

BRANZ Type Test

ST1073-TT [2015]

STRENGTH OF NON-STRUCTURAL COMPONENT SUPPORT BRACKETS FITTED TO THE UNDERSIDE OF 200MM HOLLOW CORE SLAB UNITS

CLIENT

Seismic Restraints NZ Ltd
P O Box 38143
Wellington
New Zealand

TEST SPONSOR

Seismic Restraints NZ Ltd
P O Box 38143
Wellington
New Zealand

LIMITATION

The results reported here relate only to the item/s 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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Reviewer

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DOCUMENT REVISION STATUS

ISSUE NO.	DATE ISSUED	REVIEW DATE	DESCRIPTION
1	4 August 2015	Not required	Initial Issue

1. OBJECTIVE

To determine the tensile strength of a proprietary steel bracket and 10mm threaded hanger rod in combination with two 90 mm long Hilti M10 HKH hollow deck anchors, fitted to the underside of a 200mm hollow core slab unit.

The system is intended for use in New Zealand. The test method is a direct tensile test to failure.

2. DESCRIPTION OF SPECIMENS

2.1 Products tested

The brackets are manufactured from nominally 6mm thick mild steel and are expected to be fitted beneath a hollow core slab unit for hanging mechanical plant items. Each bracket has a 6mm thick mild steel retainer plate for the hanger rod, which is fastened to the bracket with M6 screws. The hanger rod may be 12mm or 10mm in diameter. Nuts are expected to be fitted above and below the bracket to lock the hanger rod in place.

A diagram of the bracket is presented in Figure 1.

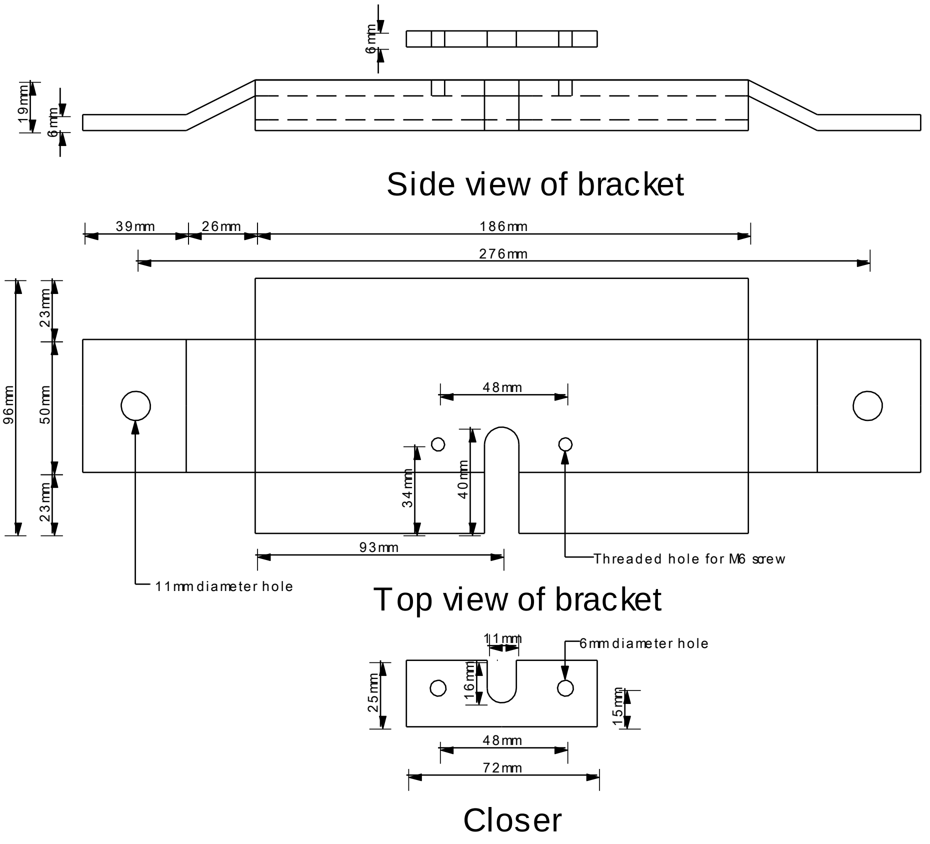

Figure 1. Details of the tested bracket and closer

3. DESCRIPTION OF TESTS

3.1 Date and location of tests

The tests were carried out in June 2015, in the Structures Test Laboratory of BRANZ Ltd, Judgeford, New Zealand.

3.2 Specimen construction

A section of hollow core slab was provided by the client for the testing. The hollow core slab unit was inverted at BRANZ for convenience to carry out the tests.

3.3 Test setup and equipment

Each test specimen was installed and tested before installation of the next specimen.

For each specimen, two 14 mm diameter holes were drilled through the hollow core slab unit at a spacing of 276 mm to match the hole positions in the bracket. The holes were drilled where the concrete was the thinnest at the bottom of the core, and on the same core line. No hammer action was employed in the drilling process so that minimal concrete spalled from the inside of the core.

The 10 mm diameter hanger rod was then fitted to the bracket and two Hilti M10 HKH hollow deck anchors were fitted through the bracket. The anchors were fitted through the holes in the slab unit and tightened. Note that initially the anchor began to force the outer sleeve apart under moderate tightening load and then reached a point where the load increased markedly. A view of the bracket in its installed state is given in Figure 2. The status of the sleeve once the anchor was tightened is shown in Figure 3.

Figure 2. View of the test specimen installed on the soffit of the hollow core slab unit

Figure 3. View of the anchor sleeve once fully tightened

A centre-hole hydraulic ram and hollow loadcell were used to apply and record the load respectively to the hanger rod for each specimen. The loadcell was connected to a strain indicator set to record the peak load achieved. The load cell calibration was within International Standard EN ISO 7500-1 1999 Grade 1 accuracy.

3.4 Test procedure

A bridge was setup over the hanger rod for each specimen so that the reaction points did not interfere with the anchor bolts or the surrounding concrete (Figure 4). The load was applied using a hand pump, pumping at a constant rate until the peak load was reached.

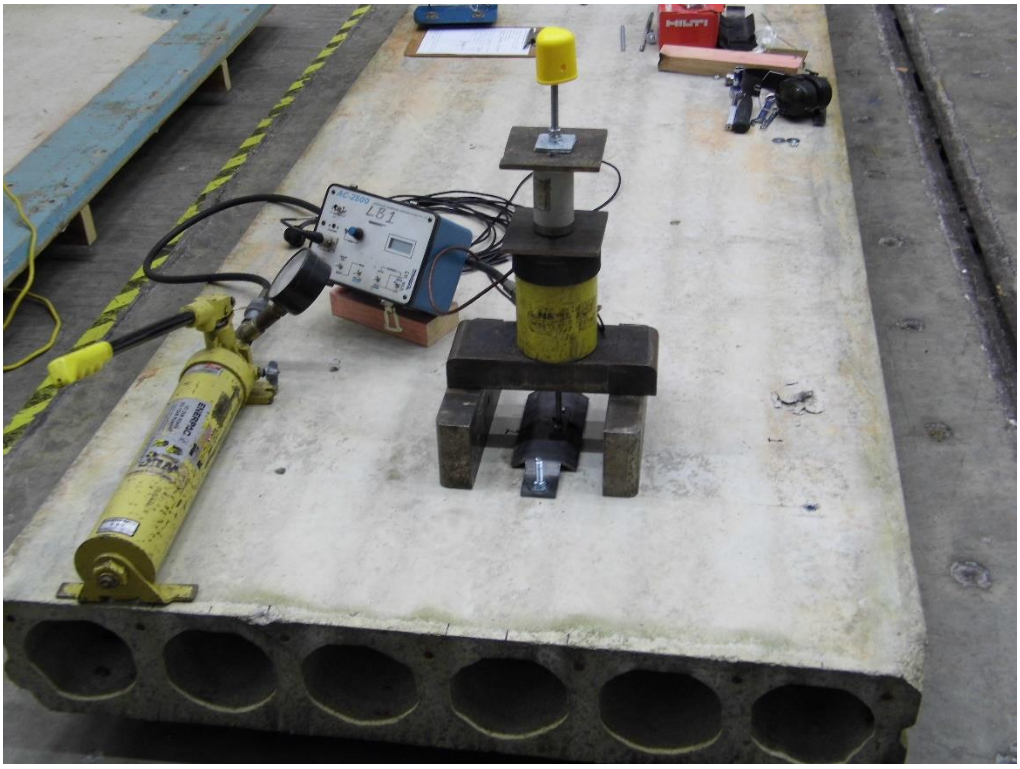

Figure 4. View of the test setup with a specimen

4. OBSERVATIONS AND RESULTS

4.1 Observations

In all of the specimens, as the load increased, the bracket was observed to bend at the centre of its length.

In all specimens except specimen 2, the slab cracked at one of the anchors and a cone failure appeared (Figure 5) at the peak load. The failure mode for Specimen 2 was stripping of the nut from the hanger rod.

4.2 Results

It was important to relate the strength of the specimens to the strength of the concrete in the hollow core slab unit. Three 50 mm diameter cores were taken from the unit and tested by Materials Advisory and Testing Services Ltd to obtain an estimation of the compressive strength of the concrete. The mean strength of the three cores was 53 MPa.

Figure 5. Typical failure mode for all specimens except specimen 2

The failure loads and failure modes for the six bracket test specimens are presented in Table 1.

Table 1. Test results for the six bracket specimens

SPECIMEN NUMBER	FAILURE LOAD (kN)	FAILURE MODE
1	16.5	Cone failure in concrete
2	20.7	Nut stripped off hanger rod
3	16.2	Cone failure in concrete
4	17.7	Cone failure in concrete
5	22.8	Cone failure in concrete
6	17.8	Cone failure in concrete
Mean strength	18.6	
Std. Deviation	2.6	
Characteristic strength	**13.1**	

The characteristic strength was derived using the BRANZ Evaluation method EM1, where:

$$R_k = P_{min}\left(\frac{n}{27}\right)^{v}$$

where

R_k = the characteristic strength (kN)

$P_{(min)}$ = the minimum recorded specimen peak strength (kN)

n = the number of specimens

v = the coefficient of variation of the results (=Std Dev./Mean)

5. REFERENCES

BRANZ Evaluation Method No. 1 (1999). Structural Joints – Strength and Stiffness Evaluation. BRANZ, Judgeford, New Zealand.

BRANZ Type Test Summary

This is to certify that the specimens described below have been tested by BRANZ Ltd on behalf of

Seismic Restraints NZ Ltd
P O Box 38143
Wellington
New Zealand

Test standard: BRANZ Evaluation Method 1.

Specimen name: Seismic Restraints NZ Ltd Soffit bracket

Specimen description: The Seismic Restraints NZ Ltd soffit bracket is a mild steel bracket fixed to the soffit of hollow core slab units with two 90 mm long Hilti M10 HKH hollow deck anchors. M10 or M12 hanger rods may be connected to the bracket to support mechanical plant items.

A full description of the test specimens and the test results are given in BRANZ Test Report:

ST1073-TT [2015] – dated 4 August 2015

The test results were the basis for the following:

Building Code Document	Bracket characteristic strength (kN)
NZBC Clause B1	13.1

Issue Date: 4 August 2015

Expiry Date: 4 August 2020