WASHINGTON STATE UNIVERSITY
Composite Materials and Engineering Center
VOILAND COLLEGE OF ENGINEERING AND ARCHITECTURE

Report No. CMEC 15-009
Test Evaluation of Post-Frame Building Product

Prepared

for

Solid Structures, Inc.
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Spokane, WA 99217

By

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Introduction

The Composite Materials and Engineering Center (CMEC), at Washington State University in Pullman, WA, performed a series of tests on several post-frame building products supplied by Solid Structures, Inc. of Spokane WA. The products were metal brackets that are attached to the post assembly and are anchored to simulate in ground installation with concrete casing (Figure 1). The tests were conducted according to the guidelines Solid Structures Inc. provided. The CMEC received the brackets and post material on 20 May, 2015.

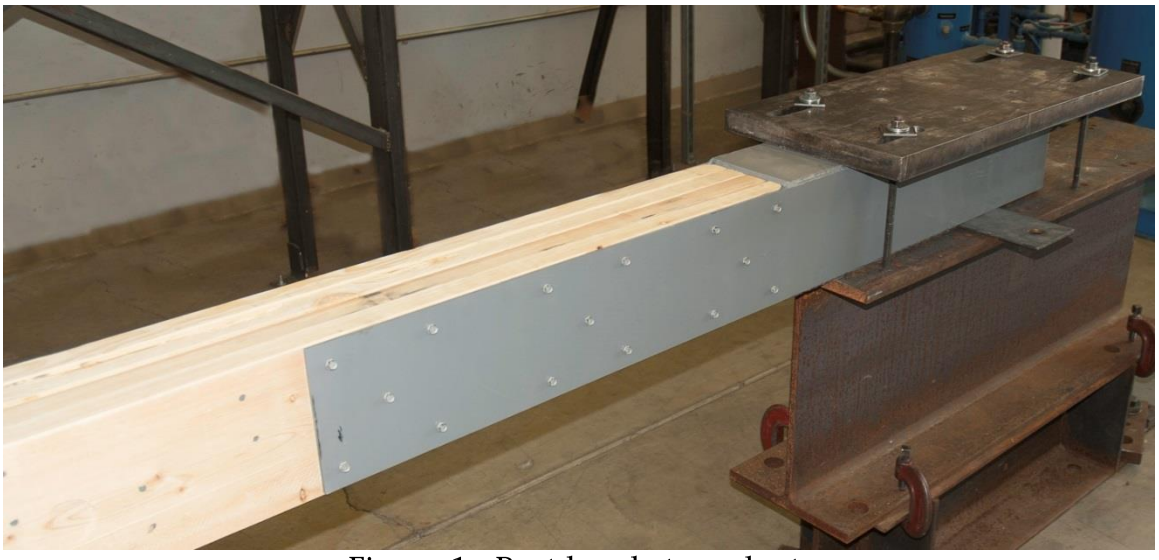

Figure 1. Post bracket product.

Test Materials

The product was a steel bracket of various sizes (to fit 2x6, 2x8 and 2x10 dimensional lumber). The brackets were made with 3/16-inch or ¼-inch steel ranging in length from 54 to 66-inches. The main body of the bracket was 30 inches long and the strap that attached the bracket to the post varied in length. The posts that were tested were all approximately 120 inches long. The post material was stamped as number 2, Douglas Fir, Douglas Fir (North) or Douglas Fir/Larch (North). The test posts were not conditioned prior to testing. The dimensions of all post specimens were measured and recorded prior to testing. Moisture content of the lumber was measured with a capacitance-type meter and found to range from 11 to 15%, with most pieces being near 12%.

Test Methods and Results

Bending

Two types of loading were conducted. A propped cantilever test (Figure 2) and a cantilever test (Figure 3) were conducted on ten and four specimens, respectively. The support span for the propped cantilever test was 120 inches and the load was applied at the mid-span using a rounded loading fixture that had a 58-inch diameter. The reaction support on the fixed end of the system was wide enough to prevent damaged to the specimen at the point of contact and the post bracket was secured in place using four lengths of high strength threaded rod. The support apparatus at the propped end of the system included a bearing plate, rollers and a pivot point that provided uniform support across the width of the specimen and ensured unrestricted longitudinal deformation of the beam at the reaction. For the cantilever test setup the reaction support at the propped end of the system was removed to allow the beam to deflect as necessary. The specimens were loaded at a constant rate a displacement (0.6 in/min) until failure. Deflection at the neutral axis of the beam was measured and recorded at 0.5 second intervals at the midpoint of the beam and at the reaction point on each end of the beam. The load imparted into the system was measured and recorded at 0.5 second intervals throughout each test.

Figure 2. Typical propped cantilever test setup.

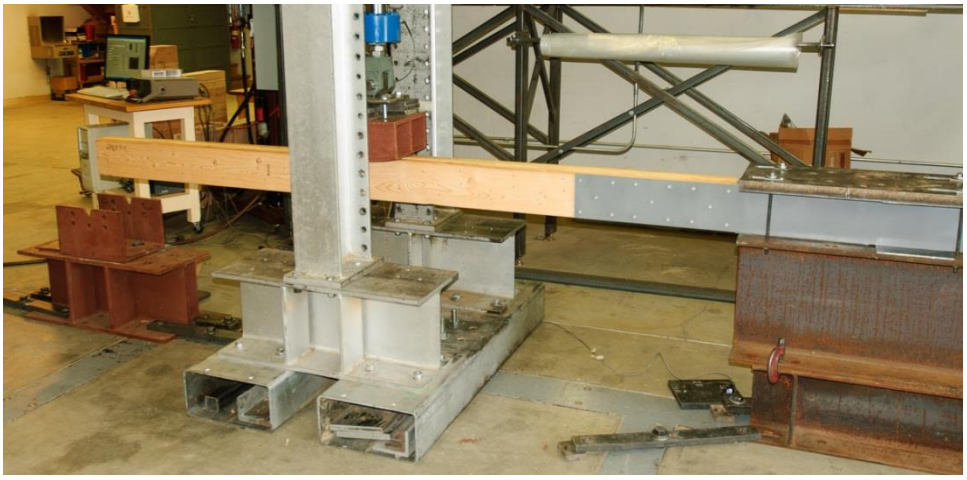

Figure 3. Typical cantilever test setup. The reaction at the free end was removed to allow vertical movement.

Table 1 provides a summary of the testing results. Appendix A shows some typical failures.

Table 1. Summary of testing results

Specimen Name	Specimen Number	Test Type	Lumber Dimension	Number of Plies	Bracket Steel Thickness	Strap Length	Offset from clamp to end of steel tube (in)	Max Load (Lbs)	Failure Mechanism/Comments
2x6x3	1	Propped cantilever	2x6	3	3/16"	24"	5	6,363	Post-tension side and bracket steel yielding
2x6x3	2	Propped Cantilever	2x6	3	3/16"	24"	5	7,962	Post-splintering and tension and bracket steel yielding/ Same bracket as 2x6x3-1, but the bracket was inverted and tested again
2x6x3	3C	Cantilever	2x6	3	3/16"	24"	1	2,948	Bracket steel yielding
2x8x3	1	Propped Cantilever	2x8	3	3/16"	24"	5	15,298	Post-splintering tension and bracket steel yielding/Support blocks not removed from propped end
2x8x3	2C	Cantilever	2x8	3	3/16"	24"	1	5,219	Bracket steel yielding and screw yielding
2x8x4	1C	Cantilever	2x8	4	1/4"	36"	1	8,273	Bracket steel yielding and screw yielding
2x8x4	2	Propped Cantilever	2x8	4	1/4"	36"	5	19,232	Post-splintering tension
2x8x4	3	Propped Cantilever	2x8	4	1/4"	36"	5	16,168	Post-tension/ Same bracket as 2x8x4-2, but the bracket was inverted and tested again
2x10x3	1	Propped Cantilever	2x10	3	3/16"	30"	5	22,363	Post-splintering tension and screw yielding
2x10x3	2	Propped Cantilever	2x10	3	3/16"	30"	5	20,035	Post-tension
2x10x4	1	Propped Cantilever	2x10	4	3/16"	30"	5	21,011	Post-tension
2x10x4	2	Propped Cantilever	2x10	4	1/4"	36"	5	18,506	Post-tension
2x6x4	1	Propped Cantilever	2x6	4	1/4"	30"	5	9,189	Post-tension and bracket steel yielding
2x6x4	2	Cantilever	2x6	4	1/4"	30"	1	3,979	Bracket steel yielding

Testing conducted by Robert Duncan and Scott R. Lewis

Report prepared by:

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CMEC Quality Manager

Appendix A

Figure A1. 2x8-4 ply bending failure initiating on tension failure.

Figure A2. 2x10-3 ply shortly before failure.

Figure A3. Cantilever after steel yielding.

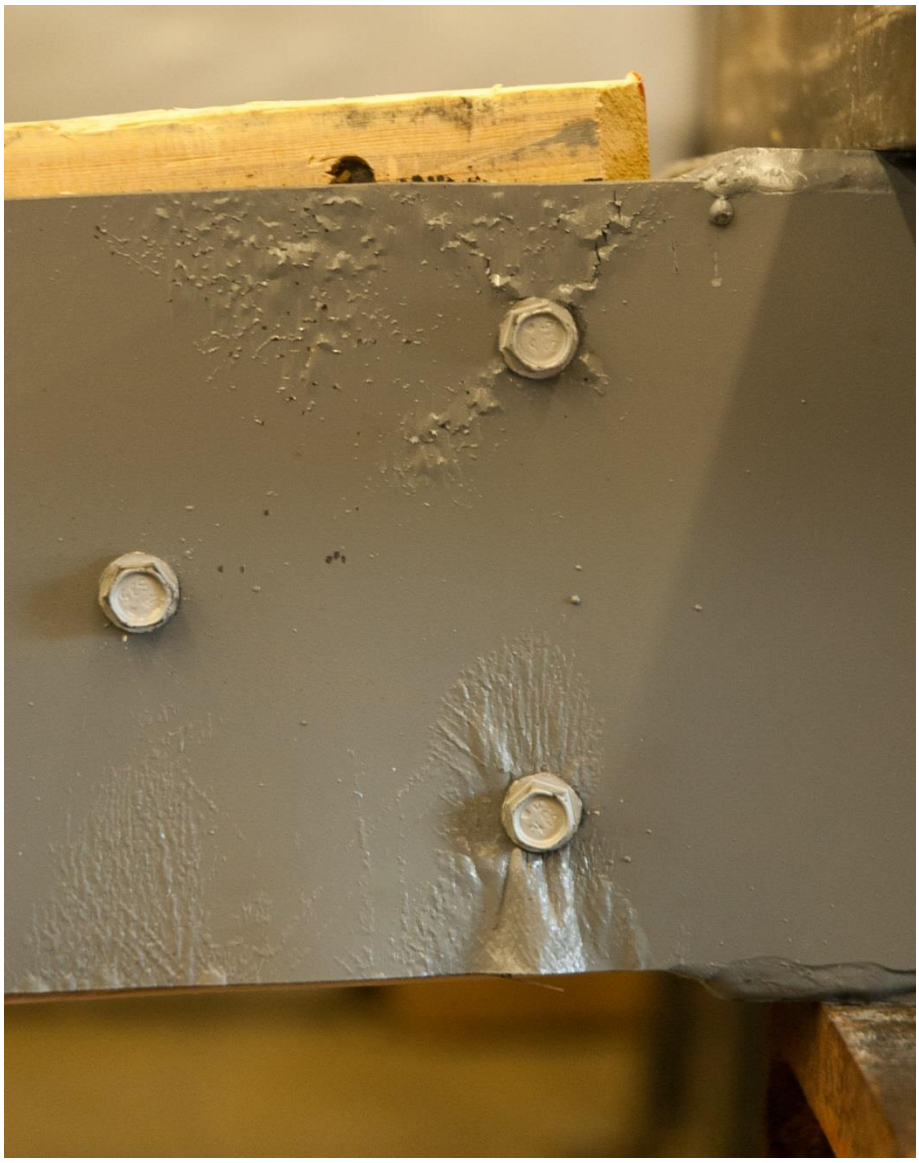

Figure A4. Yielded steel (same specimen as figure A3). The paint coating helped to show yielding of the steel.

Figure A5. Yielded steel on 2x6-3 ply propped cantilever test.

Figure A6. 2x10 3-ply splintering tension failure

Figure A7. 2x6-4 ply shortly before failure.