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TEST REPORT

ST1205

BIFORM JOIST MOUNT AND PACKER TESTING

CLIENT
Biform Limited
New Zealand

PROJECT NUMBER:	ISSUE DATE:	PAGE:
ST1205	**12 May 2017**	**1 of 10**

LIMITATION

The results reported here relate only to the items tested.

TERMS AND CONDITIONS

This report is issued in accordance with the Terms and Conditions as detailed and agreed in the BRANZ Services Agreement for this work.

SIGNATORIES

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1. OBJECTIVE

Testing was performed to determine the compressive load carrying capacity of the Biform joist mounting system that includes joist mounts and stackable packers used to achieve different heights for the joist mounts. The joist mount and packer system is intended to be used for raising the level of a substructure off of a solid slab or structure.

2. DESCRIPTION OF SPECIMENS

Test specimens were provided by the client and delivered to BRANZ for testing. This included 6 examples of the joist mounts and 6 each of the 1 mm thick, 2 mm thick and 3 mm thick stackable joist mount packers. The joist mounts and packers are made from a black plastic and the packers clip into the underside of the joist mounts and into one another. The joist mounts are 100 mm square in plan, 30 mm tall and can accommodate 45 mm or 50 mm wide timber joists (see Figure 1). A drawing of the 2 mm thick packer is shown in Figure 2.

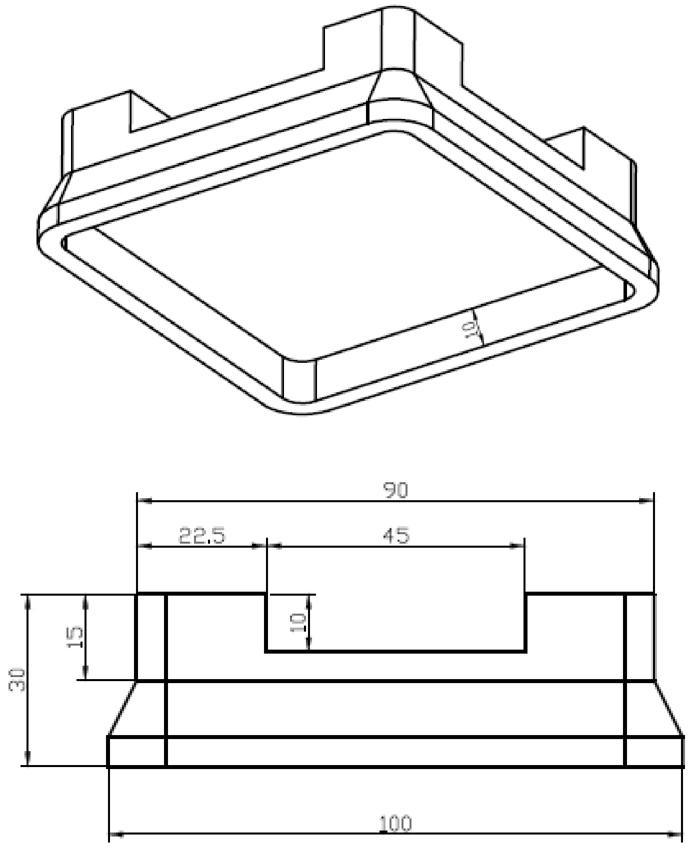

Figure 1. Isometric (Top) and Elevation (Bottom) Drawings of Biform Joist Mount Provided by The Client

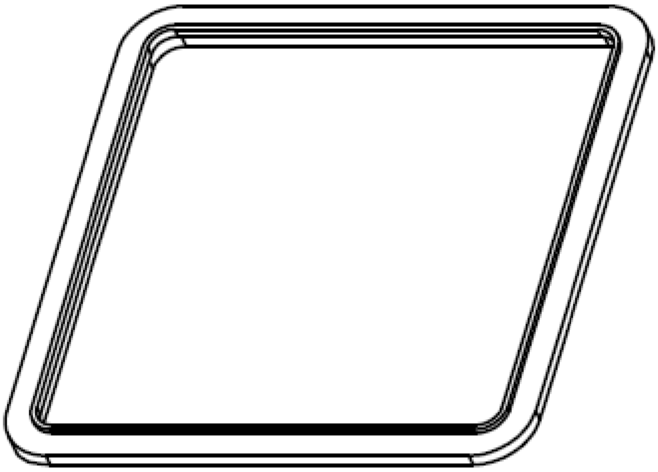

Figure 2. Drawing of a 2 mm Thick Biform Joist Mount Packer Provided by The Client

3. DESCRIPTION OF TESTS

3.1 Date and Location of Tests

The tests were carried out in March and April 2017 at the Structural Engineering Laboratory of BRANZ Ltd, Judgeford, New Zealand.

3.2 Test Configurations and Equipment

Compression testing was conducted on the following configurations:

1) Joist mount with 50 mm wide steel block for loading
2) Joist mount with 42 mm wide steel block for loading
3) Joist mount with three 1 mm packers (42 mm wide loading block)
4) Joist mount with three 2 mm packers (42 mm wide loading block)
5) Joist mount with three 3 mm packers (42 mm wide loading block)
6) Joist mount with three 1 mm, three 2 mm and three 3 mm packers (42 mm wide loading block)

The 42 mm wide steel loading block was used for all except the first test because it allowed the joist mount to deflect more easily during loading and was considered the more conservative method of applying the loads. Whereas the joist mounting system is intended for use with timber joists, steel blocks were used for load application to avoid potential crushing of the timber during loading. These configurations were tested to assess the load carrying capacity of scenarios likely to be used with the joist mounts.

Compression loads were applied to the test specimens using a Dartec Universal Testing machine and the load was measured with a 100 kN loadcell. The test load and cross head displacement measurement were recorded using a computer controlled data acquisition system. The load cell was calibrated to International Standard EN ISO 7500-1 [1] Grade 1 accuracy.

3.3 Test Procedure

The load was applied using a rigid steel plate to each specimen at a displacement rate of 1 mm per minute until failure occurred as shown in Figure 3.

Figure 3. Testing Set Up for Biform Joist Mount and Packer Testing (Only Joist Mount Shown Here)

4. OBSERVATIONS

Maximum loads achievable for each configuration was taken as the highest load reached up to the point of failure. The failure of the specimens was slightly different between the configurations where only the joist mount was tested and those that included the packers. Because there was only 10 mm of clearance between the inside bottom of the joist mount (see isometric view in Figure 1) and the steel plate used as a base for testing (see Figure 3) failure was considered to be a deflection of approximately 9 mm because further displacement would cause the base of the joist mount to contact the steel base and this would result in unrealistic higher loads. At failure of the joist mounts there was bulging of the plastic joist mount base and this deformation was not recovered when the load was removed. Joist mount failure can be seen in Figure 4. A typical load-deflection graph of a joist mount test is shown in Figure 5.

Figure 4. Failure of Joist Mount during Compression Testing

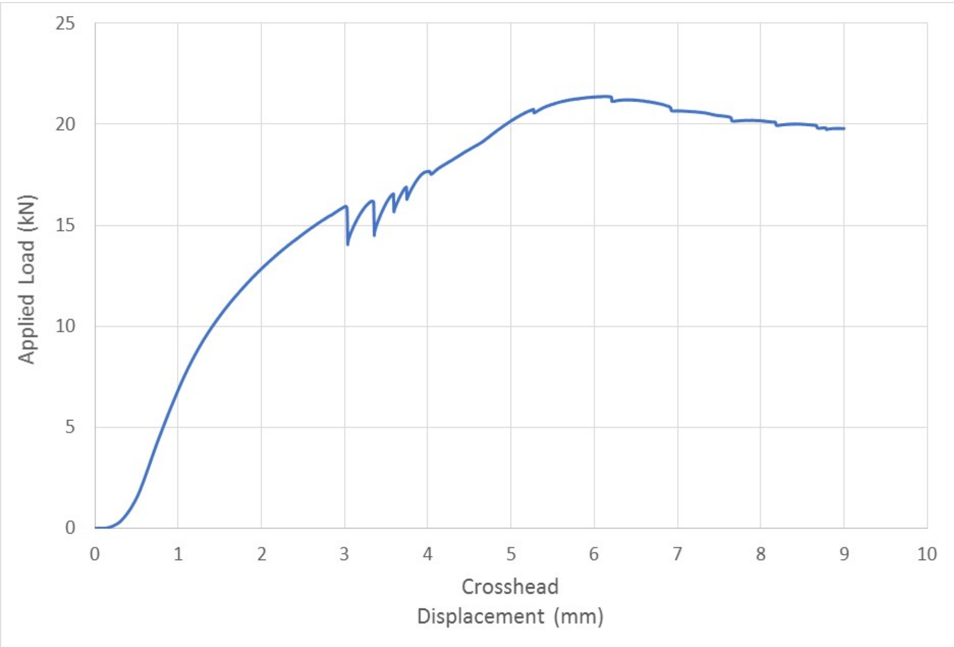

Figure 5. Load – Deflection Plot for Joist Mount Using 42 mm Wide Steel Block

Failure of specimens testing including the packers included the same bulging of the joist mounts, but included deformation of the packers which resulted in significant decreases in applied loads as the packers were no longer well aligned with the joist mounts and did not remained clipped together. For these configurations there was a distinct drop in applied load as the packers dislodged and tests were stopped soon after for each configuration. Failure of a specimen including the packers is shown in Figure 6 and a load-deflection plot of the specimen using three 3 mm thick packers is provided in Figure 7.

Figure 6. Failure of Joist Mount with Three 3 mm Thick Packers during Compression Testing

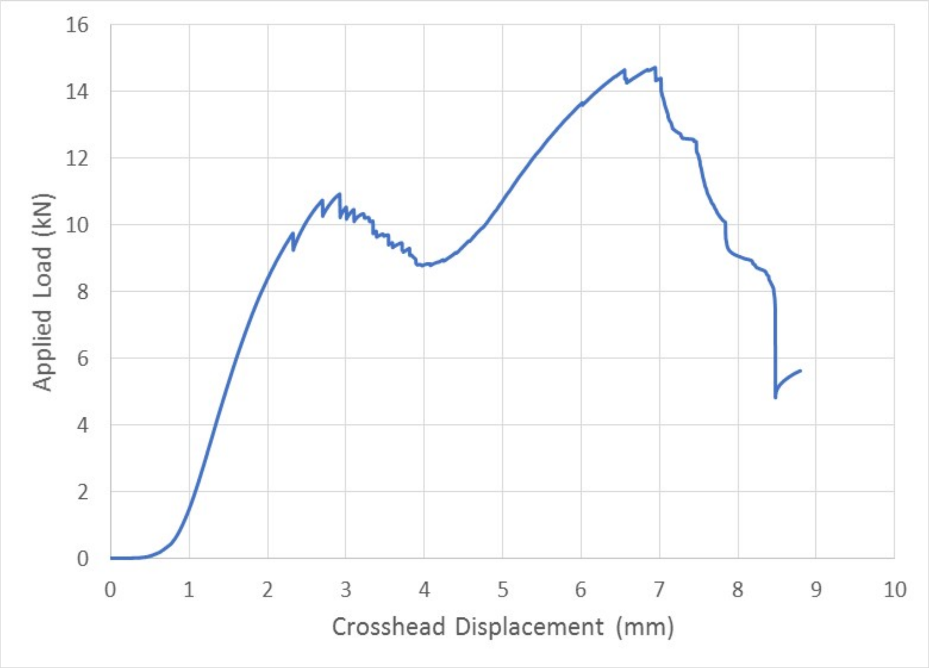

Figure 7. Load – Deflection Plot for Joist Mount Including Three 3 mm Thick Packers

5. RESULTS

The maximum loads achieved during each of the 6 tested configurations are provided in Table 1. Allowable design loads for the joist mount only and the joist mount using the different packers tested were derived from the test data using the k_t values described in Appendix B of AS/NZS1170.0 [2] for the different configurations as described in Table 2. The design capacity for each configuration is the value of the lowest test result divided by the appropriate factor for variability (k_t). The tests using packers were combined because the different configurations were assumed to be similar enough to each other to represent how the packers could be used in practice.

Table 1. Maximum Loads Resisted during Compression Testing of Biform Joist Mounts and Packers

Test	Configuration	Max. Load (kN)
1	Just holder using 50 mm wide steel block	25.19
2	Just holder using 42 mm wide steel block	21.37
3	Holder with three 1 mm packers	13.94
4	Holder with three 2 mm packers	15.77
5	Holder with three 3 mm packers	14.73
6	Holder with three each 1, 2 and 3 mm packers	14.49

Table 2. Analysis of Results of Biform Joist Mounts and Packers to Determine Allowable Design Loads

Analysis for tests with packers (4)	Load (kN)
Average	14.73
Standard Deviation	0.77
COV (%)	5.20%
kt (4 specimens, cov = 7.5%)	1.23
Design Capacity (kN)	11.38
Analysis for tests of only joist mounts (2)	Load (kN)
Average	23.28
Standard Deviation	2.70
COV (%)	11.60%
kt (2 specimens, cov = 14%)	1.59
Design Capacity (kN)	13.46

6. SUMMARY

Testing was performed to determine the compressive load carrying capacity of the Biform joist mounting system that includes joist mounts and stackable packers used to achieve different heights for the joist mounts. Descriptions of testing, results and subsequent analysis were provided along with design capacities for the joist mounts by themselves and the joist mounts when used with different packers.

7. REFERENCES

(1) International Organisation for Standardisation (ISO). 2015. *ISO 7500:2015 Metallic Materials – Verification of Static Uniaxial Testing Machines, Part 1: Tension/Compression Testing Machines – Verification and Calibration of the Force-Measuring System*. ISO, Geneva, Switzerland.

(2) Standards New Zealand. AS/NZS 1170.0:2011. Structural design actions. Part 0: General Principles. SNZ, Wellington, New Zealand.