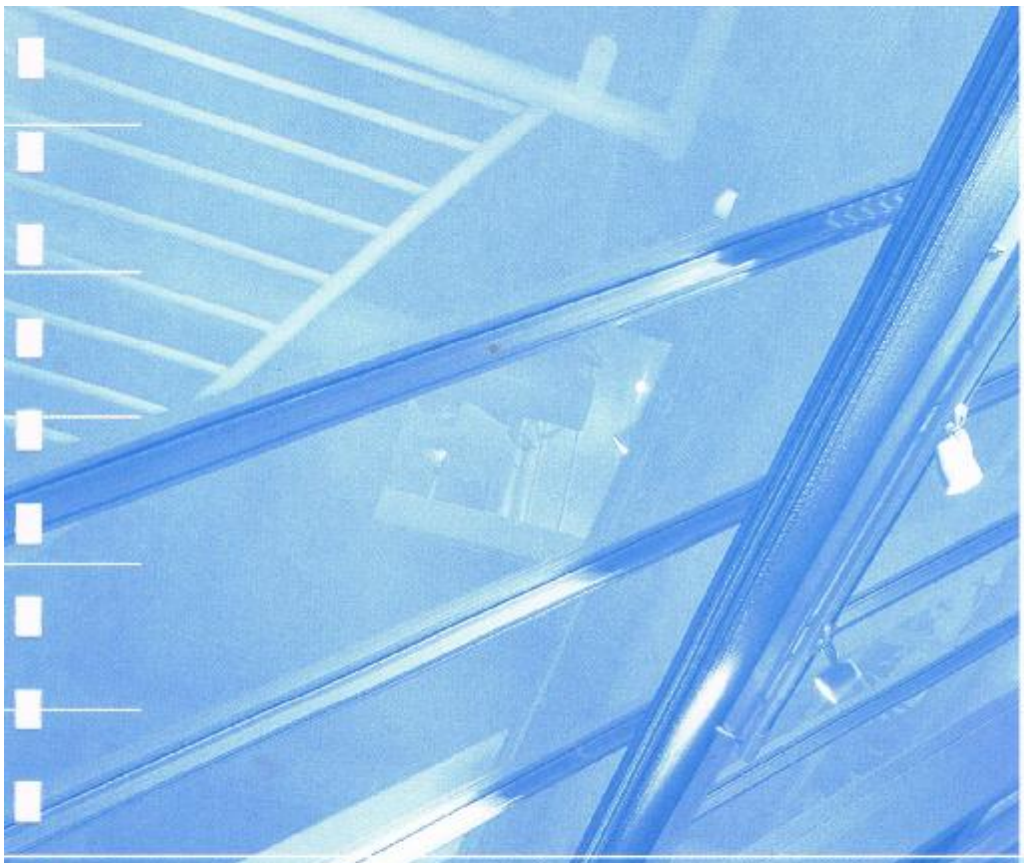


Test report :
ACR(M)001:2000 test for fragility on Naturalight Systems Ltd Standard rooflight

Test report number 209 150b

BR

...in partnership

Prepared for :
Mr D Derrick

Naturalight Systems Ltd

18 July 2002

Prepared on behalf of BRE by

Signature	M. C. Pound
Name	Malcolm Pound
Position	Senior Consultant

Approved on behalf of BRE

Signature	
Name	pp Dr D B Moore
Position	Director of Centre for Structural Engineering
Date	26 JULY 2002

BRE
Construction Division
Bucknalls Lane
Garston
Watford
WD25 9XX

Tel : 01923 664200
Fax : 01923 664096

Email : enquiries@bre.co.uk
Website : www.bre.co.uk

1 Introduction

At the request of Mr W Reay of Naturalight Systems Ltd, Bedlington, Northumberland, BRE tested samples of Standard rooflight on 20 May 2002.

The tests assess the fragility of the specimen rooflights when subjected to impact by a large, soft body as in the standard ACR(M)001:2000.

The tests were carried out under the BRE Standard Terms and Conditions of Business by P Dillon as part of contract number CV 9219, and observed by Mr D Derrick and Mr J Hogg from Naturalight Systems Ltd.

2 Details of the tests carried out

The tests were based on ACR (M) 001: 2000 Test for fragility of roofing assemblies[1]. This standard is applicable to any product that will form a roof or part of a roof assembly. The test attempts to simulate accidental impacts that can occur when humans stumble and fall onto the top surface of roof products. It provides information about the degree of resistance to the impacts and classifies the products tested accordingly.

The tests use a 45 kg cylindrical shaped impactor bag filled with compacted sand. The impactor, drop heights, number of drops and time of retention after impact are according to ACR (M) 001: 2000.

The impactor bag described above was dropped vertically onto the outdoor surface of the specimen rooflight. Depending on the results from the first impact a second identical impact may be performed at the same position on the same test specimen. When impacts are completed at one position then the next position is tested usually using new components. The height above the specimen, from which the impactors was released, gave impact energies of 530 J (Joules). The impact energy in Nm (Newton metres) is calculated by multiplying the force of the impactor in Newtons by the drop height in metres. A Newton metre is equivalent to a Joule. For example: 441.45 N x 1.2 m = 529.74 Nm (J).

Impacts are usually performed at three positions to match those specified in the ACR standard. They are:

i. Within 150 mm of the centre of the test sample
ii. Within 300 mm of a support point, at least 150 mm away from the support
iii. Within 150 mm of the edge of the sheet, adjacent to the underlap with the other sheet, at a position chosen by the 'competent' person.

The rooflight was impacted at the three positions on the glazing shown in Diagram 1:
1. Central, at the apex of the glazing.
2. At a point along the longer sides, 300 mm up from the edge of the glazing.
3. Near a corner of the glazing, at a point 300 mm from where it meets the upstand.

When impacting curved or sloping glazing the impactor can sometimes bounce off the surface on impact. When this occurred the impactor was placed carefully back onto the surface of the rooflight at the impact point and the time for retention of the impactor was started.

3 Performance criteria, classifications and definitions

ACR (M) 001: 2000 Test for fragility of roofing assemblies

1st impact at a point. On impact, if the impactor falls through the test assembly and hits the ground, the test assembly is classified as fragile.

If the impactor is retained on the test assembly the assembly must retain the load for at least 5 minutes. This time period may be shortened or extended if justified by the 'competent' person.

If the test assembly retains the load for the 5 minutes after the impact then it will be classified Class C. Non-fragile assembly.

2nd impact to same point as 1st. The impactor is removed and a second impact similar to the first is made to the same point. If the impactor is retained on the test assembly after the second impact it must be retained for 5 minutes. If the impactor is not retained after the second impact the test assembly will be classified Class C. Non-fragile assembly. If, however, the test assembly retains the impactor after the second impact it will be classified Class B. Non-fragile assembly.

To attain a higher grade than Class B a person competent to do so closely examines the roofing assembly. If this examination shows no sign of damage to sheet or assembly likely to affect the long term strength and weathertightness then the test assembly shall be upgraded to Class A Non-fragile material.

Any tearing at fixings, any fracture points, delamination within the product or damage to the surface protection that could accelerate the degradation process should be regarded as sufficient not to give a Class A rating.

ACR (M) 001: 2000 definitions:

Competent person – A person who can demonstrate that he/they has/have: a) sufficient knowledge of the mechanical and physical properties of the material and assembly under test. b) practical experience of installation of the product, usage and behaviour and failure in service

In these tests the competent person was Mr D Derrick of Naturalight Systems Ltd.

4 Test specimen

Naturalight Systems Ltd supplied new parts for members of their staff to assemble the rooflight specimens described and tested in this report. The test specimen and components were all stored for at least one hour in the test laboratory conditions before testing. Figure 1 shows the Standard rooflight specimen mounted on the test rig.

Type: Rectangular, double polycarbonate skinned domed rooflight, mounted on a galvanised steel upstand. Reference: NaturaLight Systems Ltd Standard rooflight.

Fixings: The metal upstand was fixed to the metal purlins at about 600 mm centres using self drilling/tapping screws. The dome was fixed to the upstand with self-drilling screws through moulded head washers.

Purlins: The metal purlins are part of the test rig. They are 3 m long x 0.175 m deep x 0.050 m wide arranged with centres at about 600 mm apart for these tests.

Dimensions: The overall internal size of the test rooflight was about 2.40 m long x 1.20 m wide.

5 Test set-up

The test rig is that specified in ACR (M) 001: 2000 and consists of a steel frame with steel legs giving a horizontal specimen mounting surface height of about 900 mm. The rig is mounted on a concrete floor. The test specimen is fixed securely to the purlins on this test rig so that it spans across three purlins.

The large, soft body impactor was suspended vertically above the rooflight at an appropriate drop height and released from an electronic release mechanism with a remote trigger. Figure 1 shows the test rig, general test set-up and configuration of the specimen rooflight.

6 Results for the Standard rooflight

The weight of the impactor bag was checked prior to the day's testing and found to be within the prescribed limits, at 45 kg. The length of the drop height gauge was also checked and found to be within ± 3% of 1.2 m. Laboratory conditions were within 20 °C ± 3 °C.

The soft body impact test results are given in full below and in the photographs of some tests. Any work or actions carried out on the rooflight between pairs of impacts is recorded below.

The test impacts were performed at three positions on the specimen rooflight shown on diagram 1. The results are given below:

Position 1. Central, at the apex of the glazing. Figure 2.

1st impact. The impactor bounced off the rooflight on impact. It was replaced and was then retained at the point of impact for 5 minutes. There was some deformation of the upstand at the sides closest to the impact. Figure 3.

2nd impact. The impactor bounced off the rooflight on impact. It was replaced and was then retained at the point of impact for 5 minutes. There was no further apparent damage to the rooflight fixings, glazing or upstand.

Position 2. At a point along the longer sides, 300 mm up from the edge of the glazing.

1st impact. The impactor was retained close to the point of impact for 5 minutes. The impact caused the dome to invert, deforming the edge of the upstand, Figure 4. After the impactor was removed the dome did not recover in the short period between the first and second impacts.

2nd impact. The impactor was retained close to the point of impact for 5 minutes. There was some further deformation of the edge of the upstand, particularly local to the glazing fixings.

Actions: The dome was manually re-inverted before impacts at the next position.

Position 3. Near a corner of the glazing, at a point 300 mm from where it meets the upstand

1st impact. The impactor was retained close to the point of impact for 5 minutes. There was a small area of dome that partially inverted local to the impact, Figure 5.

2nd impact. The impactor was retained close to the point of impact for 5 minutes. There was a small area of dome that partially inverted local to the impact.

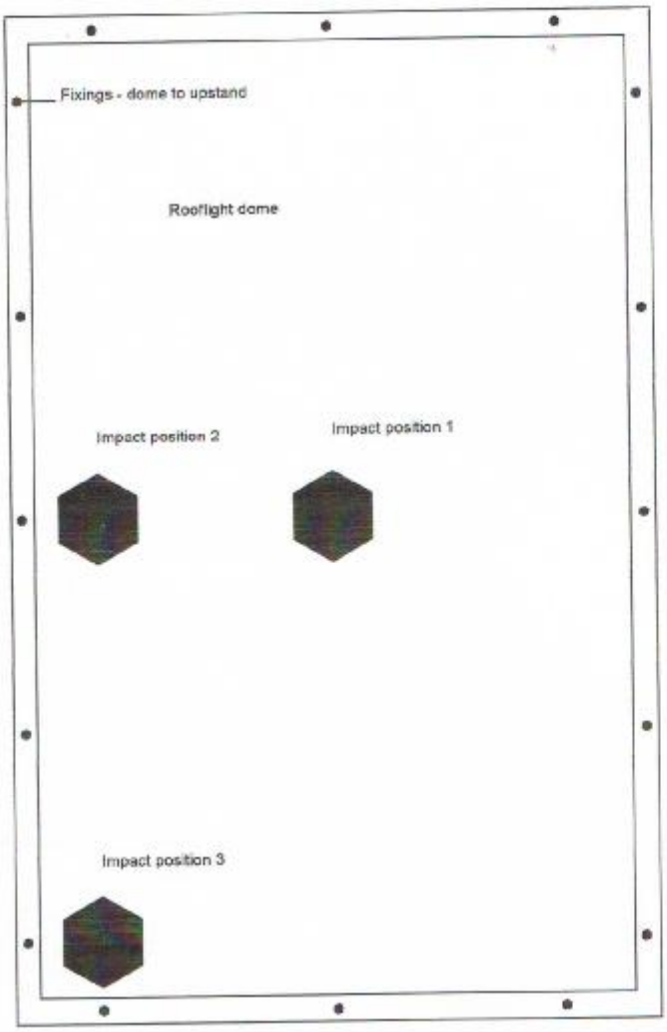


Diagram 1. Impact positions on the Standard rooflight specimen

7 Conclusions and classifications

The impact tests reported here have assessed the fragility of a specimen of Naturalight Systems Ltd, Standard rooflight. The tests were performed according to methods in ACR(M) 001:2000 and results interpreted with regard to the classifications in it.

Where possible impacts were made to equivalent positions on the rooflight to the three positions specified in the standard. The results are classified as:

i. Within 150 mm of the centre of the test sample – Position 1 on the rooflight - Class B non-fragile assembly
ii. Within 300 mm of a support point, at least 150 mm away from the support – Position 2 on the rooflight - Class B non-fragile assembly
iii. Within 150 mm of the edge of the sheet, adjacent to the underlap with the other sheet, at a position chosen by the 'competent' person – No equivalent position on the rooflight - Position 3 on the rooflight - Class B non-fragile assembly

The results show that at all three positions tested the specimen rooflight assembled, mounted and fixed in the manner described herein attained the overall classification of Class B non-fragile assembly.

The position impacted that suffered most damage was position ii as above.

8 References

1. ACR (M) 001:2000. Test for the fragility of roofing assemblies. Advisory committee for roofwork. Materials Standard.

Figure 1. The Naturalight Systems Ltd Standard rooflight specimen mounted on the BRE test rig

Figure 2. The Naturalight Systems Ltd Standard rooflight specimen under tests – impact to position 1.

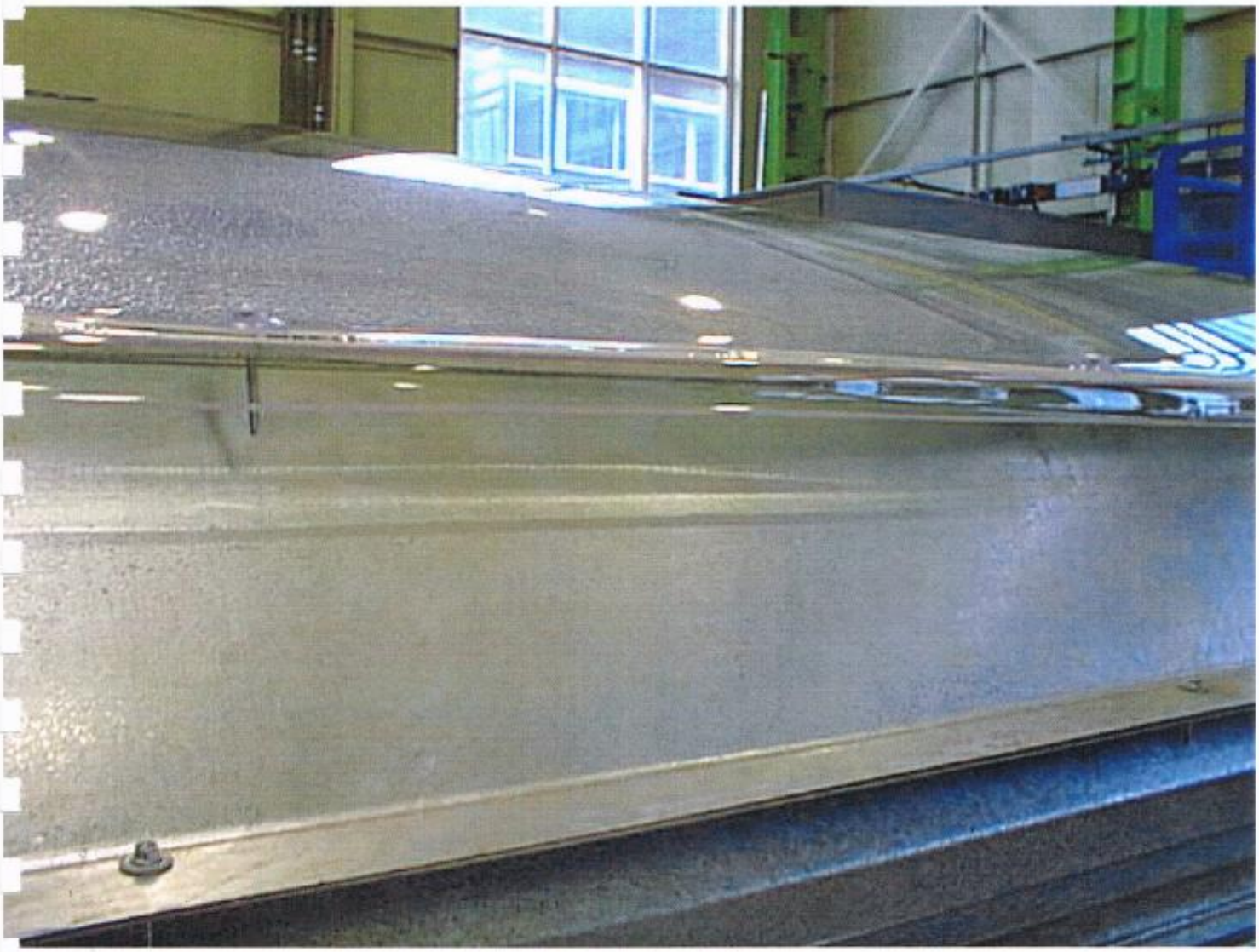


Figure 3. There was some deformation of the upstand at the sides closest to the impact.

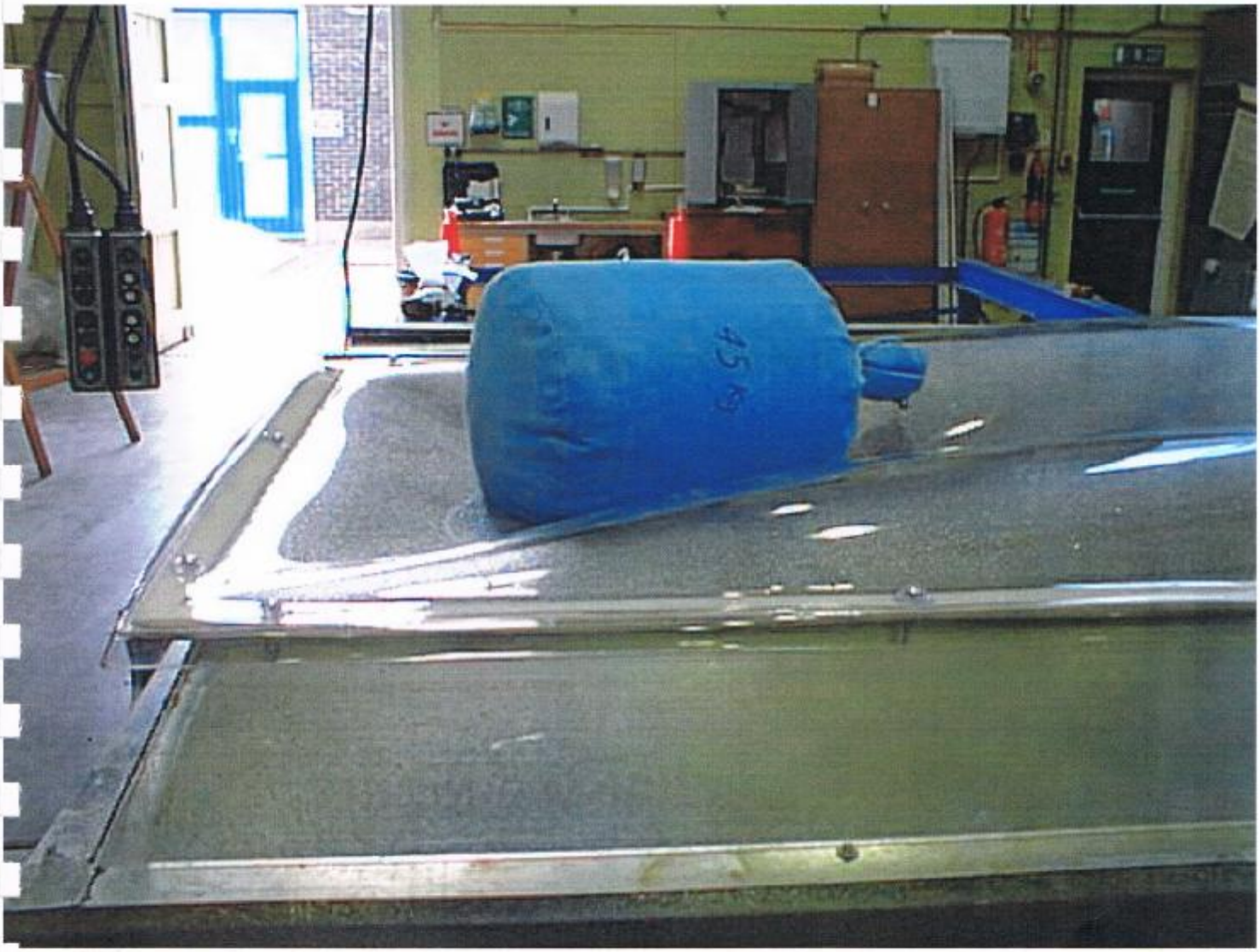
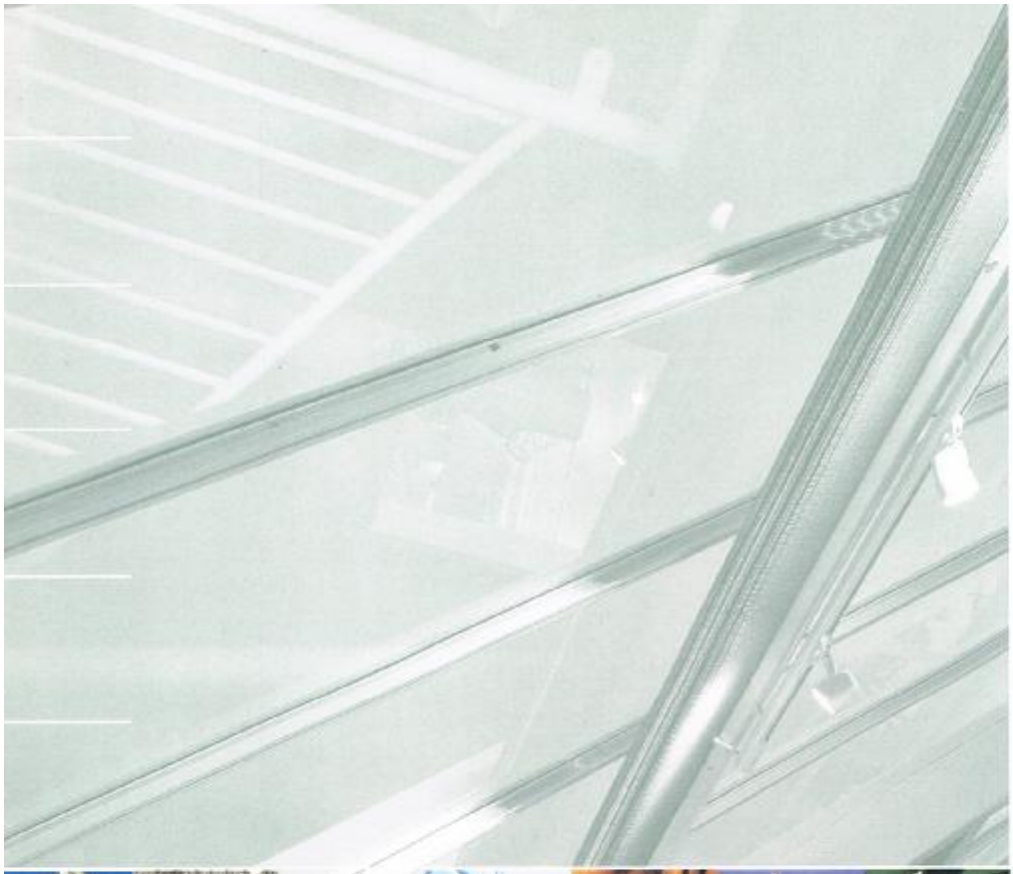


Figure 5. After the 1st impact at Position 3 there was a small area of dome that partially inverted local to the impact

Figure 4. The 1st impact at Position 2 caused the dome to invert, deforming the edge of the upstand



BRE

BRE, Garston, Watford WD25 9XX
T 01923 664000
F 01923 664010
E enquiries@bre.co.uk
www.bre.co.uk