

**Title: Impact testing a sample of GRC
Panels for S7 & S8 Stratford TIQ**

Certificate of Test Number: 21493

Customer's Name & Address:

Telling Architectural Limited
Unit 7
The Dell Business Park
Enterprise Drive
Four Ashes
Wolverhampton WV10 7DF

Our Ref: N950/TR0040

VTC Job No: 3TK8

Your Ref:

Date: 3 February 2015

Date sample(s) received: 8 December 2014

Sample(s) received from: Telling Architectural

Sample No(s): C5211

If unsigned by the tester this is because the tester is site based and therefore unable to sign this Certificate of Test. However, all work has been checked, validated and approved prior to inclusion.

This Certificate of Test is copyright. Reproduction of the whole or any part thereof must not be made without the express permission of VINCI Technology Centre UK Limited.

This Certificate of Test and the results shown are based upon the information, drawings, samples and tests referred to herein.

VINCI Technology Centre UK Limited accepts no liability for any damages, charges, costs (including, but not limited to, legal costs) or expenses in respect of or in relation to any damage to any property or other loss (save for death or personal injury occasioned by reason of any negligence on the part of VINCI Technology Centre UK Limited) whatsoever arising directly or indirectly from the use of this Certificate of Test, or the use of any goods or materials referred to in this Certificate of Test.

Tested by: 
D. Bennett (position: Technician)

Authorised by: 
S. R. Moxon (position: Head of Operations)

VINCI Technology Centre UK Limited

01525 859000

info@technology-centre.co.uk

www.technology-centre.co.uk

Stanbridge Road, Leighton Buzzard, Bedfordshire, LU7 4QH

Registered office, Watford, England. Registered No. 05640885



1. INTRODUCTION

This certificate of test describes impact tests carried out at the request of Telling Architectural Limited on 10 December 2014 at the Technology Centre in Leighton Buzzard.

The test was carried out in accordance with CWCT TN75/76.

The tests were witnessed by:

Dave Adams	-	Telling Architectural Limited
Colin Boon	-	Prater
Peter Goff	-	Buro Happold
Kevin English	-	Lend Lease
John Dawes	-	Lend Lease

2. SUMMARY OF TEST RESULTS

Impact energy (Nm)	Imapctor	Exposure Category	Safety Class	Serviceability Class
120	Soft body	B	N/a	1
350	Soft body	E	Negligible risk	N/a
500	Soft body	B	Negligible risk	N/a
613	Soft body	N/a	Low risk	N/a
10	Hard body	B	Negligible risk	1

Note: Tables 1 to 5 are taken from CWCT TN75.

Table 1 – Exposure categories

Category	Description	Examples	
A	Readily accessible to public and others with little incentive to exercise care. Prone to vandalism and abnormally rough use	External walls of housing and public buildings in vandal prone areas	Zone of wall up to 1.5 m above pedestrian or floor level
B	Readily accessible to public and others with little incentive to exercise care. Chances of accident occurring and of misuse	Walls adjacent to pedestrian thoroughfares or playing fields when not in category A	
C	Accessible primarily to those with some incentive to exercise care. Some chance of accident occurring and of misuse	Walls adjacent to private open gardens. Back walls of balconies	
D	Only accessible, but not near a common route, to those with high incentive to exercise care. Small chance of accident occurring or misuse	Walls adjacent to small fenced decorative garden with no through paths	
E	Above zone of normal impacts from people but liable to impacts from thrown or kicked objects	1.5 m to 6 m above pedestrian or floor level at location categories A and B	
F	Above zone of normal impacts from people and not liable to impacts from thrown or kicked objects	Wall surfaces at higher positions than those defined in E above	

Table 2 – Soft body test energy

Exposure category	Safety	Serviceability
A	No values are given as severity of potential vandalism needs to be assessed	
B	500 Nm	120 Nm
C	500 Nm	120 Nm
D	No values given as risk of impact is minimal	
E	350 Nm	120 Nm
F	350 Nm	120 Nm

Table 3 – Hard body test energy

Exposure category	Safety	Serviceability
A	No values are given as severity of potential vandalism needs to be assessed	
B	10 Nm	10 Nm
C	10 Nm	6 Nm
D	No values given as risk of impact is minimal	
E	10 Nm	6 Nm
F	3 Nm	3 Nm

Table 4 - Classes for safety performance

Class	Explanation/examples
Negligible risk	No material dislodged during test, and No damage likely to lead to materials falling subsequent to test, and No sharp edges produced that would be likely to cause severe injury to a person during impact, and Cladding not penetrated by impactor.
Low risk	Maximum mass of falling particle 50g, and Maximum mass of particle that may fall subsequent to impact 50g, and No sharp edges produced that would be likely to cause severe injury during impact.
Moderate risk	Maximum mass of falling particle less than 500g, and Maximum mass of particle that may fall subsequent to impact less than 500g, and Cladding not penetrated by impact, and No sharp edges produced that would be likely to cause severe injury during impact.
High risk	Maximum mass of falling particle greater than 500g, or Cladding penetrated by impact, or Sharp edges produced that would be likely to cause severe injury during impact.

Table 5 - Classes for serviceability performance

Class	Definition	Explanation/Examples
1	No damage.	No damage visible from 1m, and Any damage visible from closer than 1m unlikely to lead to significant deterioration.
2	Surface damage of an aesthetic nature which is unlikely to require remedial action.	Dents or distortion of panels not visible from more than 5m (note visibility of damage will depend on surface finish and lighting conditions – damage will generally be more visible on reflective surfaces), and Any damage visible from closer than 5m unlikely to lead to significant deterioration.
3	Damage that may require remedial action or replacement of components to maintain appearance or long term performance but does not require immediate action.	Dents or distortion of panels visible from more than 5m, or Spalling of edges of panels of brittle materials, or Damage to finishes that may lead to deterioration of the substrate.
4	Damage requiring immediate action to maintain appearance or performance. Remedial action may include replacement of a panel but does not require dismantling or replacement of supporting structure.	Significant cracks in brittle materials e.g. cracks that may lead to parts of tile falling away subsequent to test, or Fracture of panels causing significant amounts of material to fall away during test.
5	Damage requiring more extensive replacement than 4.	Buckling of support rails.

3. SAMPLE DESCRIPTION

The sample comprised a GRC panel system using 1200 mm and 600 mm wide panels.

Aluminium brackets and vertical profiles were used as part of the cladding system.

The support rails were mounted onto a rigid concrete wall.

Details of the system are shown in the drawings are included in the back of this certificate.

The test sample is shown in the following photographs.

PHOTO 6555

TEST SAMPLE PRIOR TO TESTING



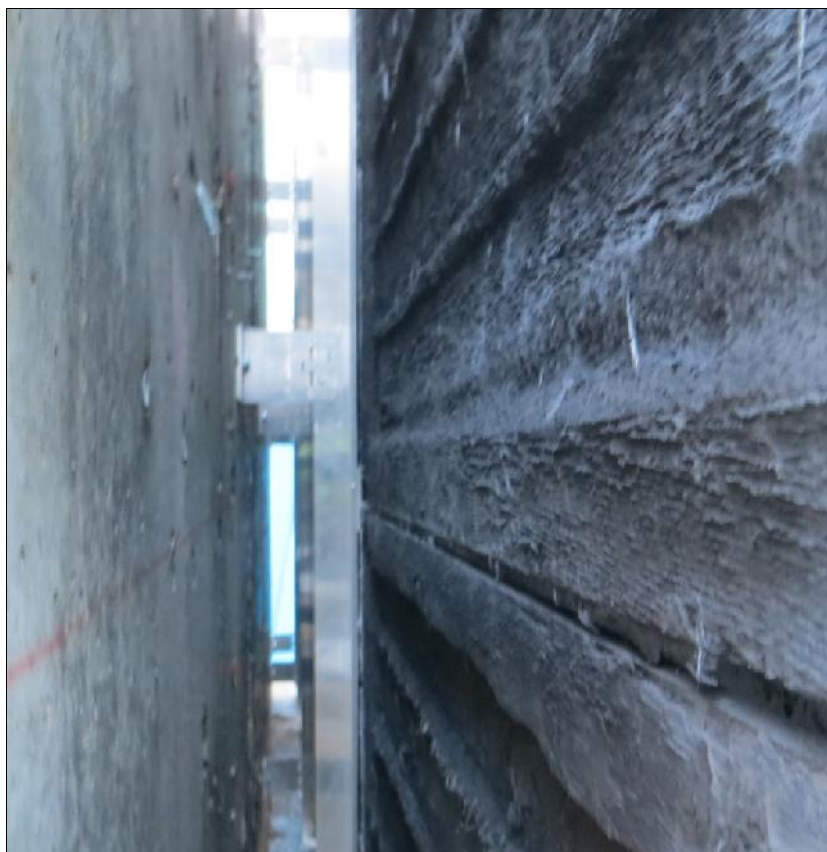
PHOTO 6556

SUPPORT BRACKET FOR CARRIER FRAME



PHOTO 6557

VIEW BEHIND PANELS



4. CONTROLLED DISMANTLE

During the dismantling of the test sample, no additional damage on the rear of the panels was observed.

5. TEST EQUIPMENT

The soft body impactor comprised a canvas spherical bag 400 mm in diameter filled with 3 mm diameter glass spheres with a total mass of approximately 50 kg suspended from a cord at least 3 m long.

PHOTO 6559

SOFT BODY IMPACTOR



The hard body impactor was solid steel ball of 62.5 mm diameter and approximate mass of 1.0 kg.

PHOTO 6578

HARD BODY IMPACTOR



6. TEST PROCEDURE

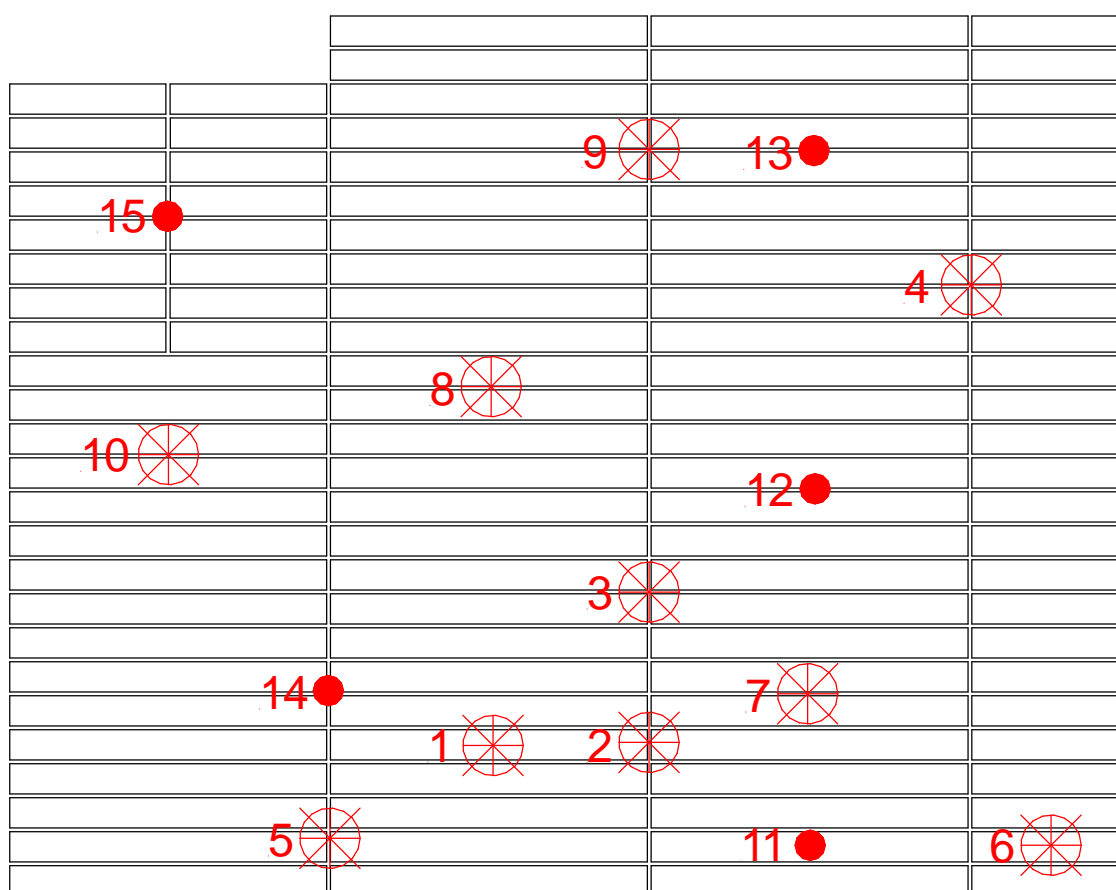
The impactor almost touched the face of the sample when at rest. It was swung in a pendular movement to hit the sample normal to its face. The impact tests were performed at the locations shown in Figure 1.

The impact energies for the soft body impactor were 120 Nm for serviceability and 350 Nm or 500 Nm for safety. The impact energy for the hard body impactor was 10 Nm for safety.

7. TEST RESULTS

FIGURE 1

IMPACT TEST LOCATIONS



Soft body impactor



Hard body impactor

7.1 SOFT BODY IMPACTS

Table 6 – Soft body results table

Location	Impact energy (Nm)	Observations
1	120 (x3)	No damage observed.
2	120 (x3)	No damage observed.
3	350 (x3)	Bracket snapped at pack of panel. Panel OK.
4	350 (x3)	No damage observed.
5	500	Bracket snapped at pack of panel. Panel OK.
6	500	Bracket snapped at pack of panel. Panel OK.
7	500	Bracket snapped at pack of panel. Panel OK.
8	500 (x3)	Small crack at top of panel after first impact. Further cracking after second and third impacts but still secure.
9	500	Vertical rail bent in. Panel secure.
10	613	Panel cracked but remained secure.

PHOTO 6560

FIXING BRACKET AFTER IMPACTS AT LOCATION 3

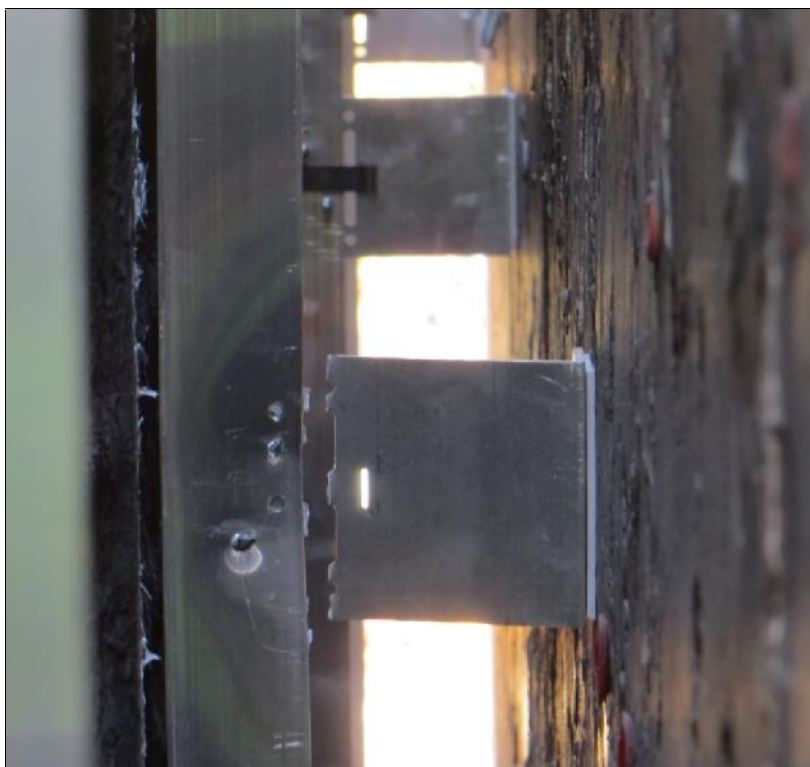


PHOTO 6562

FIXING BRACKET AFTER IMPACT AT LOCATION 7

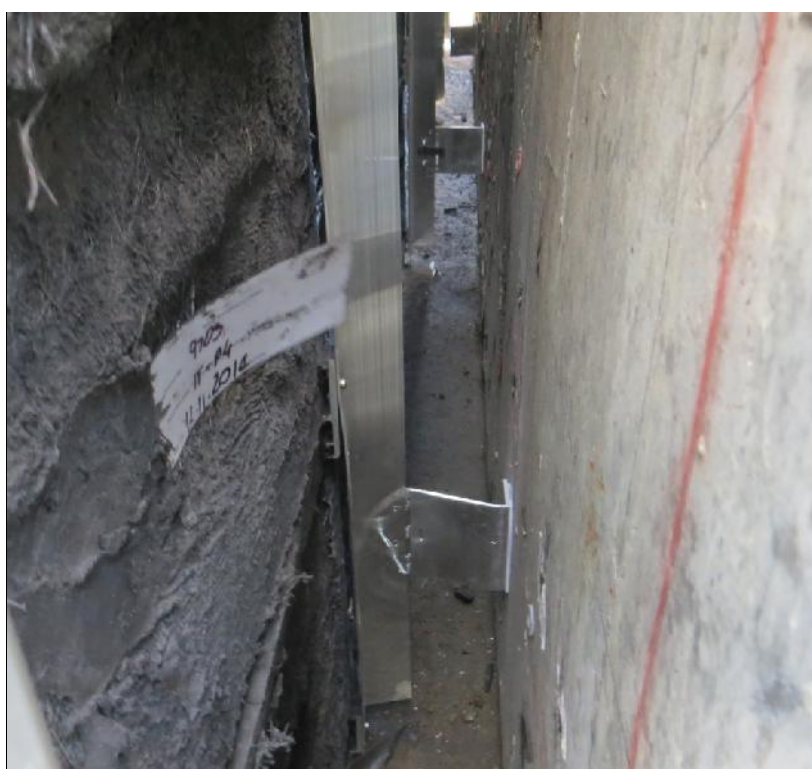


PHOTO 6564

IMPACT LOCATION 8 AFTER FIRST IMPACT



PHOTO 6582

IMPACT LOCATION 8 AFTER SECOND IMPACT

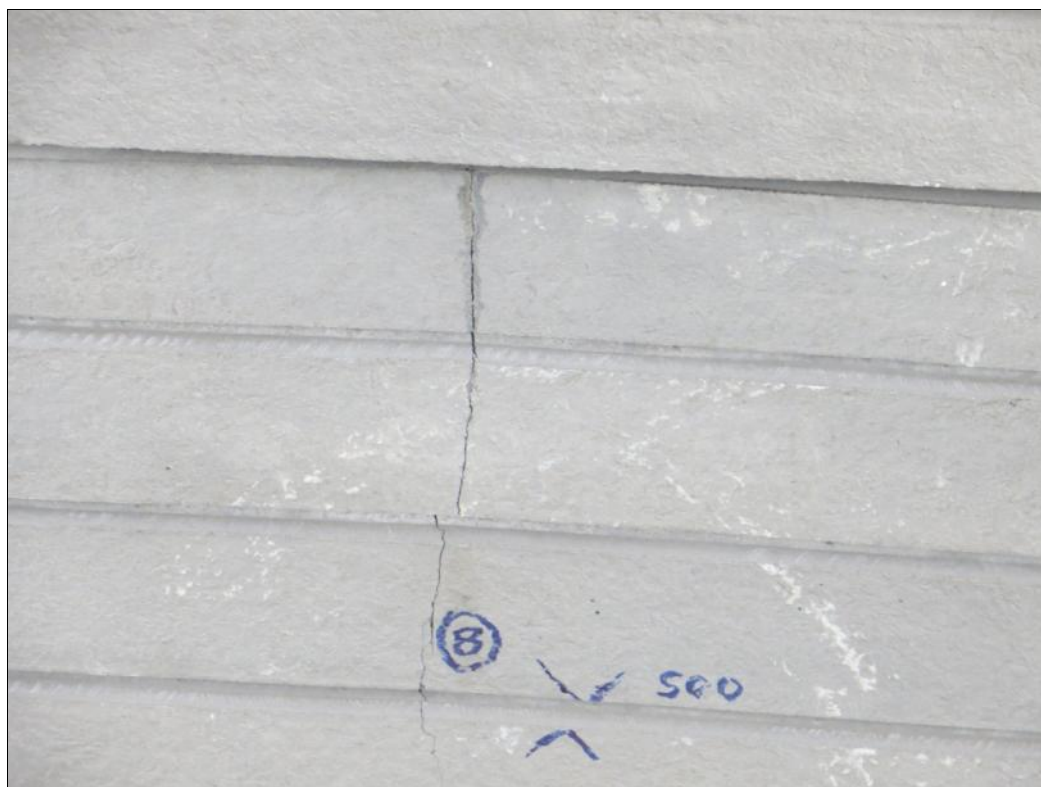


PHOTO 6589

IMPACT LOCATION 8 AFTER THIRD IMPACT



PHOTO 6568

IMPACT LOCATION 10



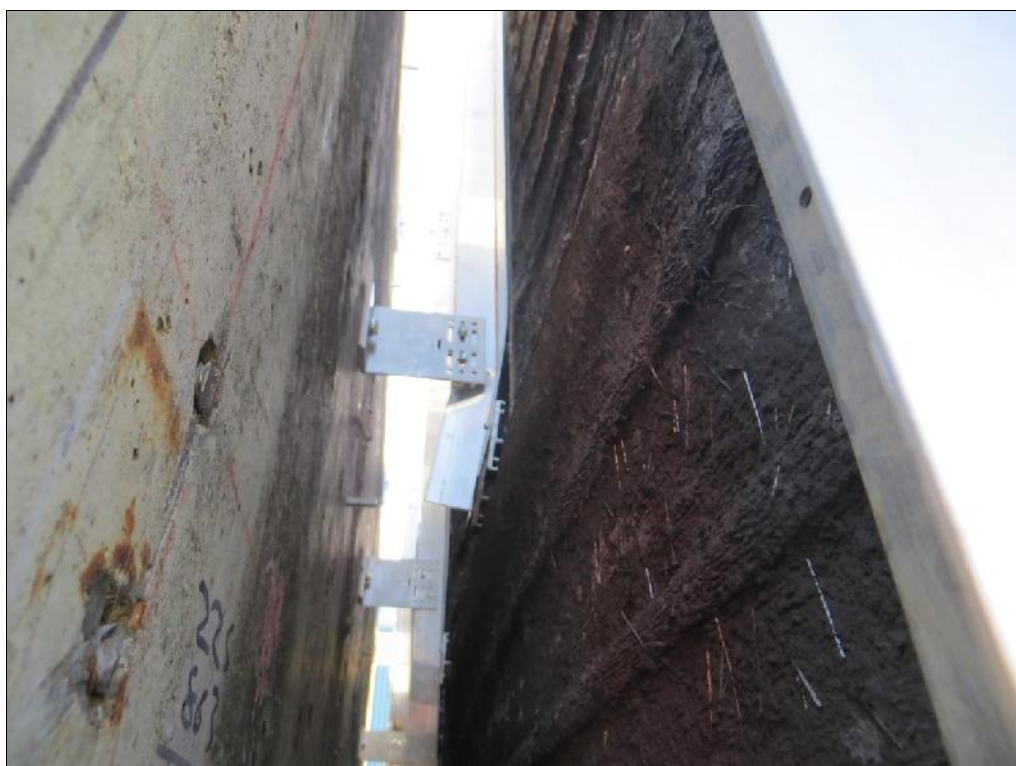
PHOTO 6569

IMPACT LOCATION 10



PHOTO 6570

VIEW AT BACK OF PANELS



7.2 HARD BODY IMPACTS

Table 7 – Hard body results table

Location	Impact energy (Nm)	Observations
11	10	Small indent in panel.
12	10	Small chip in edge of panel.
13	10	Small chip in edge of panel.
14	10	Minor edge damage, small crack.
15	10	Small chip in edge of panel.

Hard body observations

Only minor damage was observed to the surface of the panels throughout the tests.

PHOTO 6576

IMPACT LOCATION 11



PHOTO 6577

IMPACT LOCATION 12



PHOTO 6579

IMPACT LOCATION 14

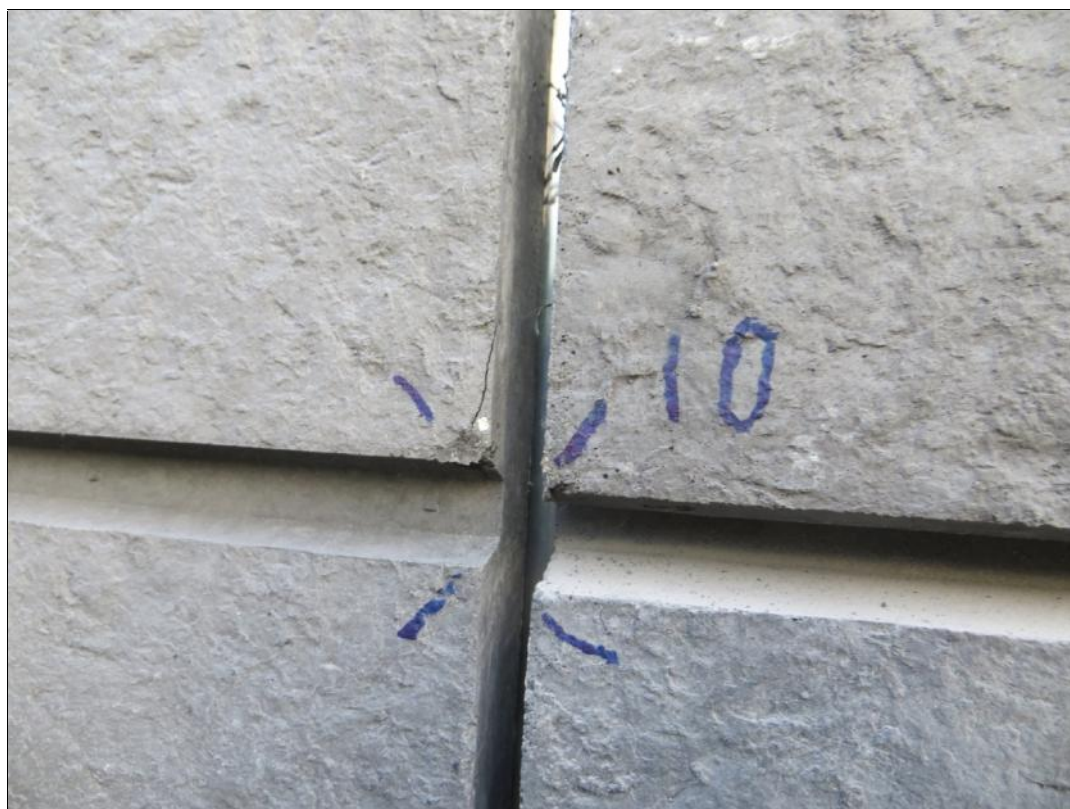
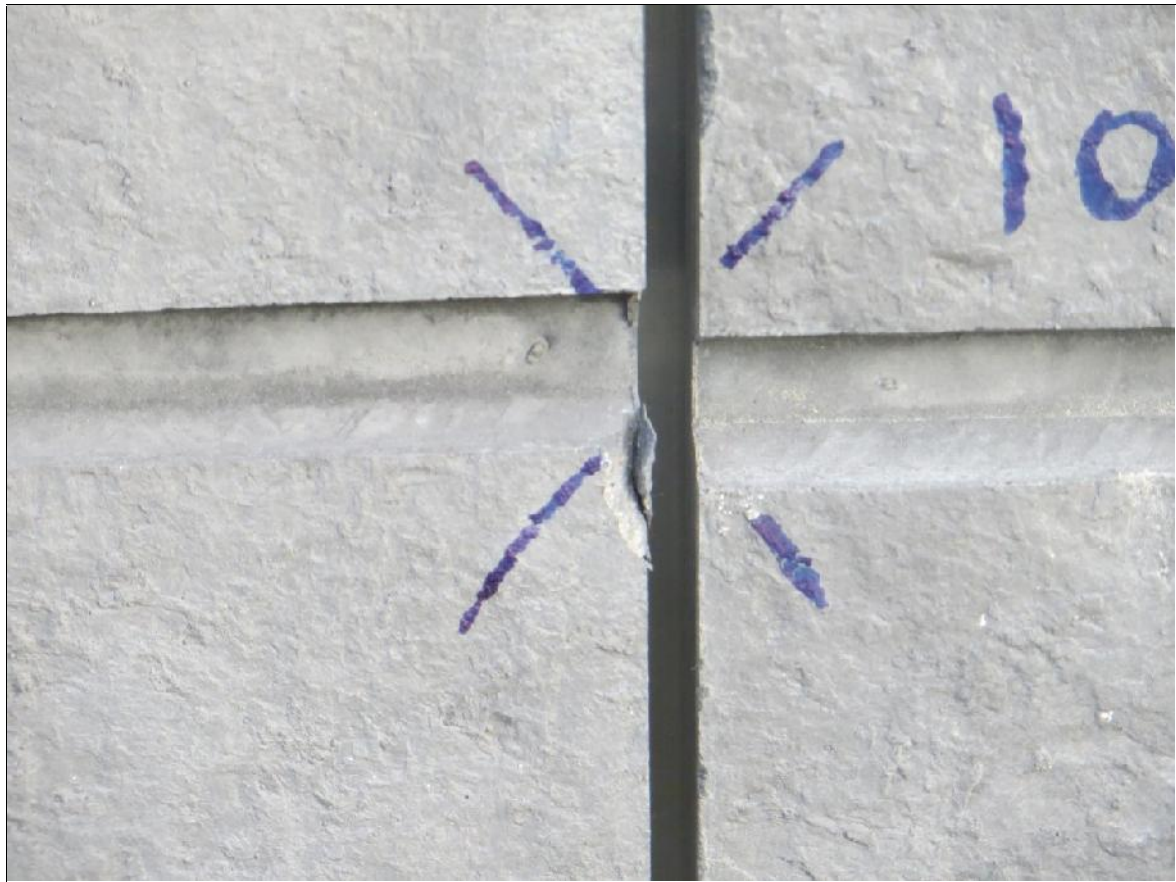


PHOTO 6580

IMPACT LOCATION 15



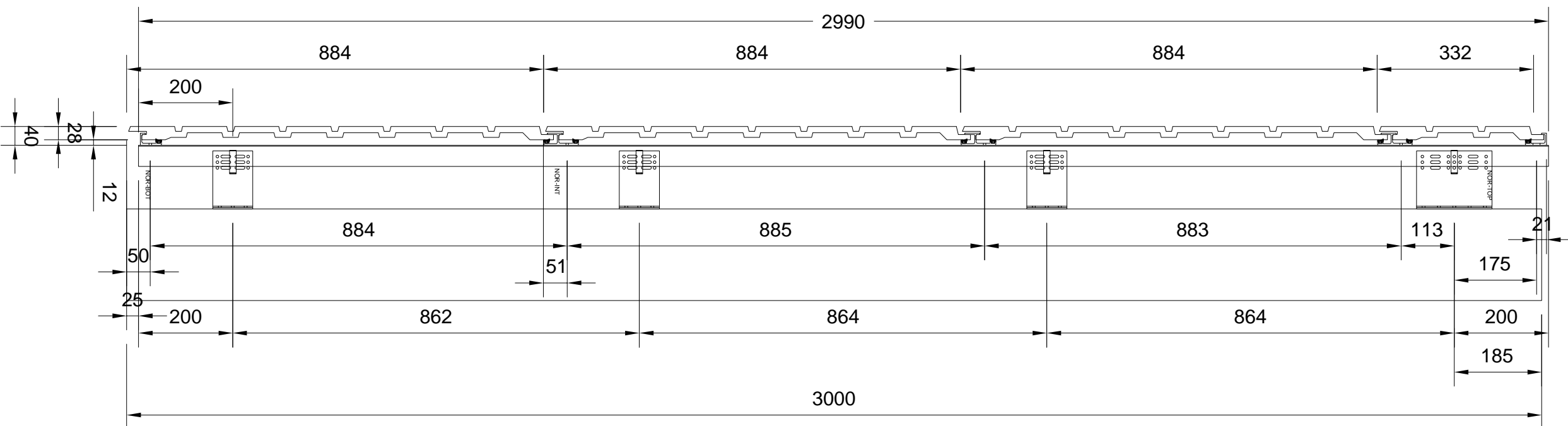
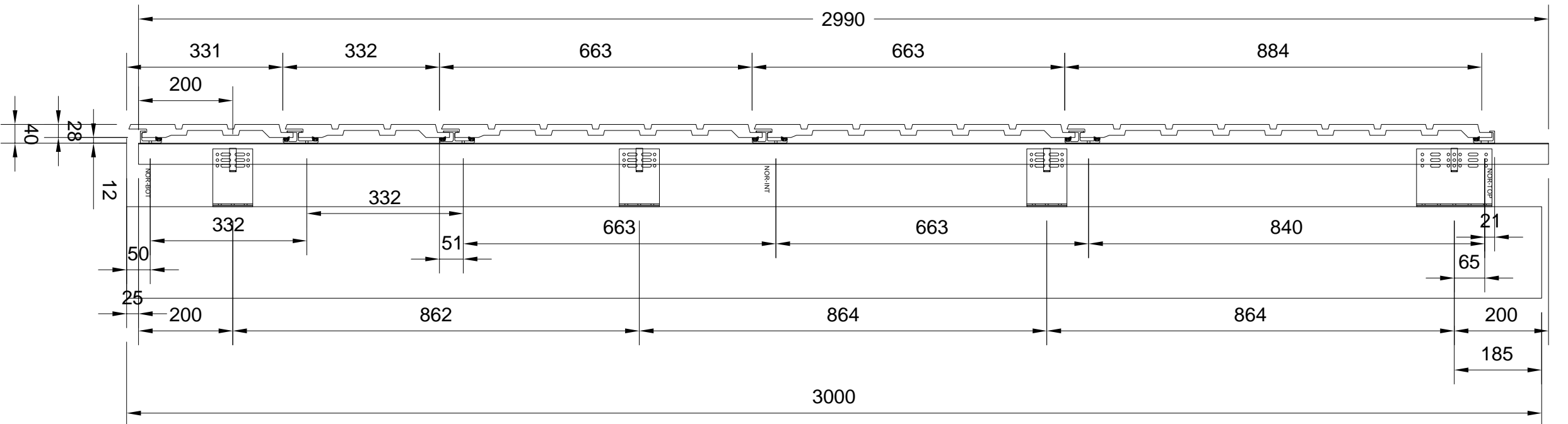
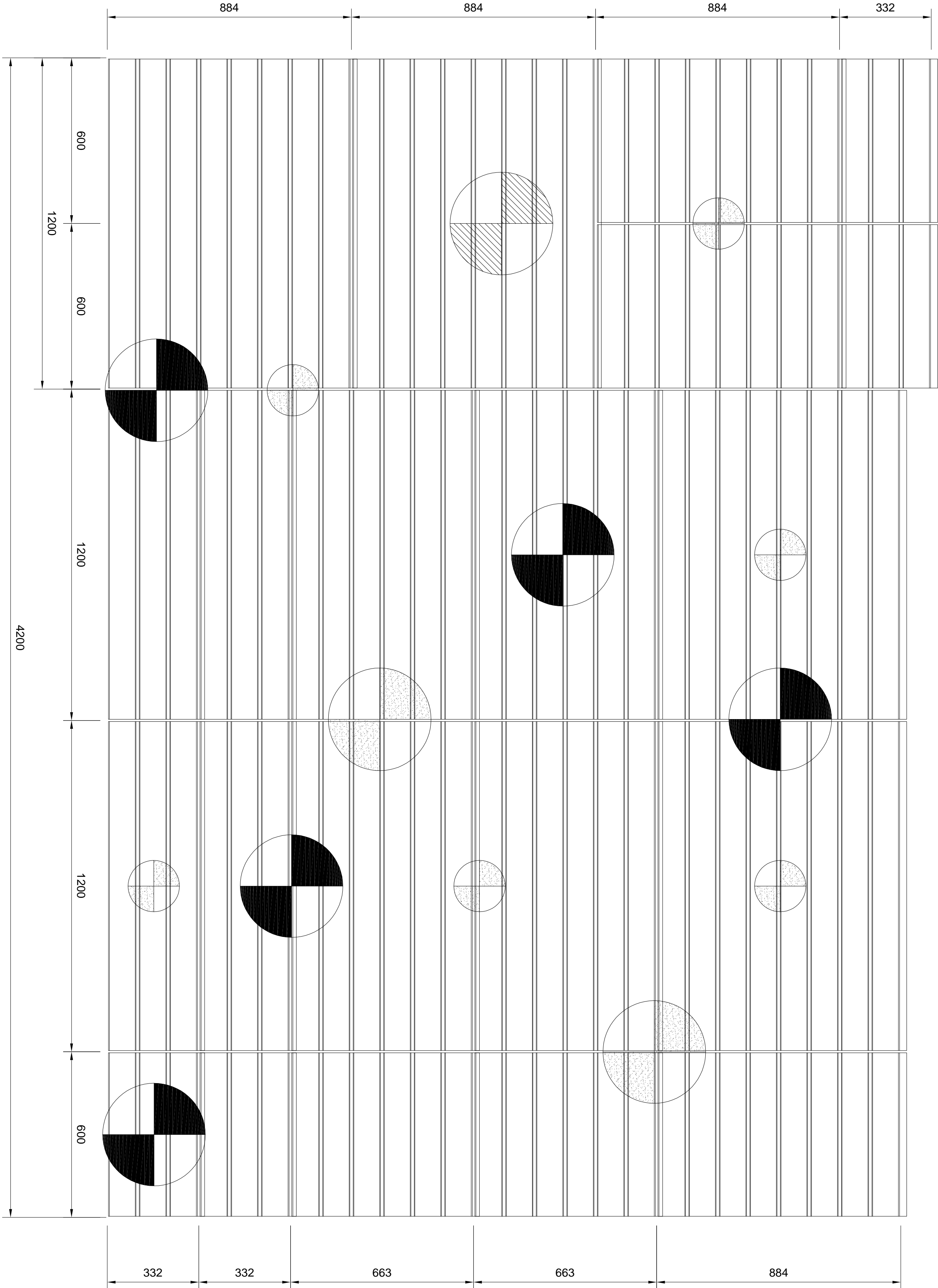
8. DRAWINGS

The following 2 un-numbered pages are copies of Telling Architectural Limited drawings numbered:

4703-IT-E1 rev B,

4703-IT-E2 rev A.

END OF CERTIFICATE



B	06-12-14	RAC	Layout amended to rig size
A	06-11-14	RAC	Impact loads added
Rev.	Date	By	Comments

Drawing Status :

FOR INFORMATION

Contract :

S7 & S8 STRATFORD
TIQ



Telling Architectural Ltd
7 The Dell
Enterprise Drive
Four Ashes
Wolverhampton
WV10 7DF

Tel : 01902 797 700
Fax : 01902 797 720

© Telling Architectural Ltd

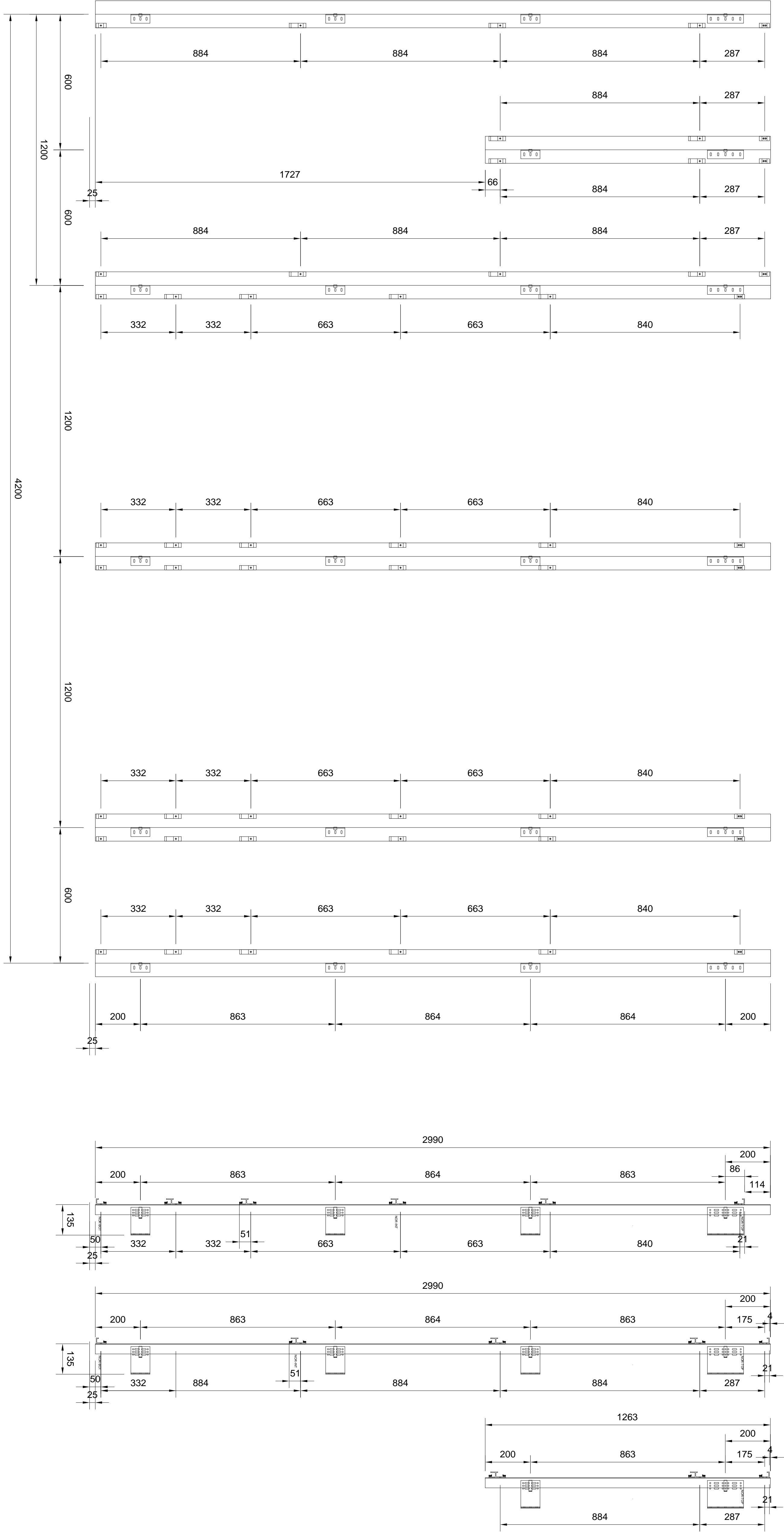
Do not scale from this drawing. If in doubt ask

Drawing Title :

IMPACT TEST PANEL
SETTING OUT DRAWING

Scale :	Checked : PSK	Drawn : RAC
1:10	Date : 05-11-14	Date : 05-11-14

Size	Drawing No.	Rev.
A1	4703-IT-E1	B



Telling Architectural Ltd
7 The Dell
Enterprise Drive
Four Ashes
Wokingham
WY10 7DF
Tel : 01902 797 700
Fax : 01902 797 720

© Telling Architectural Ltd
Do not scale from this drawing. If in doubt ask

Drawing Title :
**IMPACT TEST PANEL
SETTING OUT DRAWING FOR
SUPPORTING 'T' SECTIONS
AND BRACKETS**

Scale :	Checked : PSK	Drawn : RAC
1:10	Date : 05-11-14	Date : 05-11-14

Size	Drawing No.	Rev.
A1	4703-IT-E2	A

A	08-12-14	RAC	Layout amended to rig size
Rev.	Date	By	Comments

Drawing Status :

FOR INFORMATION

Contract :
**S7 & S8 STRATFORD
TIQ**