DYNAMIC WEATHER RESISTANCE TEST TO AS2050-1989 ON PRESSED METAL ROOFING PANELS MANUFACTURED BY CARTER HOLT HARVEY ROOFING INTERNATIONAL LIMITED

CSIRO Report No. DTR275 and Job No. NDDZTR2275

1. INTRODUCTION

Sponsor: Carter Holt Harvey Roofing International Limited
90-104 Felton Mathew Avenue
Glen Innes Auckland 6
NEW ZEALAND

Test Date: 30 June 1994

Background:

The CSIRO was engaged by Carter Holt Harvey Roofing International Limited to carry out dynamic weather resistance test to AS2050-1989: Appendix C on a representative sample roof of Corona Roofing System. This report details the result of the test.

2. SPECIMEN

The panel is of pressed sheet steel, the shape in end section has two opposite right angle returns, one forming the lower edge of the panel, the other serving to "weather" the upper end (or head) of the panel. Each panel was laid on the roof and contains a number of shake-like profiles. The panels are coated in a layer of crushed stone adhered to the metal panel using an acrylic coating.

The test specimen consisted of a 1.8 m wide panel comprising six rows of panels as shown in Figure 1. The panels were fixed on 50 mm by 38 mm timber battens by nailing with galvanised clout headed nails driven through both panels into the edge of the batten.

3. TEST CONDITIONS

The dynamic weather resistance test assesses the weather resistance of the body of a properly fixed complete roof. Wind and rain is simulated by blowing water spray on to the specimen and assessing the penetration compared to that of a control roof.

The wind speed and rate of water application used for the dynamic weather resistance test are not claimed to represent actual conditions during rain storms. They have been arbitrarily chosen and found to give results which correlate reasonably with observed performances of roofs on low rise buildings up to 10 metres high.

The test specification AS2050-1989 requires this test as part of the requirements for acceptance of concrete tiles (AS1757) and for terracotta tiles (AS2049). While there is no specification for metal tiles it is generally accepted that this long-standing test is a realistic arbiter of roof adequacy.

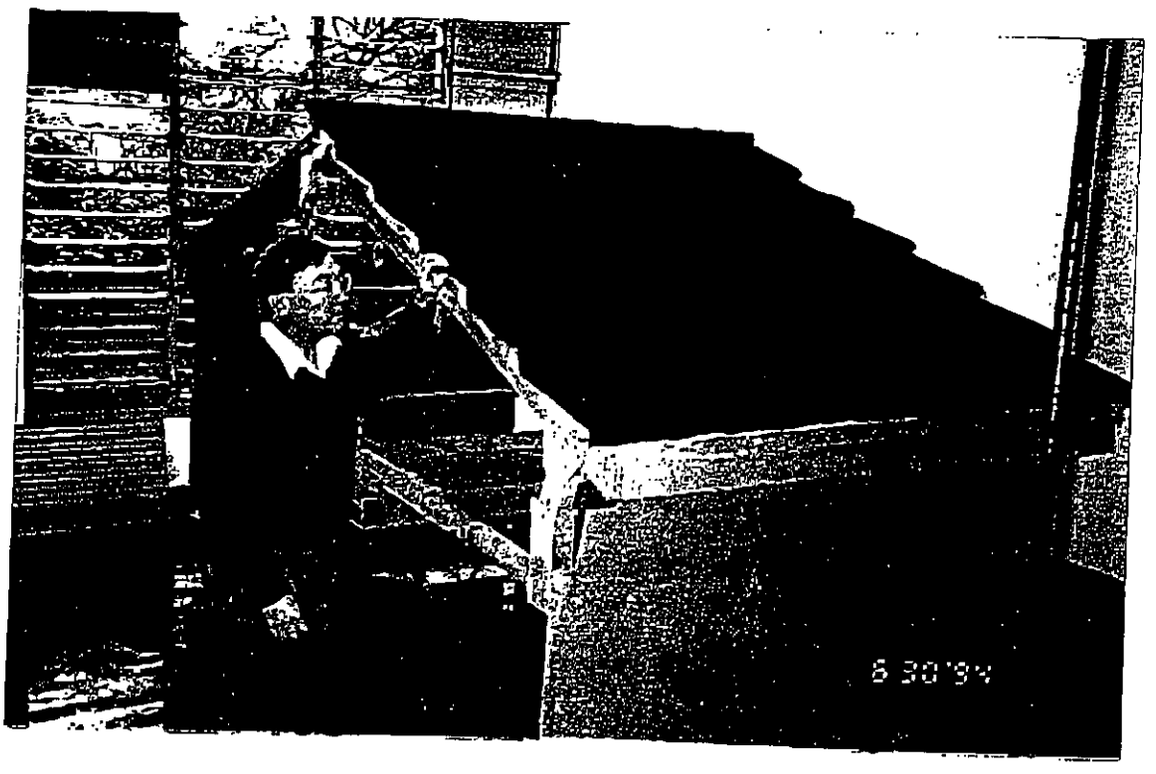


Figure 1: Test Specimen

The test apparatus consists of a 1200 mm diameter, 8 blade fan driven by an 18.65 kW electric motor. The windstream from this fan is discharged into the test chamber by means of a 1230 mm square duct, 3000 mm long and fitted with flow straightening vanes at the discharge end.

Water is introduced into the windstream by two sets of spray nozzles. The first consists of a set of 12 nozzles installed in vertical pipes which are mounted immediately downstream from, and in line with, the straightening vanes. This set discharges water horizontally into the windstream. The second is a set of 8 nozzles installed in a sparge pipe mounted 900 mm above the centre of the windstream and 1500 mm downstream from the discharge orifice. It discharges water downwards at an angle of 30° to the vertical and in the direction of the windstream.

The end of the chamber is freely open to ambient conditions through a series of louvre blade vents.

A full scale model roof which will accept a panel of roofing 1800 mm by 1800 mm on each side of the ridge is placed in the windstream with its ridge 3600 mm downstream from the discharge orifice. The rafter pitch is adjustable from 40° to flat and the attitude of the specimen to the windstream can be altered by rotating the roof on a turntable.

The chamber and test apparatus are depicted in Figure 2.

3.1 Control Specimen

The control specimen consisted of an 1800 mm panel of "Marseilles" pattern terracotta roofing tiles, comprising 6 rows of 8 tiles. The tiles were laid in staggered bond on 35 mm by 35 mm timber battens at 380 mm centres. The tiles were branded "GUICHARD CARVIN & CIE - MARSEILLE St ANDRE" on the underside of each tile.

The wind generator was set to 16 m/s and water was introduced into the windstream at 440 mL/s to maintain a run-off rate of 170 mL/s, which is the equivalent to a water application rate of 50 mL/s per square metre of roof area.

Note: The control specimen is tested only at a rafter pitch of 27° as this represents a commonly used pitch for traditional terracotta tiles roofs.

The test conditions were maintained for 2 minutes with the ridge of the specimen normal to the windstream. The specimen was then turned at 45° to the windstream with the laps facing into the wind and the test conditions maintained for a further 2 minutes.

The above test procedure was repeated on the test specimen at rafter pitches nominated by the sponsor.

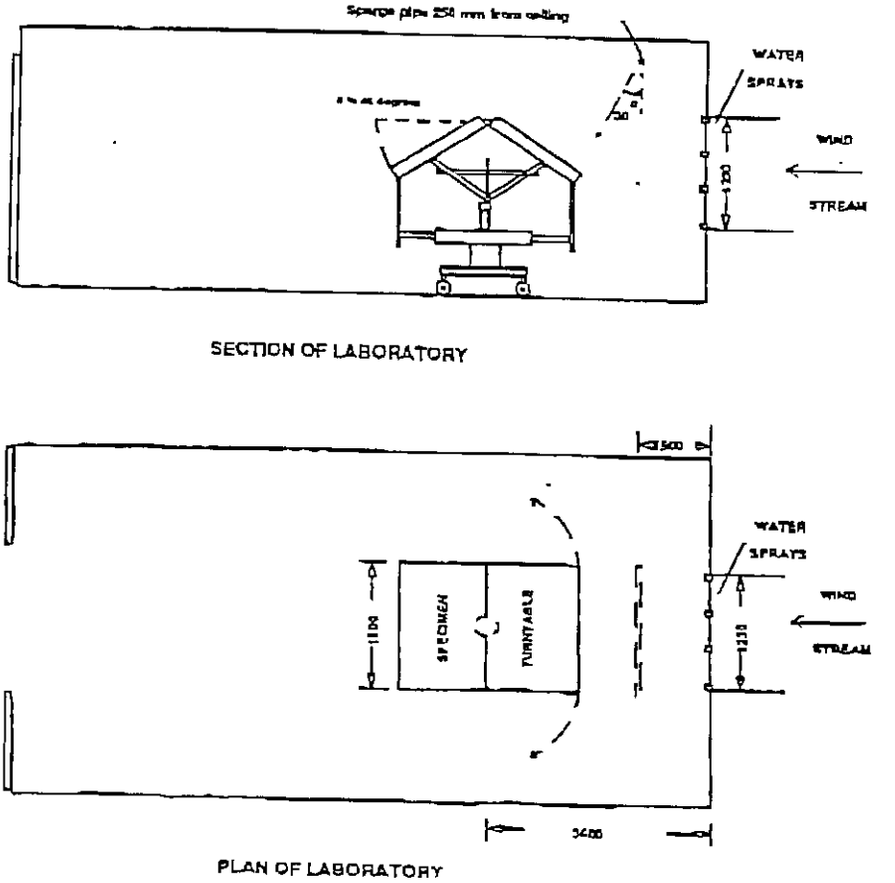


Figure 2: Arrangement of Roofing Tests.

4. RESULTS

The control specimen or datum is tested at 27° and compared to the test specimens.

4.1 Datum

With the ridge of the control specimen normal to the windstream the following instances of water penetration were noted.

- At the head lap between rows two and three at tile three and four.

With the specimen at 45° to the windstream water penetration was observed as follows:

- At the head lap between rows two and three at tile three and four.

4.2 Test Specimen

The test specimen was tested at rafter pitches of 12°, 15°, 20°, 27°, 40°.

No leakage occurred with the roof deployed normal to the windstream.

No leakage occurred with the specimen deployed at 45° to the windstream.

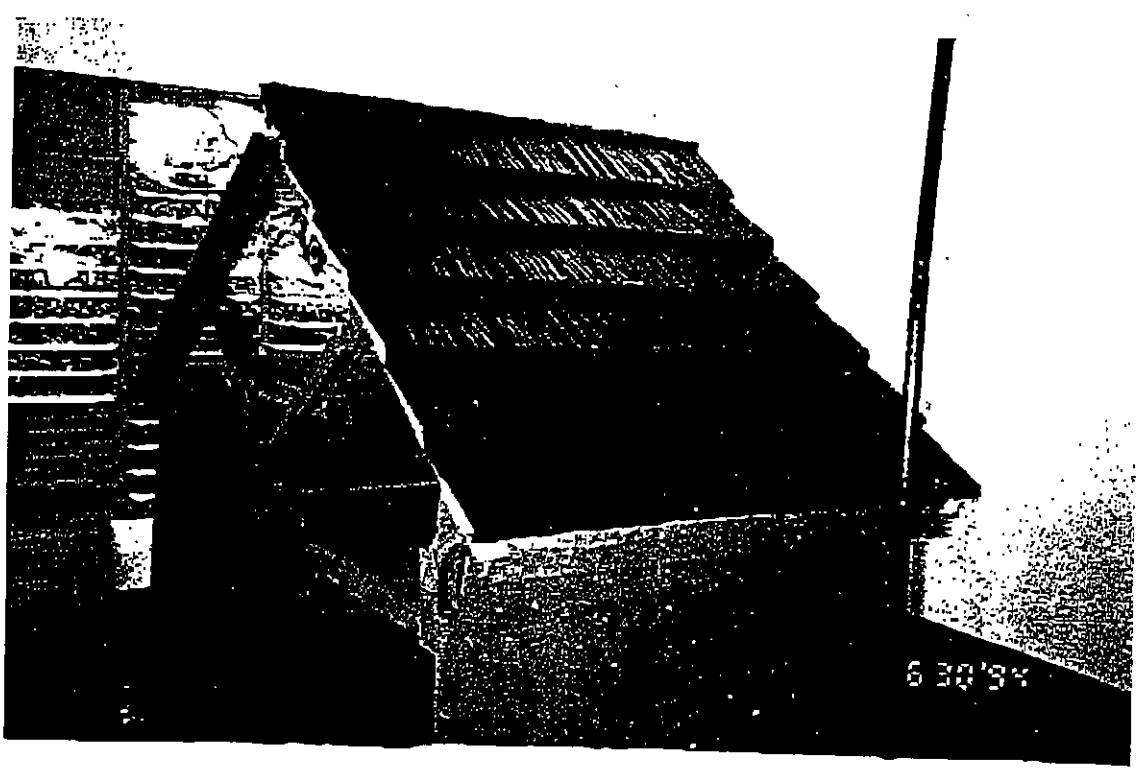
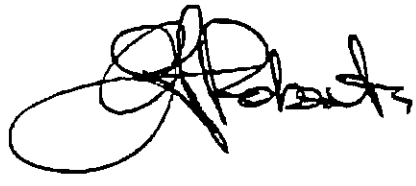


Figure 3: Roofing panels subjected to wind and rain during the test.

5. CONCLUSIONS

The Corona Roofing System was presented to CSIRO by Carter Holt Harvey Roofing International Limited on the 30 June 1994. It was tested for Dynamic Weather resistance as per AS2050 -1989: Appendix C, at pitches 12°, 15°, 20°, 27°, 40°. The panels pass the performance criterion of AS2050-1989 Clause 1.4.2.



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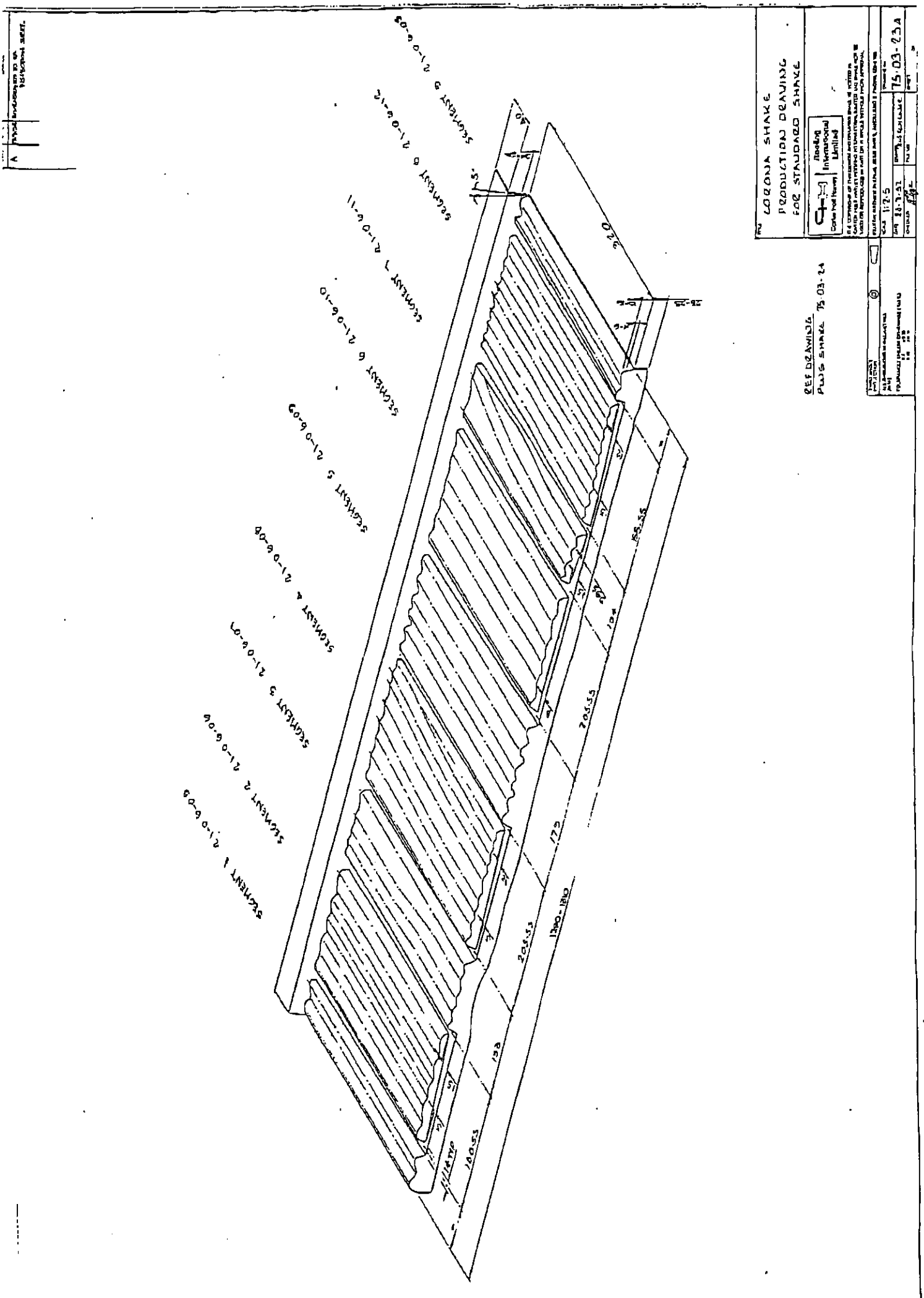
Date of Issue: 18 August 1994

Appendix A Specimen Drawings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FOR STANDARD SHAKE
Roofing International Limited
SCALE 1:2.5
DATE 10.7.01
75-03-23A
REF DRAWING
PLUS SHAKE 75-03-24
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SEGMENT 2 2-0-6-09
SEGMENT 3 2-0-6-09
SEGMENT 4 2-0-6-09
SEGMENT 5 2-0-6-09
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SEGMENT 7 2-0-6-11
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SEGMENT 9 2-0-6-12
185.55
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205.53
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100.53

Appendix B Test Specification

AS2050-1989 Appendix C

APPENDIX C

DYNAMIC WEATHER RESISTANCE TEST

(This Appendix forms an integral part of this Standard.)

C1 SCOPE. This Appendix sets out a test to assess the weather resistance of the body of a properly fixed completed tiled roof.

NOTES:

1. The wind speed and rate of water application used for the dynamic weather resistance test are not claimed to represent actual conditions during rain storms. They have been arbitrarily chosen and found to give results which correlate reasonably with the observed performance of roofs on low-rise buildings, e.g. up to 10 m.
2. Where sarking and specific fixings are required, these should be included in the test specimen.

C2 PRINCIPLE. Rain is simulated by blowing waterspray on to the specimen and assessing the penetration.

C3 APPARATUS. The following equipment is required:

(a) *Wind generator:* A wind generator capable of producing a windstream of 16 m/s that varies not more than ±1 m/s over a discharge area of 1.5 m^2. It shall be fitted with a discharge duct, 1.2 m square.

(b) *Water sprays:* A controlled supply of water capable of introducing water into the windstream through two sets of nozzles. The first set shall be fine sprays that discharge horizontally into the windstream at the opening of the air duct. The second set shall be coarse sprays mounted above the wind that discharge downwards at 60° in the direction of the windstream.

(c) *Roof support:* A full-scale model roof which will accept a panel of roofing 1800 mm × 1800 mm on each side of its ridge. The rafter pitch and attitude of the specimen shall be adjustable and the model roof shall be so positioned that the centre of the test panel aligns with the centre of the windstream. The underside of the model roof shall be accessible for observation of specimen performance during tests.

(d) *Measuring equipment:* The following items of equipment shall be provided to monitor the test conditions.

(i) A device to measure wind velocity to an accuracy of ±1 m/s.

(ii) A device to indicate water flow. The device shall be calibrated by a collection/time method at periods not exceeding 6 months.

(iii) A device to measure the rafter pitch. A clinometer capable of measuring to 0.5 degrees would be suitable.

C4 TEST SPECIMEN. The test specimen shall consist of a panel of roofing tiles, 1800 mm × 1800 mm fixed to the model roof in an identical manner to that of the roof in practice. Where sarking is specified, the sarking material shall be replaced with clear plastic sheeting to allow observation of the roof's performance. The ridge, eave and gables shall be flashed to prevent water penetration at these points which might mask the performance of the body of the specimen roof.

C5 CONTROL SPECIMEN. A control specimen shall be used to establish a datum for the assessment of weather resistance. It shall consist of a panel of Marseilles pattern terra cotta tiles drawn from a reserve held by the National Building Technology Centre; Division of Building, Construction and Engineering; CSIRO.

The reserved tiles are marked on the underside 'GUIGHARD GARVIN Cie' and 'MARSEILLES ST ANDRE' and display on both surfaces a bas-relief of a bee.

The tiles are laid without sarking on 50 mm × 50 mm timber battens on one side of the model roof.

C6 PROCEDURE. The procedure is as follows:

(a) *Datum.* Establish a datum as follows:

(i) Set the control specimen to a rafter pitch of 27°. (This is known as 1/4 pitch as the height of the ridge is 1/4 the span of the roof.)

(ii) Set the wind generator to 16 m/s and introduce water into the windstream until a run-off of 0.17 L/s is maintained. These settings will be used as the benchmark for all subsequent tests.

(iii) Apply the test conditions to the control specimen for 2 minutes with the ridge normal to the windstream and observe and record its performance.

(iv) Alter the attitude of the control specimen so that the ridge is at 45° to the windstream and the laps are facing into the wind. Apply the test conditions for a further 2 minutes and observe and record the performance.

(v) Comment on any water that may have penetrated to the underside of the specimen, noting drainage or dripping from tiles and the position on the specimen.

(vi) The performance of the control specimen shall be used as the benchmark for all subsequent tests.

(b) *Test.* Carry out the test as follows:

(i) Set the test specimen to the first specified rafter pitch. (This will usually be the rafter pitch above which sarking is not required.) In the absence of a specification use 27°.

(ii) Apply the benchmark test conditions to the specimen and perform steps (iii) to (v) in (a) above.

(c) *Assessment.* Compare the observed performance of the test specimen with that of the control specimen and note the results.

C7 REPORT. The report shall include the following information:

(a) A full description of the specimen tiles and the method of fixing them to the roof structure. This shall include a scale drawing of the test tiles showing overall dimensions and the size and positions of all drainage channels and weather checks.

(b) The details of the lot from which the test samples were selected.

(c) The date and location of the tests.

(d) A full description of the tests performed referenced to this Standard, i.e. AS 2050 and the observed performance of the specimen during the tests.
NOTE: The description should include the pitch of the specimen and whether or not sarking was used.

(e) An assessment of the test performance relative to the performance of the control specimen.

END OF REPORT