
# Performance of Tuff Tread Trench Covers

*Melba Swintex*

**Report 2018/09/01**

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**Heavy Structures Laboratory**
The University of Sheffield

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## CONFIDENTIAL

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**Prepared for** **Melba Swintex**
Derby Works, Manchester Road
Bury, Lancs
BL9 9NX

**Prepared by** **Dr Maurizio Guadagnini**
**Mr Shaun Waters**
Heavy Structures Laboratory
The University of Sheffield
Department of Civil and Structural Engineering
Sir Frederick Mappin Building
Mappin Street
Sheffield
S1 3JD

| Dissemination Level | | |
|---|---|---|
| **PU** | Public | |
| **PP** | Restricted to other project participants | |
| **RE** | Restricted to a group specified by the client | |
| **CO** | Confidential | ✓ |

## EXECUTIVE SUMMARY

This report presents the results of a series of tests that were carried out to characterise the mechanical performance of the Tuff Tread trench cover. Two series of tests were conducted on three specimens to determine: a) the maximum deformation under the specified safe working load of 400kg; and b) performance under an imposed load of 800kg.

Based on the experimental results it was found that:

- All of the tested specimens complied with the HAUC specifications, with a maximum measured displacement under a sustained load of 400kg equal to approximately 29mm (<35mm).
- All of the specimens were able to carry a maximum imposed load of 800kg without any sign of failure.
- The maximum load capacity was approximately 1,500kg.

# TABLE OF CONTENTS

# 1 INTRODUCTION

This report presents the results of a series of tests that was carried out to characterise the mechanical performance of the Tuff Tread trench cover.

This trench cover is a footway board, and as such should comply with the Highway Authorities & Utilities Committee (HAUC) Advice Note No. 2018/01[1]. According to this note, when loaded at the centre, the footway board should be capable of supporting a working load of 400kg with a deflection of no more than 5% of the maximum allowable span (i.e. 35mm over a span of 700mm). In addition, the ultimate failure load should not be less than 800kg.

# 2 PERFORMANCE TESTS

Two series of tests were conducted on three specimens to determine:

**Series I** maximum deformation under the specified safe working load of 400kg

**Series II** performance under an imposed load of 800kg

## 2.1 Experimental setup and instrumentation

The test setup is shown in Figure 1. The footway boards are 1290mm long and 890mm wide. All specimens tested as simply supported over a clear span of 700mm (not secured to the supports as specified in the HAUC 2018/01). The load was applied by a servo-hydraulic actuator through a 250mm diameter circular pad positioned in the centre of the specimen, whilst the deflection of the board was monitored through a Linear Variable Differential Transducer (LVDT) positioned on the underside of the specimen and directly under the centre of the circular pad.

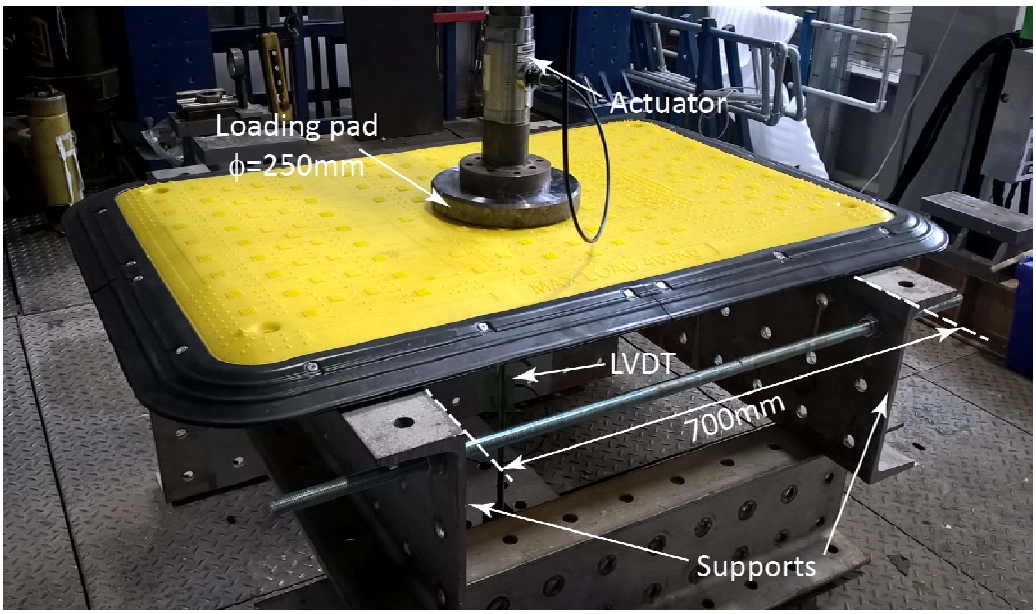


**Figure 1** Experimental set-up and instrumentation

## 2.2 Testing procedure

The procedure followed to test the specimens in Series I and II is described below and the relevant load-time history graphs are included in Annex I.

[1] Highway Authorities & Utilities Committee (HAUC) Advice Note No. 2018/01 – Specification and Operational Requirements for Footway Boards, Driveway Boards, Footway Ramps and Road Plates. http://hauc-uk.org.uk

**Series I: 400kg**

The first series of tests was carried out in load control at a rate of about 50kg/min (0.5kN/min) up to a maximum total load of 400kg (~3.9kN). The load was maintained constant for 5 minutes and subsequently the specimen was unloaded. The residual displacement was monitored for approximately 2 minutes after removal of the load.

**Series II: 800kg**

The second series of tests was carried out to confirm that the specimens would not fail when subjected to a total applied load of 800kg.

Specimens TT1 and TT2 were loaded in load control up to a load of 400kg (rate of about 50kg/min – 0.5kN/min) and in displacement control thereafter up to a maximum total load of 800kg (rate of 5mm/min). The maximum displacement was maintained constant for 1 minute to measure possible load relaxation and subsequently the specimen was unloaded. The residual displacement was monitored for approximately 2 minutes after removal of the load.

Specimen TT3 was loaded in load control at a rate of about 50kg/min (0.5kN/min) up to a maximum total load of 800kg (~7.8kN). The load was maintained constant for 1 minutes to measure any additional deformation and subsequently the specimen was unloaded. The residual displacement was monitored for approximately 2 minutes after removal of the load.

## 2.3 Summary of results

A summary of the test results is given in Table 1 in terms of displacement at the applied load, $s_{inst}$; displacement under the sustained load, $s_{sus}$; and residual deformation after removal of the load, $s_{res}$.

**Table 1** Summary of test results

| *Test ID* | *SERIES I - $P_{max}$=400kg* | | | *SERIES II - $P_{max}$=800kg* | | |
|---|---|---|---|---|---|---|
| | *$s_{inst}$ (mm)* | *$S_{sus}$ (mm)* | *$s_{res}$ (mm)* | *$s_{inst}$ (mm)* | *$S_{sus}$ (mm)* | *$s_{res}$ (mm)* |
| TT1 | 25.7 | 27.3 | 3.0 | 45.1 | - | 9.6 |
| TT2 | 27.6 | 29.1 | 4.6 | 47.0 | - | 11.9 |
| TT3 | 26.6 | 28.1 | 4.7 | 47.1 | 48.2 | 13.4 |

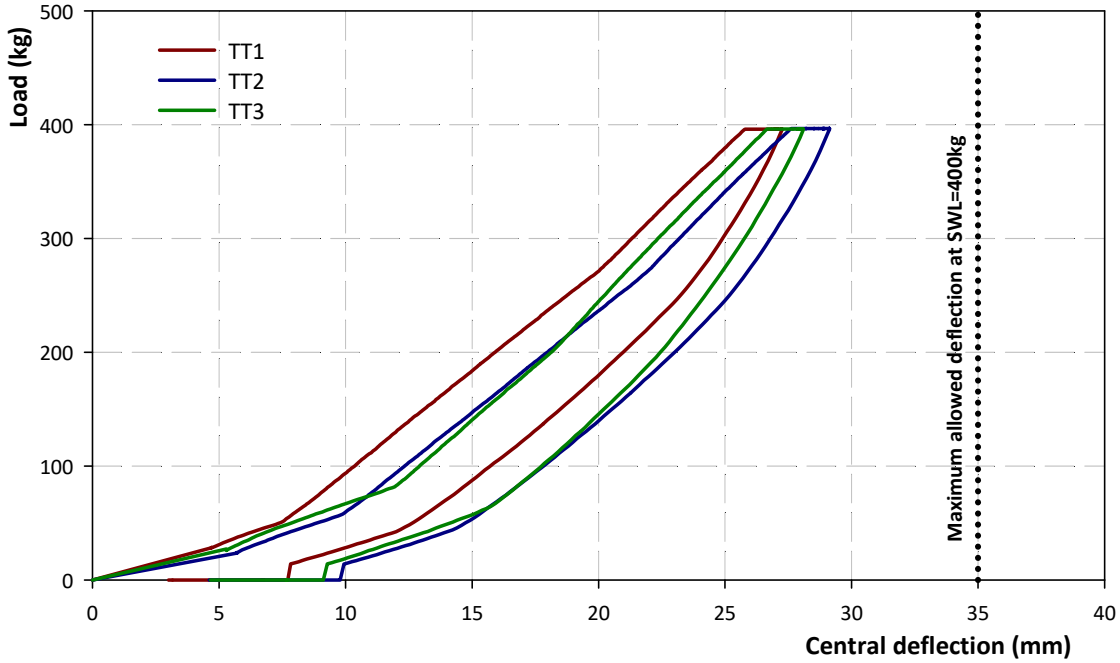


**Figure 2** Experimental Load-deflection behaviour of Series I specimens (400kg)

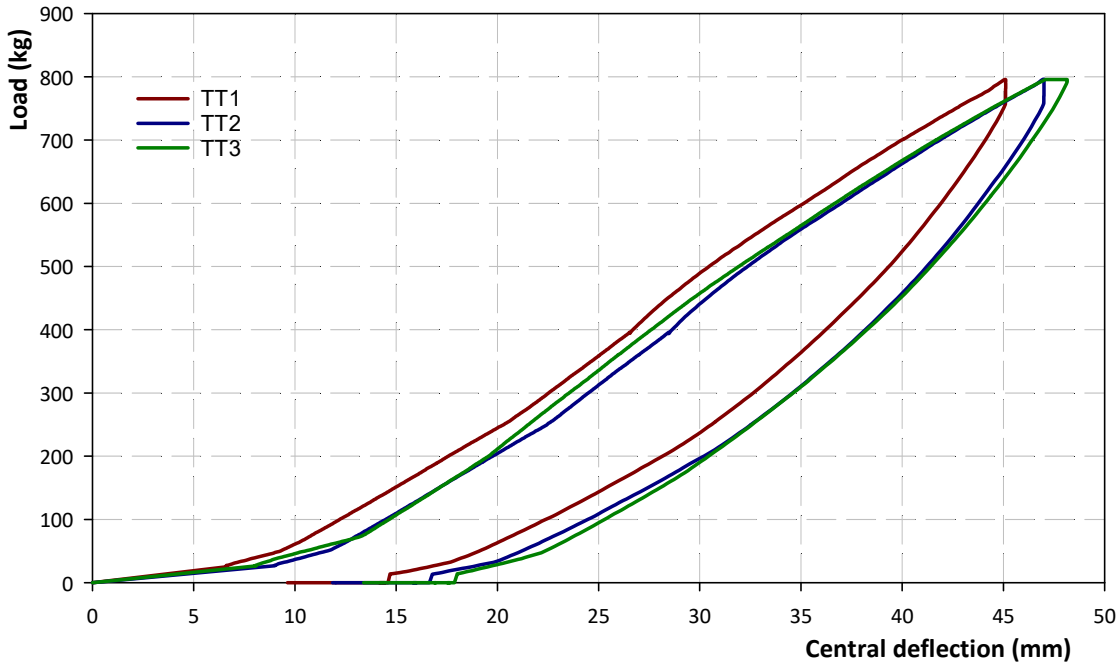


**Figure 3** Experimental Load-deflection behaviour of Series II specimens (800kg)

## 3 LOAD CAPACITY TEST

After the tests performed at the specified applied loads of 400kg and 800kg, an additional test was carried out on specimen TT3 to determine the maximum load capacity of the footway board (Figure 4). The load was applied in displacement control at a rate of 20mm/min up to a displacement at which no further increase in load resistance was recorded. The maximum load capacity was approximately 1,500kg.

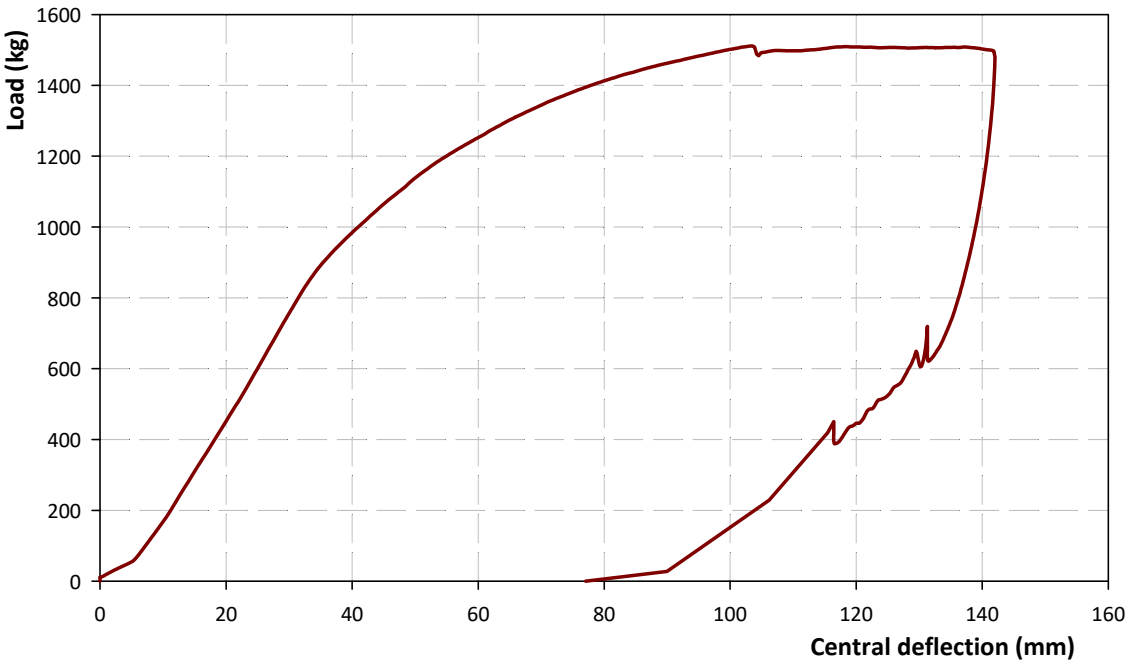


**Figure 4** Experimental Load-deflection behaviour of specimen TT3 (maximum load capacity)

# ANNEX I
## TESTING PROTOCOLS

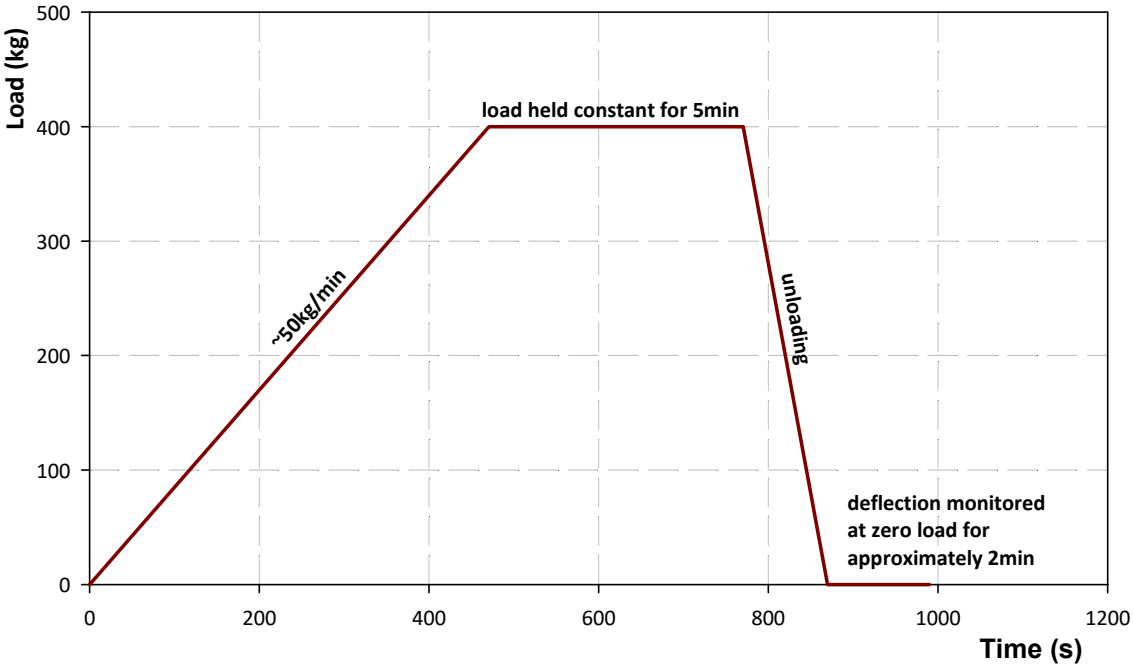


**Figure A 1** Load-time history for specimens tested in Series I (400kg)

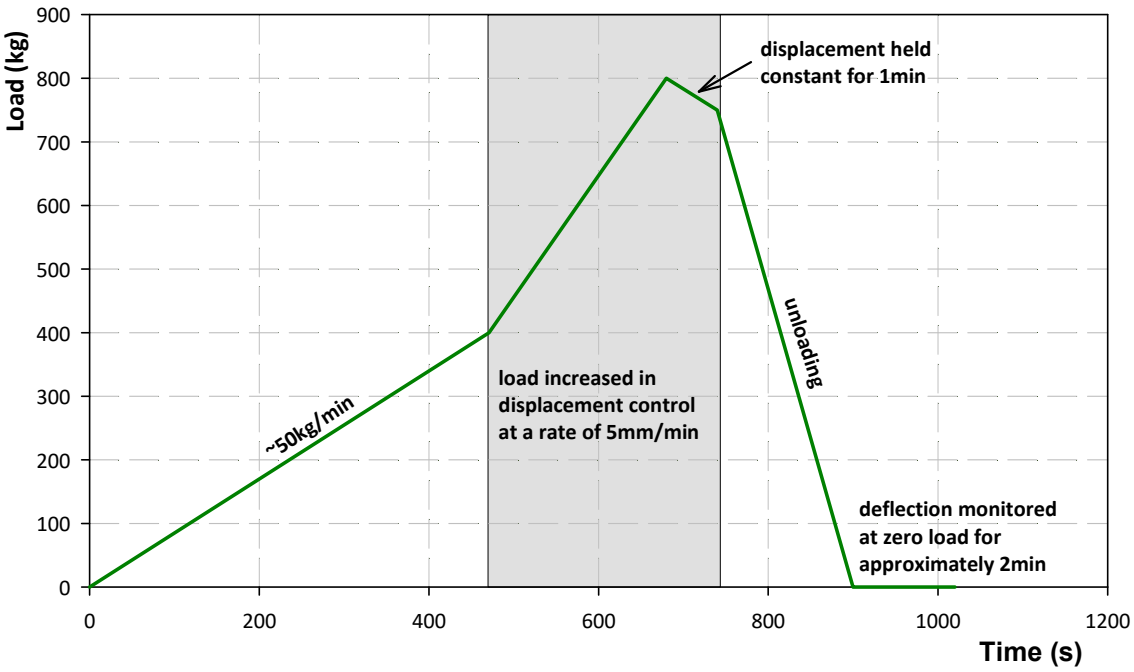


**Figure A 2** Load-time history for specimens TT1 and TT2 tested in Series II (800kg)

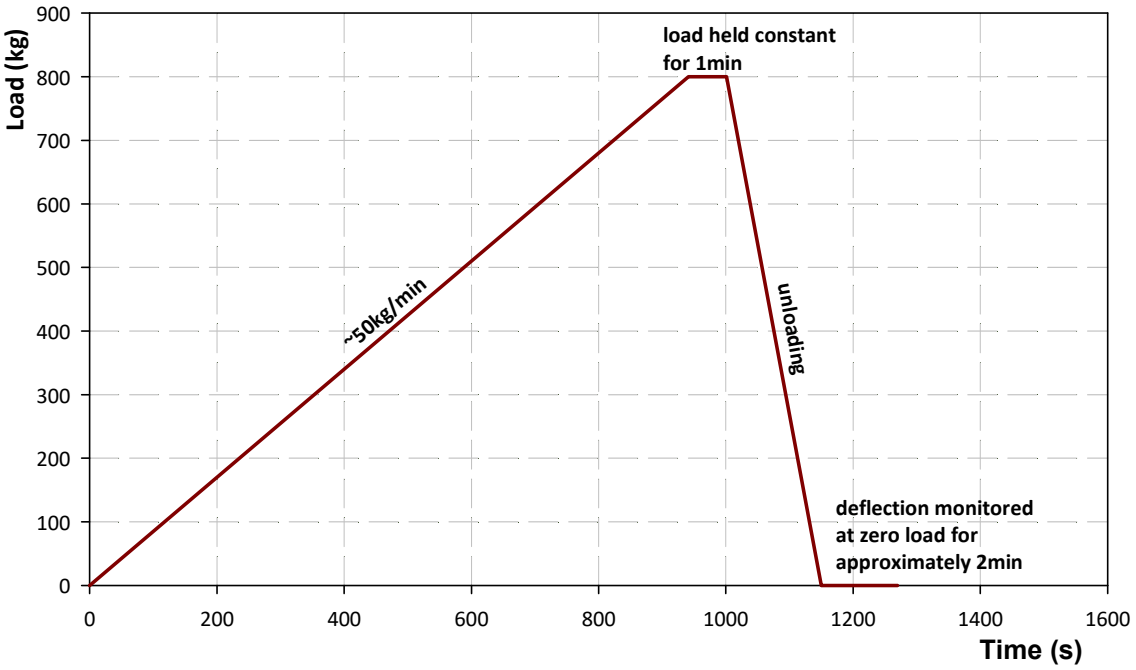


**Figure A 3** Load-time history for specimens TT3 tested in Series II (800kg)

# ANNEX II
## PHOTOGRAPHS OF TEST SPECIMENS

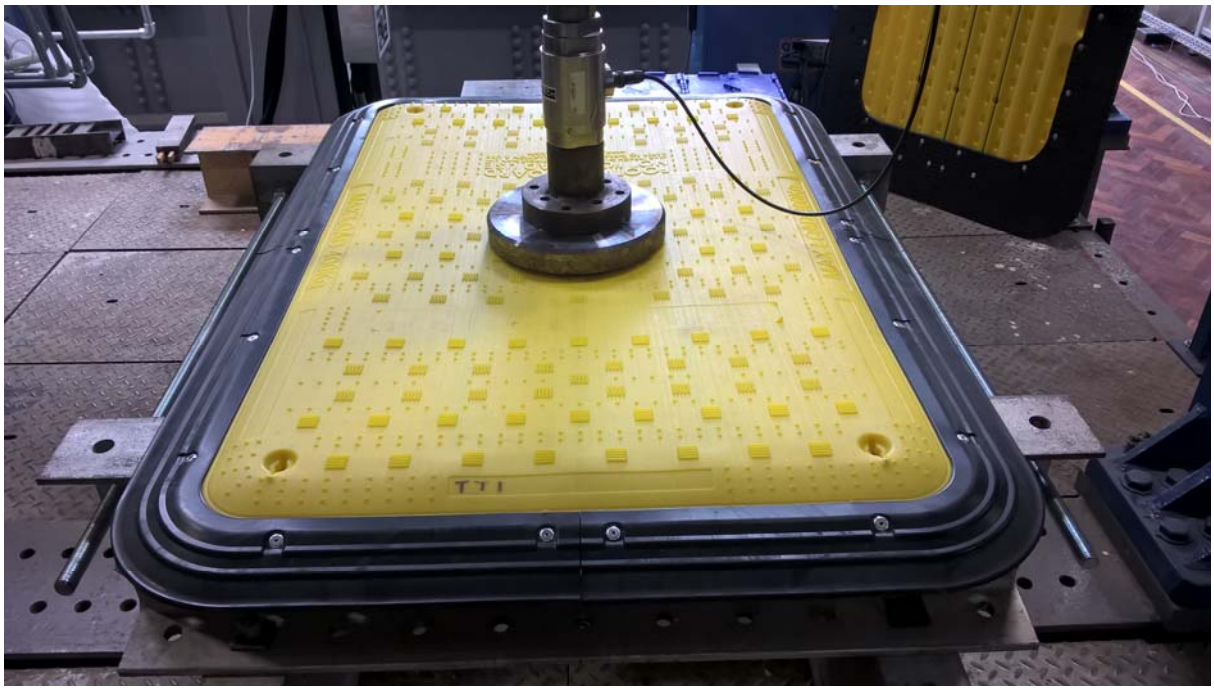


**Figure A 4** Specimen TT1

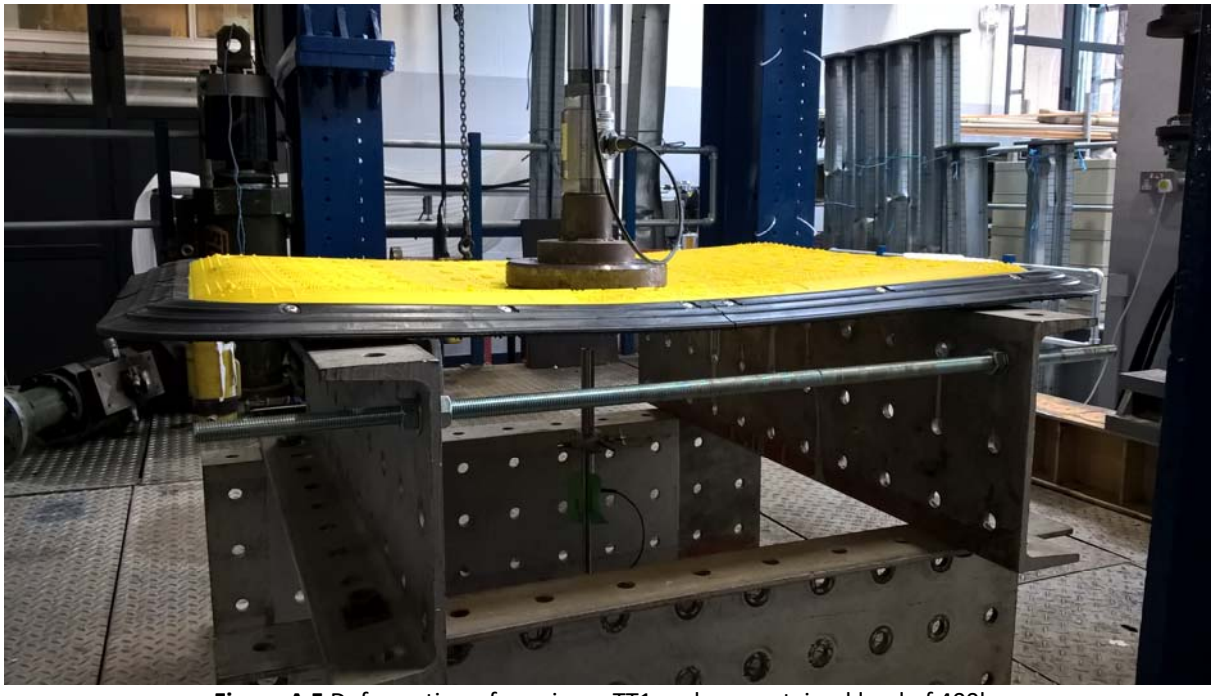

**Figure A 5** Deformation of specimen TT1 under a sustained load of 400kg

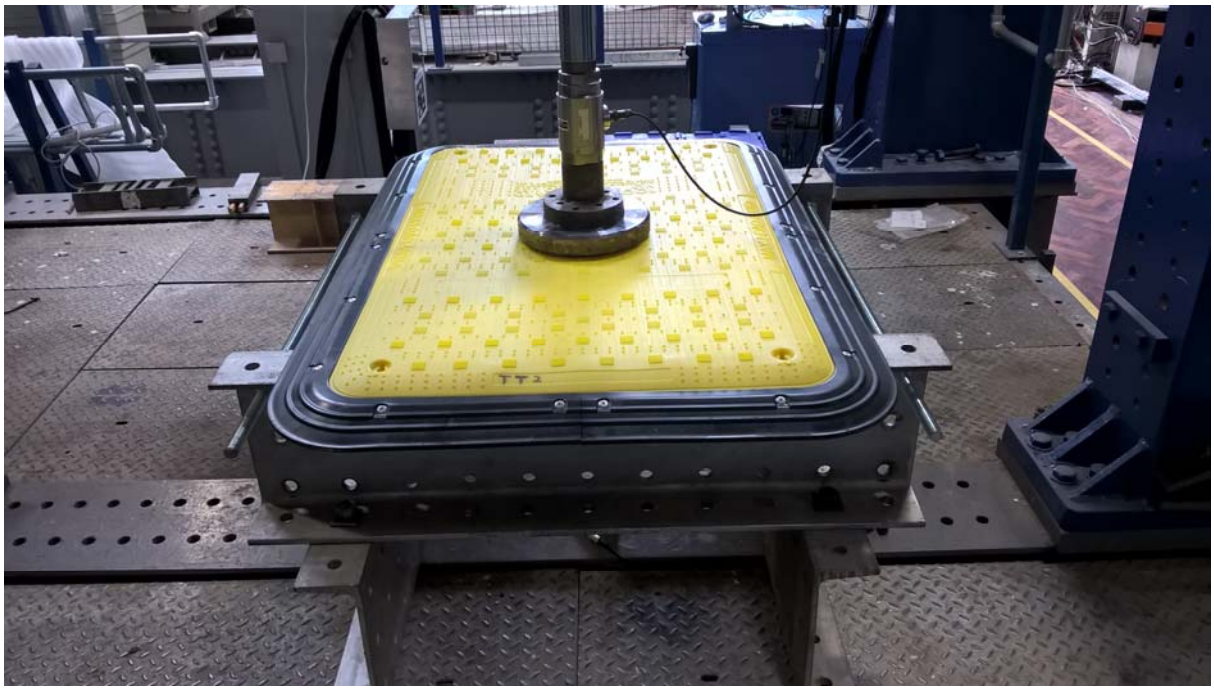


**Figure A 6** Specimen TT2

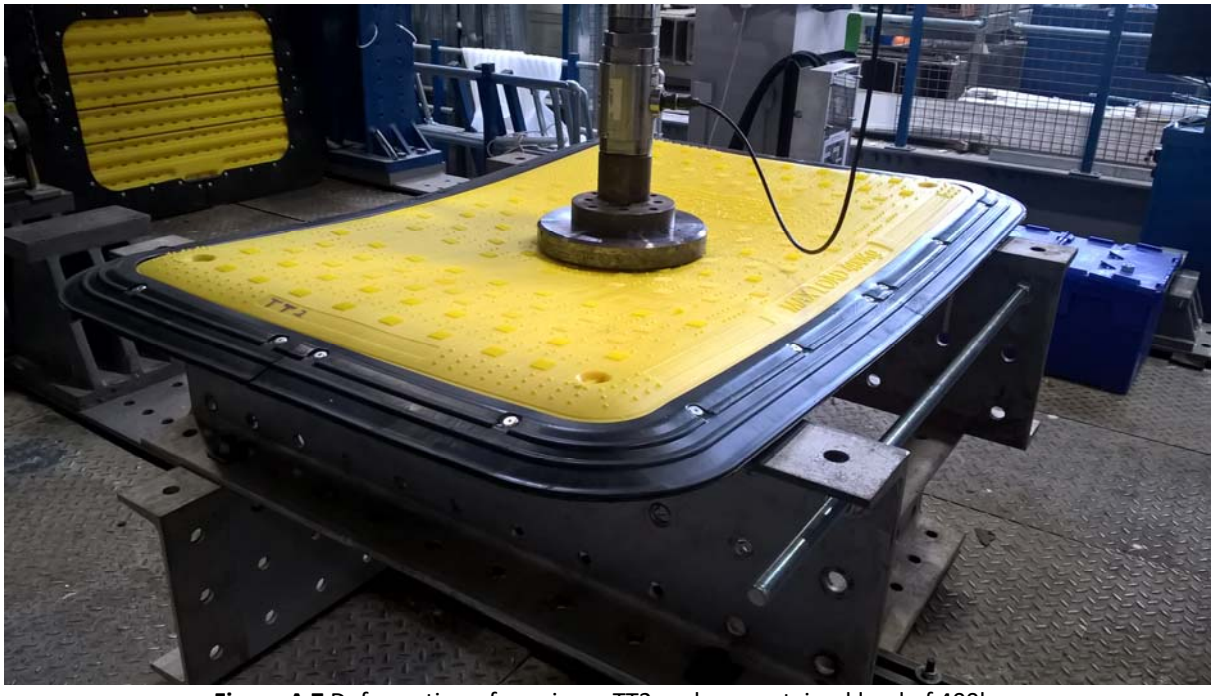


**Figure A 7** Deformation of specimen TT2 under a sustained load of 400kg

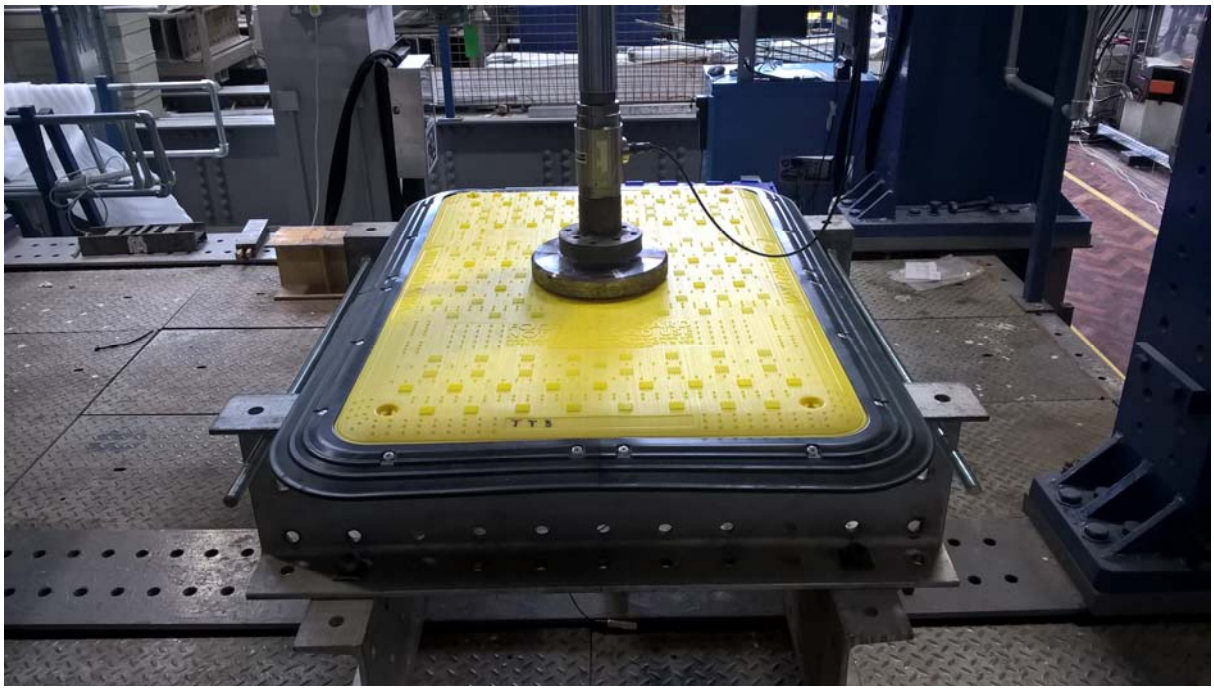

**Figure A 8** Specimen TT3

**Figure A 9** Deformation of specimen TT3 at increasing levels of load (maximum load was approximately 1,500kg)