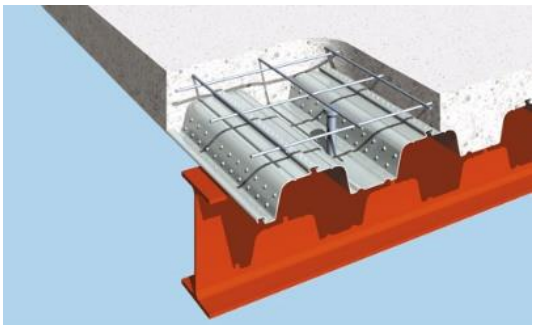


BRANZ Technical Opinion

ST 11332-TO[2020]

PULLOUT STRENGTHS OF THREE STEEL AND TUBE WEDGENUTS, ATTACHED TO THREE COMFLOR METAL DECKING PROFILES

CLIENT

Steel and Tube Ltd
26 Hautonga Street
Petone
Lower Hutt 5040.

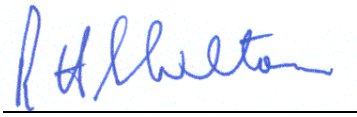
LIMITATION

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



Author

Roger Shelton
Senior Structural Engineer
BRANZ

Reviewer

Robin Xie
Associate Structural Testing Engineer
BRANZ

DOCUMENT REVISION STATUS

ISSUE NO.	DATE ISSUED	DESCRIPTION
1	11 September 2020	Initial Issue

1. OBJECTIVE

To determine the pull-out strength of a proprietary hanger system using steel wedgenuts and M10 threaded rods. The hangers were fitted into the dovetail slot in the underside of a concrete slab cast into three different ComFlor metal deck systems.

The test method was a direct axial tensile test simulating gravity loading from building services such as ducting, pipes or cable trays installed in a composite concrete/metal deck flooring system. The system is intended for use in New Zealand.

2. DESCRIPTION OF SPECIMENS

2.1 Product tested

ComFlor is a composite metal deck flooring system for all multi-rise buildings, as illustrated on the title page of this report. Three cold formed metal deck profiles were supplied by the client for testing, each incorporating a dovetail slot to accommodate fixings of hangers supporting building services. Dimensions of the ComFlor steel profiles as tested are presented in Figure 1, 2 and 3. Nominal steel thickness of each was advised by the client to be 0.75 mm.

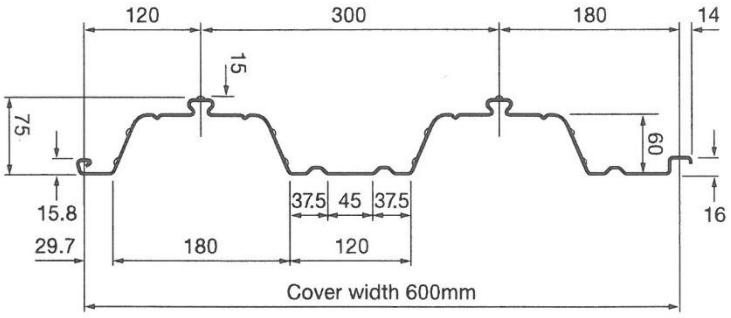


Figure 1. ComFlor 60 profile

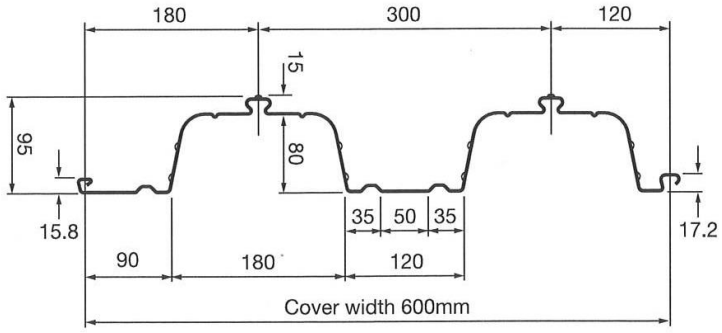


Figure 2. ComFlor 80 profile

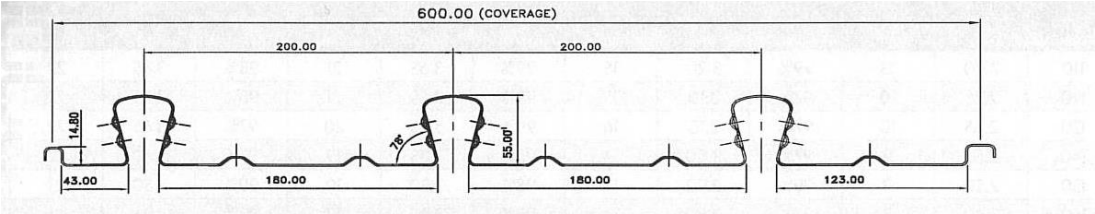


Figure 3. ComFlor SR profile

The wedgenuts as tested are shown in Figure 4. Each nut had a thickness of 10 mm, and an M10 threaded hole. For testing each nut was fitted with a M10 threaded rod with a fender washer and lock nut. A complete assembly can be seen in Figure 5.

ComFlor 60.
M10WM(65).
21mm x 14mm

ComFlor 80.
M10WN(80).
18mm x 12mm

ComFlor SR. 22mm x 18mm

Figure 4. Wedgenuts as tested, with packet markings, and measured outside dimensions

Figure 5. Wedgenut with threaded rod, fender washer and nut

2.2 Test specimens

The profiles were supplied by the client already built into nominally 600 mm wide x 1,800 mm long and 140 mm thick overall steel moulds. Concrete was cast into the moulds at the BRANZ Structures Laboratory, and left to cure under cover. Test cylinders cast with the slabs had a mean tested compressive strength at 28 days of 26.5 MPa. A copy of the concrete compression test report is included in Section 7 of this report.

It was noted that after casting, the width of the dovetail slot varied noticeably. The ends were restrained by the steel moulds, but the middle spread slightly under the weight of the concrete. Widths at each test location were measured, with a typical variation of between 0.2 mm and 0.45 mm for each profile.

3. DESCRIPTION OF TESTS

3.1 Date and location of tests

The tests were carried out in August 2020, in the Structures Test Laboratory of BRANZ Ltd, Judgeford, New Zealand.

3.2 Test setup and equipment

The slabs were inverted from their normal orientation for convenience in carrying out the tests.

The wedgenuts, attached to the threaded rods, were inserted into the dovetail slot and tightened over the fender washers using the locknut. Trials were done to investigate the results of variations in the amount of tightening of the nuts. There was little variation between finger tight and finger tight plus half a turn with a spanner.

A loading bridge was setup over the hanger rod for each specimen, spaced so that the reaction points did not interfere with the anchors or the surrounding concrete. A centre-hole hydraulic ram and hollow load cell were used to apply and record the load respectively to the hanger rod for each specimen. The test assembly is shown in Figure 6.

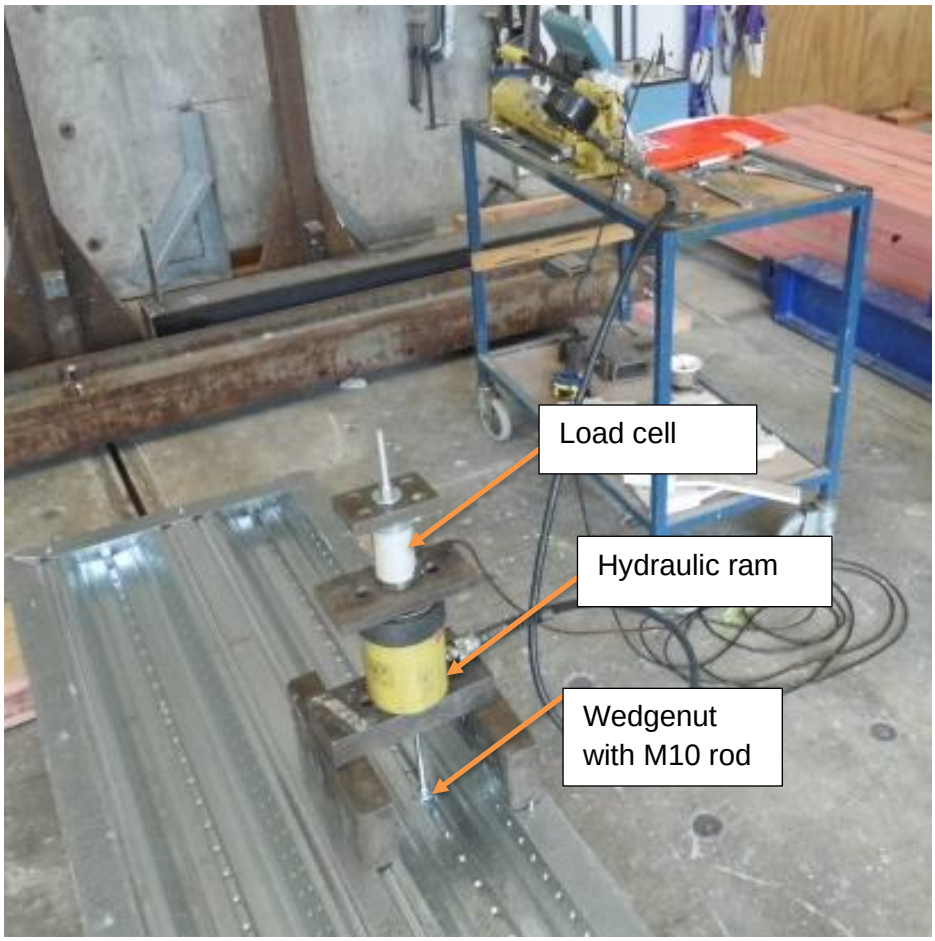


Figure 6. Testing arrangement

Loads were applied to the specimens by the ram using a hand pump, pumping at a constant rate until the peak load was reached. The load cell was connected to a strain indicator set to record the peak load achieved. The load cell was calibrated using a load cell itself calibrated to International Standard EN ISO 7500-1 (2004) Grade 1.

4. OBSERVATIONS AND RESULTS

4.1 Observations

In all the specimens, as the load increased, the wedgenut spread the dovetail slot until it was released and the fixing detached from the slab. The nuts rotated slightly as they disengaged from the dovetail. Figure 7 shows the distortion of the metal profile once the fixing had withdrawn. This distortion indicates that the concrete must have crushed locally.

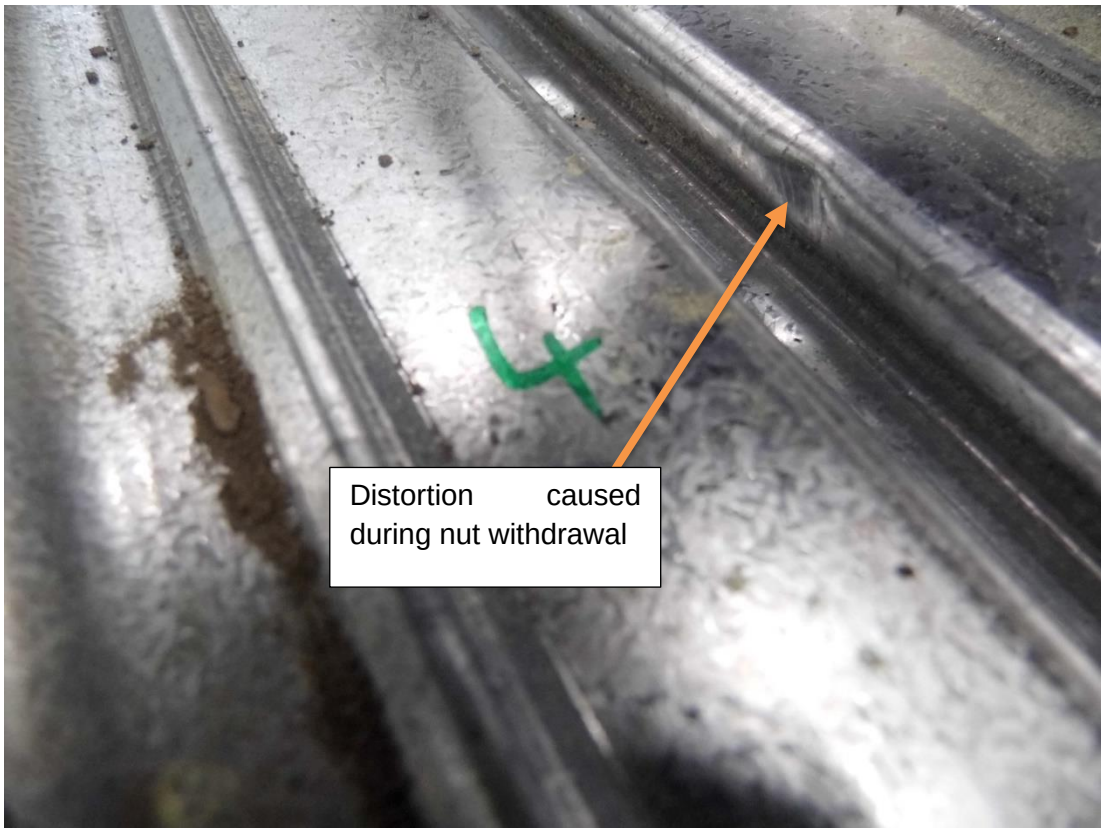


Figure 7. Distortion of dovetail slot after wedgenut withdrawal

Some wedgenuts were also chipped at a corner on withdrawal from the dovetail, see Figure 8.

Figure 8. Wedgenut after test.

4.2 Results

Maximum loads resisted by each fixing before withdrawal are presented in Table 1, 2 and 3. Variability was quite high for the ComFlor 60 and SR profiles, due largely to the variation in the slot width as a proportion of the nut width.

The analysis of the results follows the method used in AS/NZS 1170.0 (see references). The factor k_t allows for the likely variability of the population as estimated by the coefficient of variation of the test results. The Design Capacity is given by AS/NZS 1170.0 as minimum result divided by k_t.

Table 1. ComFlor 60 results

Test	Maximum load resisted (kN)
1	6.28
2	5.59
3	4.78
4	5.19
5	4.64
6	4.50
Average	5.16
Coef. of variation	16%
Minimum load	4.50
k_t	1.37
Design Capacity	3.29

Table 2. ComFlor 80 results

Test	Maximum load resisted (kN)
1	5.66
2	5.87
3	5.46
4	5.73
5	5.59
6	5.32
Average	5.52
Coef. of variation	4.5%
Minimum load	5.32
k_t	1.21
Design Capacity	4.75

Table 3. ComFlor SR results

Test	Maximum load resisted (kN)
1	6.55
2	6.82
3	7.91
4	5.73
5	7.23
6	5.05
Average	6.55
Coef. Of variation	15%
Minimum load	5.05
k_t	1.44
Design Capacity	3.51

5. OPINION

The Steel and Tube M10 wedgenuts fixed to Steel and Tube ComFlor metal deck composite flooring systems can be used to support the following ULS gravity loads:

Profile	**Max. ULS gravity loads (kN)**
ComFlor 60	3.3
ComFlor 80	4.7
ComFlor SR	3.5

6. REFERENCES

AS/NZS 1170.0:2002. Structural Design Actions, Part 0: General principles. Standards Australia, Sydney.

7. CONCRETE CYLINDER TEST REPORT

Materials Advisory & Testing Service Ltd
A Civil Engineering Materials Consultancy

Postal: PO Box 37-231, Stokes Valley, Lower Hutt 5141, NZ
Delivery: 8 Oates Street, Stokes Valley, Lower Hutt
Work: (04) 566 0266
Email: office.mats.ltd@gmail.com

CONCRETE TEST REPORT

SECTION 1: JOB INFORMATION

JOB: **BRANZ O/N: 33742** Design Strength: **25** MPa Grade: **Unknown**

LOCATION IN STRUCTURE: **N/A**

Contractor / Supplier: **Firths Belmont Plant**

Specified slump: **N/A** mm Specified air content %: **---**

SECTION 2: RESULTS OF TESTS ON WET CONCRETE TESTED IN ACCORDANCE WITH NZS 3112: Part 1: 1986, sections 4, 5 & 9 (* Not Accredited)

Slump: **---** mm Yield: **---** m^3 Air: **---** %

SECTION 3: RESULTS OF COMPRESSIVE STRENGTH OF MOULDED CONCRETE CYLINDERS TESTED IN ACCORDANCE WITH NZS 3112: Part 2: 1986, sects. 4 & 6

Lab. Reference No.	MC 20/75					
Date of test	3-Jul-20			24-Jul-20		
Age at test (days)	7			28		
Identification Marks	33742			33742		
Cylinder Capped / No. of Ends:	No	No	No	No	No	No
(*Not Accredited) Nominal Density (kg/m^3)	N/A	N/A	N/A	N/A	N/A	N/A
Height to Diameter ratio:	OK	OK	OK	OK	OK	OK
Compressive strength (MPa)	17.0	16.5	17.5	25.5	26.5	27.5
MEAN (MPa)	17.0			26.5		
Data Input by:	Rod Myers			Rod Myers		
Checked by:						

COMMENTS:

1 Information provided in SECTIONS 1 and 2 is client supplied and unverified.
2 Specimen said to be cast 26/06/20.
3 Test Specimen delivered on 01/07/20 (outside 80hrs of moulding).
4 In reference to 3. above, we have no control over site curing or curing subsequent to de-moulding prior to delivery to our Laboratory. Unless either we receive the cylinders within 80hrs of moulding OR the pre-delivery curing conditions are verified by others that they met the NZS 3112 requirements, it is unlikely that any responsibility for strength abnormalities (eg. low strength) can be forced onto the Concrete Supplier.
5 On receipt, specimen water-bath cured (21 +/- 2°C) until required time of testing.
6 Total of 6 specimen for O/N:33742 received - initial client request for testing 3 each @ 7 and 28 days.

Results to:
BRANZ
Private Bag 50 908
PORIRUA 5240
Attn: Mr Roger Shelton

Approved:

Duigald Myers
DIRECTOR
Date: **24-Jul-20**

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BRANZ Technical Opinion Summary

This is to certify that the system described below has been verified by BRANZ Ltd on behalf of

Steel and Tube Ltd
26 Hautonga Street
Petone
New Zealand.

Reference standard: NZS 1170.0:2002. (NZBC Clause B1 Structure VM1)

System name: Steel and Tube M10 wedgenuts, designed to be used with Steel and Tube ComFlor 60 or 80 or SR metal decking.

System description: Fixing system to support building services hangers from an overhead concrete slab cast on metal decking.

A full description of the system and the verification process are given in BRANZ Technical Opinion:

ST11332 – TO dated 8 September 2020

Regulatory authorities are advised to examine Technical Opinions before approving any system

Building Code Document	Opinion
NZBC Verification method B1/VM1 – NZS 1170.0:2002	Compliance with Clause B1 Structure, of NZBC

Issue Date: **8 September 2020**

Expiry Date: **8 September 2025**