0.0780	0.0323	0.0061	0.0131
Average:	0.0069	0.0017	0.0036	0.1408	0.0377	0.0817	0.0422	0.0100	0.0201

Specimen Number	Net Deflection (in.)					
	(Ledger - Rim Joist)			(Bracket - Rim Joist)		
	Adj. Ult.	300 lbf	600 lbf	Adj. Ult.	300 lbf	600 lbf
1 78952	0.1579	0.0496	0.0923	0.0529	0.0138	0.0253
2 78953	0.1344	0.0299	0.0761	0.0349	0.0040	0.0144
3 78954	0.1385	0.0580	0.0952	0.0362	0.0143	0.0241
4 78955	0.1237	0.0142	0.0528	0.0269	0.0050	0.0092
5 78956	0.1152	0.0286	0.0746	0.0259	0.0045	0.0097
Average:	0.1339	0.0360	0.0782	0.0353	0.0083	0.0165
Standard Deviation:	0.0162	0.0176	0.0169	0.0108	0.0052	0.0077
COV:	0.1	0.5	0.2	0.3	0.6	0.5

Specimen Number	Moisture Content (%) (From ASTM D4442 Testing)		Specific Gravity (unitless) (From ASTM D2395)	
	Rim Board	Ledger	Rim Board	Ledger
1 78952	6.7%	13.5%	0.55	0.53
2 78953	6.1%	20.6%	0.62	0.48
3 78954	7.0%	18.1%	0.56	0.70
4 78955	6.4%	17.2%	0.60	0.58
5 78956	6.6%	13.3%	0.60	0.64
Average:	6.6%	16.5%	-- 0.59	-0.59

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