Registration of Noise Fence Panel

May 2022

Queensland Government

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Contents

1 Overview

This document details the requirements and process by which the Department of Transport and Main Roads registers noise fence panels to meet the department's Technical Specification MRTS15 *Noise Fences.*

Registration is a prerequisite prior to supply to departmental projects; it does not replace approval or acceptance by the Administrator in accordance with the contract, or the stipulated Hold Points, Milestones and Witness Points determined by the Technical Specifications.

For this system, the panel must be registered before tendering on departmental contracts. It is intended that only registered panels be engaged on departmental projects, irrespective of the scale of the project. Assessment of tenders for departmental projects will not be delayed for pending panel applications to be completed.

The purpose of registration is to minimise the risk associated with purchasing non-conforming panels for use in departmental projects.

This document specifies conditions in relation to:

- requirements for submitting new noise fence panel products for approval (or resubmitting those previously approved and lapsed)
- requirements for extending currently approved noise fence panels products prior to the three year approved period concluding
- submission requirements, standards and required inclusions, and
- supply chain.

The registration of panels, as described in this document, is managed by Engineering and Technology Branch.

2 Communication and responsibilities

The Deputy Chief Engineer (Hydraulics, Design and Spatial) or the Manager (Noise and Landscaping Standards) are the delegated authorities responsible for this Registration Scheme. All enquiries regarding this registration covered in this document should be directed to:

Principal Engineer (Noise & Air). tmr.techdocs@tmr.qld.gov.au.

3 Reference documents

The following documents apply to registered panels:

- Transport and Main Roads Technical Specification MRTS15 *Noise Fences*
- Transport and Main Roads Technical Specification MRTS50 *Specific Quality System Requirements*
- Transport and Main Roads Standard Drawings for Noise Fences

- Third-party registration rules by the relevant International Standard Organisations (ISO) standards or by the Joint Accreditation System for Australia and New Zealand (JAS-ANZ) to the relevant standards.
- Relevant Australian and International Standards and any other Technical Specifications for noise fences.

4 Registration process

4.1 General

Assessment of the application will take the form of technical and management reviews as described in Section 4.2 and Section 4.3.

The application must be supported by appropriate documentation. Failure to supply true and correct information may result in delays in, or rejection, of panel.

The application should be submitted allowing for adequate time to assess that the Applicant fulfils all registration requirements.

Applicants may be charged a fee to meet costs involved in conducting site audits. This fee is dependent on travel costs, and whether third parties are engaged (for example, for overseas suppliers). The Applicant will be advised of this fee when panel review is progressed to the audit stage. Multiple audits may be required to finalise the registration assessment.

4.2 Technical assessment

A technical review will occur at the time of application, and at intervals throughout the registration period. As part of the technical review, complete details of the panel will be examined based upon:

- Panel drawings, including cross sectional drawing with dimensions showing all types of materials.
- Composition of the materials including name and state of origin, and percentage by weight in the finished product.
- Physical properties of the composition.
- Finished panel, demonstrating:
  - impact resistance (Guideline stipulated in Appendix A)
  - resistance to defacing sharp implements (for example, knife)
  - water absorption
  - acoustic properties
  - resistance to roadside environment (solar UV radiation, vehicle exhaust fumes from both diesel and petrol engines and spray paints, various graffiti-removal solvents and routine washing surfaces) over the required design life of 40 years particularly for plastic, recycled plastic and transparent panels (acrylic, polycarbonate and glass) (Guideline stipulated in Appendix E)

  - structural properties of the panel (tensile strength, flexural strength, modulus of elasticity in tension, tensile strain, charpy impact strength, tensile impact strength) including over the required design life of 40 years when exposed to roadside environment (Guideline stipulated in Appendix E)
  - light reflection and transparency
  - temperature of deflection under load
  - resistance to fire (Guideline stipulated in Appendix B)
  - chemical resistance to oils and acids that is no change of weight, dimensions, appearance, colour, and other mechanical properties
  - fungus resistance that is no growth of fungus
  - resistance to scratching
  - resistance to discolouration with age (yellowness)
  - thermal expansion
  - self-weight (Guideline stipulated in Appendix F), and
  - dimensional change on heating (shrinkage).
- Manufacturing processes and procedures.
- Theoretical basis of recognised structural design calculations.
- Assessment of performance by prototype wind load testing before and after roadside environment meets the net design wind pressure (Guideline stipulated in Appendix C and Appendix E).
- Assessment of performance by prototype wind load testing of composite panel on wet and condition meets the net design wind pressure (Guideline stipulated in Appendix D).
- Method of fixing the panel. Panels shall not be drilled for mounting purposes.
- Physical sample.

A full technical review may require a site visit by Noise Team staff.

4.2.1 Testing

All tests shall be carried out in accordance with internationally recognised standards and at an accredited institute approved or specified by the Administrator. All material testing in Australia shall be undertaken at the National Association of Testing Authorities Australia (NATA) certified laboratories. Such tests shall have been carried out no more than 5 years for accelerated exposure tests and 3 years for other tests, before the time of submitting to the panel for approval. All samples delivered to the testing institute shall be indelibly printed with the manufacturer's brush mark for clear identification. If testing is undertaken outside Australia, the test results shall be certified by NATA.

The accelerated exposure test shall be carried out at an accredited testing institute, approved or specified by the Administrator, in accordance with the guidelines stipulated in Appendix E. Previous accelerated exposure test results could also be accepted, provided the tests are properly performed and witnessed in a manner acceptable to the Administrator.

4.3 Management system assessment

System reviews will occur at the time of initial application and at intervals throughout the registration period. System reviews may include:

- A review of the Applicants implementation of its Quality Management Systems (QMS) addresses the entire supply chain (Refer Section 10) that relates to the supply of products.
- Collection of information such as:
  - company information
  - previous experience
  - history in manufacture of product
  - standing with third-party certification bodies. The certification scheme serves to indicate that the product consistently conforms to the requirements of the Standard. The Applicants implementation of its QMS shall be measured against AS/NZS ISO 9001 *Quality Management Systems - Requirements*. This review is not a replacement for independent certification of the QMS, when this is a requirement.
  - third-party certification shall be undertaken by a conformity assessment body accredited by the Joint Accreditation System for Australia and New Zealand (JAS / ANZ) in accordance with the requirements of AS/NZS ISO/IEC 17067 *Conformity assessment — Fundamentals of product certification and guidelines for product certification schemes* (Type 5) scheme.

Manufacturer in Australia:

a) In Australia manufacturers shall operate a 3rd party quality system certified to AS/NZS ISO 9001. Certification shall be undertaken by a conformity assessment body accredited by the Joint Accreditation System for Australia and New Zealand (JAS / ANZ). The certifier shall be acceptable to the Administrator.

b) Demonstrate technical conformance to MRTS15 *Noise Fences.*

c) Provide traceability of all materials.

d) Maintain records of all products placed on the market for a minimum of 10 years, and

e) Make available all relevant documentation when product is supplied.

Manufacturer outside Australia:

a) Outside Australia manufacturers shall operate a 3rd party quality system certified to AS/NZS ISO 9001. The system will be audited by an Auditor acceptable to the department. The Auditor shall ensure that the manufacturer(s) are working as stated in their system documentation and the system conforms with the requirements of the department.

b) The Auditor shall ensure that the manufacturer can demonstrate technical conformance to MRTS15 *Noise Fences.*

c) Provide traceability of all materials.

d) Maintain records of all products placed on the market for a minimum of 10 years, and

e) Make available all relevant documentation when product is supplied.

5 Registration

After review of the application, and any required audits are completed, the Manager (Noise and Landscaping Standards) shall decide whether registration will be granted. Should registration not be granted, a letter stating the reasons will be sent to the Applicant with a list of improvements required before re-application can be made. Reasons for rejecting application may include failure to demonstrate capacity or capability to comply with either technical or management assessment requirements in Section 4 of this document.

6 Levels of registration

Applicants who have satisfied the requirements of registration (this Scheme) shall be granted Provisional level registration for a period of one year.

Applicants who have satisfied the requirements of registration (this Scheme) and exhibit a continued level of high performance on departmental projects with limited non-conformances shall be granted full registration for maximum period of three years.

The approval of panel is based on the information provided by the manufacturer on the conditions that:

- panel composition does not change
- panel dimensions do not change, and
- performance is maintained.

A panel approval will remain valid for three years from the date nominated on the approval confirmation. If, during this three-year period:

- the panel composition or design changes
- manufacturers panel specification / drawing is updated, or
- there is a change to any governing manuals, associated Technical Specifications and guidelines

the approval ceases and a new application submission will be required.

6.1 Provisional level to full registration

Provisional to full registration level shall supply evidence of high-quality performance on a significant body of work for departmental projects. This shall include a summary of noise panel manufactured to departmental Technical Specifications over a twelve-month period, and the full list of non-conformances relating to departmental work. Submissions shall be made on the appropriate documentation.

Departmental performance reviews may also be considered.

The Applicant will be notified when this submission, complemented by departmental records, has been evaluated and whether the registration has been granted to maximum of three years.

7 Renewal of registration

Upon reaching the end of this registration period, the Applicant shall seek a renewal of registration. Within two months of any three-year approval period expiring, the Applicant is to notify the contact officer (nominated in this document) of their intention to extend for a further three years and nominate either of the following:

Such renewal will be granted, provided:

- there has been no redesign of the product
- compliance to this scheme and the specifications are maintained
- pre-requisites of registration are current (e.g. AS/NZS ISO 9001 certification), and
- there are no significant non-conformances outstanding.

If the product has been redesigned – further approval period will be granted based on submission of relevant test results and test reports.

An audit is not mandatory prior to renewal of registration but may be required to close out any issues of concern.

Registrations that expire without renewal are concluded, and the registration will be removed from the relevant register. Applicants may continue to fulfil current contracts but must not sign / tender for further contracts. Applicants removed from the list due to an expired registration may reapply for registration, without waiting the twelve-month period deregistration incurs.

If the approval period expires, the product will need to be reassessed as per Section 4.

8 Suspension

Applicants may be suspended and removed from the register depending on the circumstances. Suspended suppliers may continue to fulfil current contracts, subject to additional conditions and considerations, but must not sign / tender for further contracts.

Suspended Applicants are not granted a registration status and will not appear on the departments register.

In certain circumstances for example, safety concerns or serious breaches of this registration scheme production may by suspended immediately.

Reasons for suspension include, but are not limited to:

- Repeated, or continuing, significant non-conformances of product or process.
- Fraudulent operation of systems, including:
  - systematic submission of non-representative test results (for example, incorrect sampling processes)
  - falsifying test results
  - failing to inform the departement, or its representatives, of non-conforming tests or products, and
  - delivery of a product with knowledge that it does not comply with departmental Technical Specifications, other departmental specifications, or the relevant drawings.
- Failure to maintain a functioning, third-party certified Quality Management System in accordance with AS/NZS ISO 9001, when this is a requirement.
- Failure to abide by conditions of registration and this document.

The Applicant shall be notified of their suspension in writing by the Deputy Chief Engineer (Hydraulics, Design and Spatial) or delegated authority, together with the reasons for the decision and actions to be taken for lifting of conditions or suspension.

Suspended Applicants shall not reapply for registration until a period of 12 months has elapsed from completion of any current contract.

9 Monitoring of Registered Panel

9.1 Inspections

Inspections may be conducted as part of either ongoing registration activities or departmental contracts as per MRTS50 *Specific Quality System Requirements* Clause 10.2.

9.2 Audits

Audits of system and/or technical conformance may be undertaken at any of the following times:

- following identified systemic or major quality issues
- every two years during supply of product to departmental projects, and/or
- upon re-activation of registration before manufacture for departmental projects.

Technical audit, production will be examined based upon:

- suppliers manufacturing processes, procedures, and materials
- compliance of supplied products to the relevant specifications, and
- testing of samples of the products, if required, by the department.

A full technical audit may require a site visit by departmental staff responsible for this Registration Scheme.

System audit may include:

- A review of the Applicants implementation, of its QMS against AS/NZS ISO 9001, that it is being followed and this results in compliant products. This review is not a replacement for independent certification of the QMS, when this is a requirement.

9.2.1 Non-conformances

Non-conformances may be raised during inspections or audits and are classed as:

- Detected Non-Conformances (DNC), where a breach of specifications or this document are identified, or
- Opportunities for Improvement (OFI) where action is required to prevent Detected Non-conformances or improve performance.

Both types of issues need to be resolved in a timely manner, as nominated by the department.

The department may refer a breach of AS/NZS ISO 9001 (or ISO 3834 *Quality requirements for fusion welding of metallic materials)* in relation to the Applicants QMS to the body responsible for certifying the QMS where:

- the Applicant does not address the breach in a timely manner for supply to the department, and
- the breach is likely to have a significant negative impact on transport infrastructure.

The department's advice to the body responsible for certifying the QMS may contain:

- details of the suspected breach, including the original non-conformance notice, and
- details of the Applicants response to the department's action with the Applicant on the matter.

9.2.2 Audit reports

Following an audit, a report will be sent to the Applicant providing a summary of the findings and will include any causes of concerns. Actions required to address these concerns will be outlined and must be undertaken, to the satisfaction of the auditors, for the audit to be closed out. Failure to close out audits may result in a suspension as described in Section 8.

10 Expectation of Applicant

Individual product / supplier categories may include additional expectations of Applicants.

10.1 Supply chain

Applicants must endorse and demonstrate to the department that the supplier's Quality Management Systems address the entire supply chain that relates to the supply of the product. It is the responsibility of the Applicant to ensure that all companies in the supply chain are providing goods produced in accordance with the requirements of departmental specifications and relevant Australian Standards.

10.2 Non-conformances

Where non-conformances are detected, that may affect the quality of products supplied to the department, the Applicant shall immediately advise the Contract Administrator in accordance with MRTS50 *Specific Quality System Requirements* Clause 10.2. These records shall be made available at time of audit and registration review.

Appendix A – Impact Resistance Test

A.1 General

Noise panels placed alongside roads are exposed to the impacts of stones thrown up from the road surface and other sources. It is essential that they are resistant to such impacts, only sustaining superficial damage.

This appendix provides a standard laboratory test which simulates minor impacts such as those caused by stones thrown up from the road surface and other sources.

A.2 Requirements

When testing in accordance with A.3:

a) a hardened 4 kg shot-put steel ball of 102 mm diameter

b) the impact energy of 118 J is simulated by freely dropping the steel ball from a height of 3.0 m

c) damage shall be confined to the outer parts of the construction and internal elements shall not be damaged or displaced by the impacts

d) the ball shall not penetrate the outer wall of any hollow elements

e) depth of deformation considered to be acceptable is 4 mm damage to the surface of material in the form of crater diameter of 20 mm and not larger than 40 mm.

A.3 Test method

A.3.1 The impact stones and other material shall be simulated by testing with shot-put ball described in A.3.2 to A.3.4 on the longest span for the panel and witnessed by the Administrator.

A.3.2 The test is used to determine the resistance of the panel, with posts or other supports like those intended for use in practice. The support shall be held in the horizontal plane and restrained from lateral movement and rotation.

A.3.3 The panel shall be supported at its edges horizontally a minimum of 100 mm above the ground and opposite the point of impact as shown in Figures A.3.3.

A.3.4 The 4.0 kg steel ball is suspended 3.0 m above the panel and dropped freely on the following three points within a test area bounded by a margin of 125 mm around the edge of the test panel, a minimum of four times of each exposed face as shown in Figure A.3.4:

a) near minimum two corners of the test area

b) near the centre of the test area, and

c) at one other point within the test area, chosen at random.

A.3.5 The exact position of the points to be tested shall be chosen to be representative of the panel as whole, by avoiding ribs, or other obvious places of local strength.

A 3.6 The diameter and depth of the resulting indentation shall be measured.

A.4 Test report

Test report shall include a full description of the test arrangement, including details of supports, procedures and location of points of impact.

It shall also include:

a) identification of the tested panel and the name of the manufacturer

b) testing location with a dated signature of the witnessing person responsible

c) full description of the panel and its thickness

d) drawing showing the cross section of the tested panel

e) results of tests; and assessment as to whether these indicate satisfactory performance.

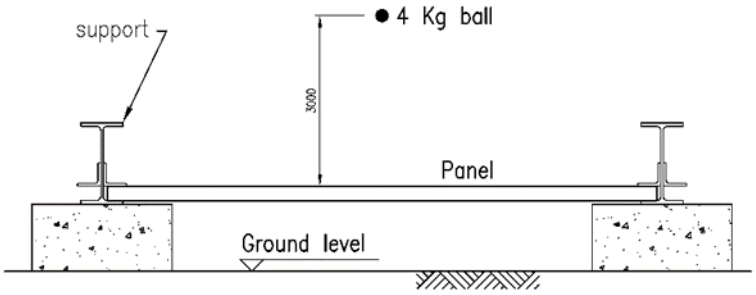


Figure A 3.3

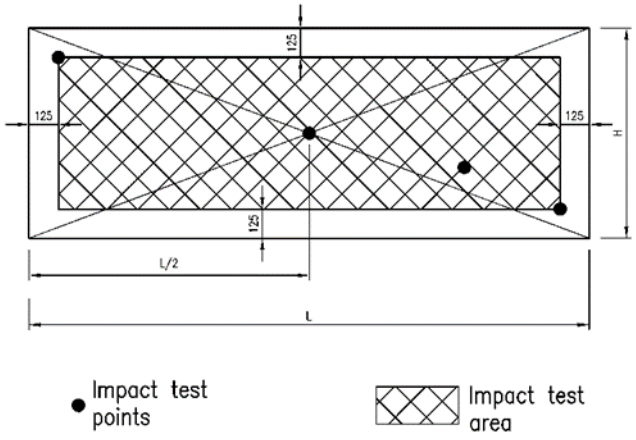


Figure A 3.4

Appendix B – Resistance to fire

B.1 General

A noise fence can be exposed to fire arising from dry vegetation or other materials in proximity. More severe fires from spilt fuel can arise as result of traffic accidents.

Where a noise fence is near property it can also be necessary to consider the need to ensure that fire is not spread from the road.

It does not provide information on the results of exposure to more severe conditions e.g. ignition by burning spilt fuel.

This appendix describes a test for a representative panel of a vertical noise fence to minimise fire hazard as a function of the cause:

a) Small arson ignition – limit fire to not spread beyond the immediate area of ignition.

b) Vehicle fire – limit fire spread to the panel adjacent to the point of ignition.

c) Bushfire – minimise fire propagation along the wall under defined minimum bushfire conditions. e.g. Bushfire Attack Level (BAL) 12.5.

B.2 Requirements

The noise fence, after being tested by the method given in B.3, shall be classified as follows:

- Class 1: if there is no damage other than discoloration.
- Class 2: if the damaged area above either source is less than 0.06 m² and extends to no more than 200 mm above the base of the panel, and the panel has not been burnt through to the other side.
- Class 3: if the panel has been damaged to a greater extent than as defined for Classes 1 and 2.

B.3 Resistance to Fire test

The panels shall be tested in accordance with AS 1530.4 *Methods for fire tests on building materials, components and structures,* Part 4*: Fire-resistance tests for elements of construction*.

The panel system is installed and tested in a manner representative of the intended application.

The loading system shall be capable of compensating for the maximum deformation of the panel.

B.3.1 Testing panel

The panel element of at least 2.0 m long by 1.5 m high shall be tested by exposure to localised sources of fire at its base next to the front and rear faces independently. Panels shall be free of absorbed water before testing; the moisture content shall be reduced to 18% by an approved drying method.

The weight and dimensions of the panel to be tested shall be measured and the panel shall be photographed. An identical panel shall be examined to determine its construction. Dimensions of its elements, including wall thickness of hollow sections, shall be measured and noted on a sketch at 1:20 scale.

B.3.2 Testing

Testing shall be carried out in an enclosed fireproof and draught-free chamber having a volume of at least 150 m³.

Fume extraction devices may be installed in or near the ceiling but shall be prevented from fanning any flames during the test.

The temperature of the chamber, including the floor, before the test begins shall be between 15°C and 25°C. The chamber should be fitted with an observation port or window in a suitable position to observe the panel during testing.

B.3.3 Sources of fire

Two identical sources of fire shall be prepared as follows:

a) A rectilinear wire mesh basket 300 mm by 200 mm by 300 mm high shall be made from welded steel wire mesh, having square mesh of 3 mm diameter drawn steel wire at 50 mm centres.

b) In addition, three 3 mm diameter wires 300 mm long shall be secured in a vertical position inside the basket, equally spaced along the central line of the shorter dimension.

The flammable material shall comprise shavings of spruce, 0.2 mm thick by 2.0 mm wide, and approximately 50 mm long. The material shall be free from splinters and have a maximum moisture content of 30%; it shall be acclimatised at 20°C and 65% relative humidity until its weight is constant.

600g of the shavings shall be lightly pressed down into each basket so that it is just filled.

B.3.4 Panel supporting

The test panel shall be supported in a vertical position corresponding to its orientation in use, on a plinth supporting the full length of the panel. The plinth shall be of masonry or concrete and have a vertical step to a level of 250 mm above the floor of the chamber. The base of the test panel shall be completely in contact with the plinth and the face to be tested shall be flush with the edge. The two sources of fire shall be placed on the floor of the chamber with their longer dimension flush against the plinth and face of the test panel. Both sources shall be lit simultaneously, and the time taken for the test shall start at this point.

B.3.5 Performance of panel

Criteria of failure:

- Structural adequacy: The ability of a loadbearing panel of construction to support load. (Deemed to have failed upon collapse or reaching a rate of / total deflection).
- Integrity: The ability of the panel construction to resist the passage of flames and gases from one space to another. (The measurement is made by cotton pad, gap gauges or sustained flaming).
- Insulation: The ability of the surface of the panel of construction not exposed to furnace to maintain a temperature below the specified limits.

The performance of the panel shall be observed during the test and the time at which any significant change takes place recorded. After the sources of fire and any part of the panel which may have ignited have burnt out, the panel shall be examined, and the extent of any damage photographed and

measured. The opposite face of the panel shall not be tested until it and the floor of the chamber have cooled to below 25°C.

B.4 Reaction to fire, smoke density and toxic fumes

The panels shall be classified in accordance with AS 5113 *Classification of external walls of buildings based on reaction-to-fire performance*, Clause 4.2 – External wall fire test.

B.4.1 Principles of the tests for reaction to fire

B.4.1.1 Introduction

The noise fence shall be classified in accordance with AS 5113, Clause 5.3 of Table 1, and additional classifications for smoke production and/or flaming droplets and toxic fumes in accordance with ISO 5659-2.

B.4.1.2 Smoke and toxic fumes

A flat specimen, representative for the noise fence, shall be tested in accordance with ISO 5659-2 at a constant irradiance of 50 kW/m².

B.4.2 Testing and preparation

B.4.2.1 Specimen

The specimen shall be prepared according to the standard as it is installed including coatings, joints, seals, frames and preservation products. Only those parts of the noise reducing device that represents > 1.0% of its total mass shall be considered.

B.4.2.2 Dimensions of the specimen

The dimensions of the specimen are given in the relevant standards. These standards gave information too about eventual frames.

B.4.2.3 Number of specimens

The number of specimens to be tested is given in the relevant standards. Minimum of five (5) specimens.

B.4.2.4 Mounting of specimen

For the single burning item test, the minimal distance from the back surface of the specimen and backing board shall be 80 mm in order to create the circumstances for a free-standing wall.

B.4.2.5 Range in thickness

If the product or material is available in different thicknesses, then the smallest thickness and the largest thickness shall be tested. The worst value shall be declared for the whole family.

B.4.2.6 Range of colours

If the product or material is available in different colours, then the lightest, the darkest and one colour in between shall be tested. The worst value shall be declared for the whole family.

Transparent material without colouring is also considered as coloured and shall be tested separately.

The darkest colour to be tested.

B.4.2.7 Combination of thickness and colour

In the situation where a combination of thickness and colours exists, the colours shall be tested first and the worst result out of these tests shall be used for the testing of the thicknesses.

B.4.2.8 Different orientations

If a product has different orientation possibilities, the orientation as installed shall be tested.

B.4.2.9 Panel with different compositions

If panel can have different compositions (for example: steel, fibre cement, organic materials), this may influence the test results. In this case the products shall be handled in separate families.

B.4.3 Smoke density

B.4.3.1 Parts to be considered in this test

The individual components of the noise fence that represents more than 1.0% of its total mass shall be considered. Coatings and surface treatments shall be considered as an integral part of the component they colour or protect.

If panel consists of more than one material, every single material shall be tested.

B.4.3.2 Measurement method

Smoke density shall be measured according with ISO 5659-2 *Plastics — Smoke generation* – Part 2*: Determination of optical density by a single-chamber test*, Clause 10.9.1 Mode 2: Irradiance of 50 kW/m² with a pilot flame.

B.4.3.3 Smoke density value

The smoke density shall be calculated with the following formula:

$$D_{s,\max}10_{total} = \sum_{i=1}^{n} \frac{D_{s,\max}10_i \times w_{t,i}}{w_{t,total}}$$

where $D_{s,max}$ 10i is the maximum smoke density during 10 min of test of material i

$D_{s,max}$ 10total is the maximum smoke density during 10 min of test of the panel

$w_{t,i}$ is the weight of the panel i

$w_{t,total}$ is the total weight of all material(s) part(s) of the panel.

B.4.4 Toxic fumes

B.4.4.1 Parts to be considered in this test

The individual components of the noise fence that represents more than 1.0% of its total mass shall be considered. Coatings and surface treatments shall be considered as an integral part of the component they colour or protect.

If panel consists of more than one material, every single material shall be tested.

B.4.4.2 Measurement method

Smoke density shall be measured according with ISO 5659-2, Clause 10.9.1 – Mode 2: Irradiance of 50 kW/m² with a pilot flame.

B.4.5.3 Toxicity values

The following gas components shall be measured: CO; HCN; HCL; NOx. The measurement values shall be indicated in µg/g.

The Acute Exposure Guidelines, according to Council Directive 96/82/EC, give the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 h without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action: values for CO-content higher than 420 µg/g and HCN-content higher than 95 µg/g should be considered as dangerous for human beings.

B.4.5.3.1 Measurement method

At the end of the test done under C.4.4.2, the gas concentrations shall be determined. These measurements shall be done with test tubes filled with a solid reagent. If one of the specific gas components exists, the indicating layer discolours due to chemical reactions. The length of the colour change is a measure of the concentration. The samples for measuring the gas with colourimetric test tubes are taken directly from the smoke test chamber by means of a suction pump. The suction capacity of the pump under load shall comply with the values specified by the manufacturer of the test tubes.

The outlet valve at the smoke chamber remains closed during the test carried out in accordance with B.4.4.2. The test tube is then connected between the valve and the suction pump. At the end of the test time, the valve is opened, and the suction pump is switched on. The gas flow is then sucked through the test tube at the set volumetric suction flow. The presence of the specified gas results in the instantaneous discoloration of the reagents in the tube.

Following the instructions of the test tubes user manual is essential.

B.5 Report

B.5.1 General

The test report(s) shall include all references, together with the following information:

- the name and address of the laboratory with the dated signature of the person responsible
- the name and address of the manufacturer of the product with exact identification of the tested element, and
- a full description of the product tested, including such aspects as its name, type, form, essential dimensions, mass or density, colour and coverage rate of any coating and essential parts as frames and seals.

B.5.2 Resistance to fire

The test procedure shall be described together with the timing of significant stages, indication of, for example, maximum intensity of flames, the incidence of any observed changes to the test panel and the number of samples tested.

The test report shall record the nature and extent of any flames and smoke produced during the test.

Photographs of the test panel before, during and after the test shall be supplied and shall include an appropriate means of judging scale.

B.5.3 Reaction to fire, smoke density and toxic fumes

- Result of smoke density test and toxic fume test (reaction to fire test) referring to ISO 5659-2 and the classification of the product in terms of classification conform to AS 5113, Clause 5.3 of Table 1 – Requirements for External Wall Performance.
- Result of the brushfire test and classification according to this test and the description of the test with the timing of significant stages, indication of, for example maximum intensity of flames, the incidence of any observed changes to the test panel and the number of samples tested. The report shall record the nature and extent of any flames and smoke produced during the test. Photographs of the test panel before, during and after the test shall be supplied and shall include an appropriate means of judging scale.

Appendix C – Wind Load Testing

C.1 General

This appendix has been formulated in general terms to be applicable to any panels as far as possible. It is recognised that different panel materials have different strengths, load-deformation characteristics, and variations in properties. Wherever testing of structures or elements is specified in the relevant standard for the material.

Adopt the procedure for load testing, the test load factors, and statistical variability factors specified in the relevant standard.

The test is to be conducted in a safe manner, without any damage to the adjacent structure or risk to workers.

Load testing shall be undertaken by a person competent in, and with appropriate expertise for, performing such tests, preferably at a NATA certified material laboratory or University, approved by the Administrator. The laboratory of the manufacturer can be used. In case of dispute, the tests shall be undertaken in the presence of both parties.

C.2 Requirements

C.2.1 Strength

The test pressure load shall be determined by multiplying the ultimate limit state design load calculated in accordance with Clause 6.6.9 of MRTS15 *Noise Fences* by the factor to allow for variability of 1.5.

C.2.2 Serviceability deflection

The test pressure load shall be determined by multiplying the serviceability limit state design load calculated in accordance with Clause 6.6.9 of MRTS15 *Noise Fences* by the factor to allow for variability of 1.2.

C.3 Apparatus

C.3.1 Loading system

The required static wind pressure shall be applied by method (A) or (B) that will reproduce the distribution of load, suitably factored, appropriate to the part of the panel being tested and maintain such distribution irrespective of the extent of deflection. The test load shall be applied gradually at a rate as uniform as practicable and without impact.

A 2.0 mm thick steel plate cut exactly to size (± 10 mm) excluding the supporting frame shall be carefully placed onto the exposed area of the panel.

The loading shall be arranged so that the relationship between bending moment and reaction in the prototype are reproduced in the test panel.

Whatever method is used for testing the resistance to wind pressure, it is emphasised that it is the panel and its fastening that are under test.

Method A – Rigid unit material

The rigid unit materials may be used as a loading medium. Stacks of these should be arranged so that no bridging from stack to stack takes place. If such rigid materials are used to load a wide panel, they should be positioned so that they do not span across the panel. In ultimate load test it may be

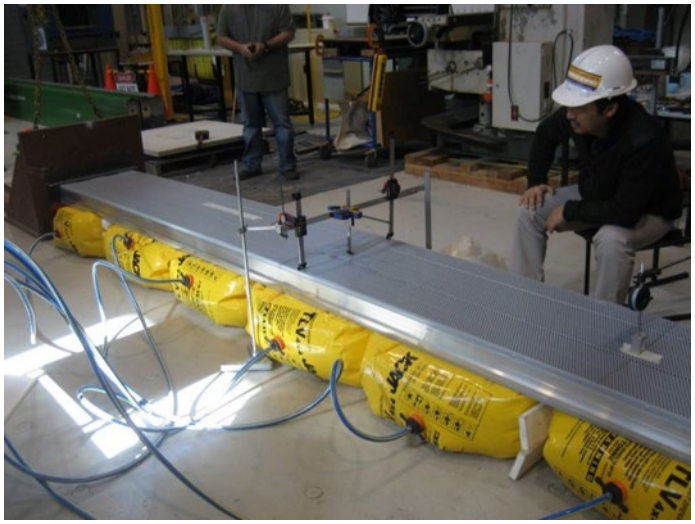
necessary to use denser materials to reduce the height of the stacks. Typical arrangement is shown in Figure C.3.1(a).

Figure C.3.1(a) – Typical arrangement – Rigid unit material

Method B – Airbag

If inflatable airbags are used as a loading medium, the bags should be sufficiently flexible to apply pressure evenly to the area under test by making contact, over the entire soffit of the area of panel to be loaded, and to maintain such contact, irrespective of the deflection. The airbags are placed between the panel and the bed of the test rig and inflated. The load is measured on the test rig and converted to an equivalent pressure. Care must be taken to ensure that the air pressure as measured by a manometer, is the pressure in the bag. Gauges on the inlet side may not always give a correct reading and it has been found in such cases that the pressure on the outlet side of the system is necessary. The typical arrangement is shown in Figure C.3.1(b).

Figure C.3.1(b) – Typical arrangement – Airbag



C.3.2 Measuring devices

Deflection shall be determined by means of a device capable of measuring to an accuracy of not less than ± 0.05 mm. The pressures or load shall be determined to an accuracy of not less than 5%.

C.4 Test procedure

The load test shall be carried out on a representative panel which shall include an appropriate number of acoustic panels of the longest span for the element type, with posts or other supports like those used in a manner representative of the intended application. The support shall be held in the horizontal plane and restrained from lateral movement and rotation.

The test panel shall be allowed to reach equilibrium laboratory conditions for at least seven days in a controlled atmosphere of 23°C ± 5°C and 50% ± 10% relative humidity, and in such a manner that all faces are adequately ventilated.

Th panel to be tested shall be either Method A or Method B. A 2.0 mm thick steel plate cut exactly to size (± 10 mm) excluding the supporting frame shall be carefully placed onto the exposed area of the panel.

The point at which the vertical deflection under the loading is greatest shall be determined and all measurements of deflection relative to a fixed datum level shall be taken at this point. An initial deflection reading shall be taken 30 minutes after placing the steel sheet. The steel sheet shall then be removed and the deflection reading repeated after 30 minutes. The difference between these two readings shall be described as the deflection under self-weight.

The steel sheet shall be replaced and an appropriate number of structural steel sections of the same length as the support shall be uniformly distributed across the steel sheet parallel to the support. The total weight of the structural sections including the steel sheet shall be equal to ultimate and serviceability loading (pressure x area) requirements for which the panel is being tested. After 30 minutes under this loading, the deflection reading shall be repeated. The difference between this and the previous reading for loading by the steel sheet alone shall be described as the deflection under simulated wind load. Note that once serviceability testing is completed, the same test panel can then be tested for strength.

The structural sections shall be carefully removed and after 30 minutes the deflection reading shall be repeated. The difference between this and the previous reading by the steel sheet alone shall be described as the permanent deflection.

The following information shall be provided to the Administrator for the preferred loading system described in C.3.1:

1. drawing showing the test setup
2. method of loading
3. method of measuring loads and deflections
4. number of units to be tested (minimum of three)
5. variability factor for ultimate loads
6. variability factor for serviceability loads
7. test load applied for ultimate limit state
8. test load applied for serviceability limit state
9. number of load increments
10. rate of loading

11. time for which test load must be maintained (30 minutes)
12. rate of unloading
13. time after which deflection recovery must be measured (30 minutes)
14. locations of deflection measurements
15. maximum serviceability deflection
16. name and place of the testing institute or NATA accredited laboratory.

C.5 Test report

The test report shall include a full description of the test arrangement, including details of supports, procedures and loading of elements submitted to the Administrator as described in C.4.

a) name and address of the testing institute with a dated signature of the person responsible

b) exact identification of the tested panel

c) full description of the panel and their thickness, length and width

d) weight of the panel both wet and dry

e) drawing showing the cross section of the tested panel

f) number of panel(s) tested, and

g) full results of the tests including a load-deflection curve and assessment as to whether these indicate satisfactory performance for the specified load.

Appendix D – Wet and dry test – Composite panels

D.1 General

Over the design life, composite panels need to resist degradation from environmental influences such as wet and dry conditions. Performance characteristics of the composite panels shall be assessed in wet and dry environment in addition to the wind load test described in Appendix C.

D.2 Requirements

D.2.1 Strength

The test pressure load shall be determined by multiplying the ultimate limit state design load calculated in accordance with Clause 6.6.9 of MRTS15 *Noise Fences* by the factor to allow for variability of 1.5.

D.2.2 Serviceability deflection

The test pressure load shall be determined by multiplying the serviceability limit state design load calculated in accordance with Clause 6.6.9 of MRTS15 *Noise Fences* by the factor to allow for variability of 1.2.

D.3 Apparatus

D.3.1 Condition for ambient temperature

Controlled atmosphere of 23°C ± 5°C and 50% ± 10% relative humidity.

D.3.2 Condition for wet temperature

Minimum water temperature of 5°C.

D.3.3 Wet and dry

The apparatus includes the following items:

a) ventilated oven capable of achieving a temperature of 60°C ± 5°C and relative humidity of less than or equal to 20% with a full load of panel, and

b) bath filled with water at an ambient temperature of more than 5°C.

D.3.4 Loading system

As described in C.3.1 of Appendix C.

D.3.5 Measuring devices

As described in C.3.2 of Appendix C.

D.4 Test procedure

D.4.1 Ambient assessment

Minimum of three panels shall be placed in a controlled ambient temperature stated in the D.3.1 for seven days.

D.4.2 Wet assessment

Minimum of three panels shall be immersed in water at the temperature stated in the D.3.2 for 24 hours.

D.4.3 Wet and dry assessment

Minimum of three samples shall be tested for the 25 wet-dry cycles consisting of:

- immersion in water at an ambient temperature (more than 5°C) for 18 hours, and
- drying in a ventilated oven of 60°C ± 5°C and relative humidity of less than 20% for 6 hours.

If necessary, an interval up to 72 hours between cycle is allowed. During this interval, panels shall be stored in immersed conditions.

After 25 cycles, place the panels in a laboratory atmosphere for seven days.

At the end of this period, carry out the wet loading test as specified in Appendix C.

D.5 System test

This test assesses the performance of the panel system under cyclic changes of heat and moisture.

D.5.1 Principle

Panels shall be fixed in accordance with the recommended installation practice.

D.5.2 Sampling

Minimum three panels used for the test shall be drawn at random from the stock of finished products.

D.5.3 Apparatus

- a frame to which the panel under test shall be fixed vertically
- water spray system which provides complete wetting of one face
- heating system to provide uniform radiant heat to give blackbody temperature across the complete test frame surface of 60°C ± 5°C and approximately uniform power output during the cycle, and
- a control system allowing the test conditions to alternate automatically as prescribed in the test procedure.

D.5.4 Test procedure

Subject the assembled frame to the following test cycle for 25 cycles:

- water spray 2 hour 50 min
- pause 10 min
- radiant heat 2 hour 50 min
- pause 10 min.

D.6 Test report

The test report shall include a full description of the test arrangement, including details of supports, procedures and loading of elements submitted to the Administrator as described in D.4.

a) name and address of the testing institute with a dated signature of the person responsible

b) exact identification of the tested panel

c) full description of the panel and their thickness, length, and width

d) weight of the panel both wet and dry

e) drawing showing the cross section of the tested panel

f) number of panels tested

g) full results of the tests including a load-deflection curve and assessment as to whether these indicate satisfactory performance for the specified load, and

h) any visible cracks, delamination or other defects observed in the panel after the system testing.

Appendix E – Accelerated environmental exposure test – Transparent or Plastic panels

E.1 General

The proposed laboratory test consists of measuring the performance characteristics of the panel materials in the as-received condition and after exposure to various environmental factors. Laboratory environments shall be chosen to include typical elements of the roadside environment, notably solar UV radiation, vehicle exhaust fumes and graffiti removal. In order to obtain, within a test program of two or three-years duration, an indication of likely performance over a 40 year design life, it is necessary for laboratory exposure to be 'accelerated' by comparison with natural outdoor conditions in Queensland.

If any detectable transmission loss is detected in the UV region of the spectrum (200 – 350 nm) by simple UV / visible spectrophotometry testing, the acrylic or polycarbonate panel shall be rejected for further testing.

The Appendix is derived from the guidelines given in I.S. EN ISO 4892-1, I.S. EN ISO 4892-2 and I.S. EN ISO 4892-3. Reference shall be made to the above I.S. EN ISO standards for any areas not covered by this Appendix.

The following panel properties shall be measured:

- Optical clarity - use UV / Visible spectrometer to determine total transmission and spectral distribution.
- Tensile or flexural properties such as elastic modulus, yield strength and rupture strength, and
- Impact resistance.

The forms of simulated environmental exposure to be applied are:

- up to 7020 hours of accelerated UV-B radiation in standard QUV weatherometer
- cyclic elevated temperature of 60°C with humidity, and condensation temperature of 40°C with active moisture (QUV weatherometer)
- high concentrations of exhaust emissions from both diesel and petrol engines
- simultaneous long-term loading and UV exposure, and
- chemical exposure to cleaning and graffiti removal products.

The accelerated exposure test shall be undertaken by person competent in, and with appropriate expertise for, performing such tests, preferably at a NATA certified material laboratory or University, approved by or specified by the Administrator.

E.2 Apparatus

E.2.1 Radiation system

The radiation system shall consist of a xenon arc lamp or fluorescent lamp fitted with suitable filters that can produce radiation with a spectral energy distribution similar to terrestrial sunlight in the ultraviolet region of the spectrum, that is a wavelength range of 290 nm to 800 nm.

An air or water-cooled absorber shall be used as the heat absorbing system. For water-cooled absorber, distilled or deionised water shall be circulated through the lamp assembly. To prevent

contamination and minimise the formation of deposits, the water shall be purified using a mixed-bed deioniser just ahead of the lamp. The recirculated lamp water shall be cooled without contamination using heat exchange unit employing either tap water or a refrigerant as the heat-transfer medium.

The radiation system shall emit irradiance of 550 W/m² to 800 W/m² in the wavelength range of 290 nm to 800 nm on the specimen surface.

The UV-radiation distribution of the filtered xenon arc and fluorescent arc source together with tolerance limits shall comply with the values as given in Table 1 of I.S EN ISO 4892-2 and Table 1 of I.S EN ISO 4892-3 respectively.

E.2.2 Test chamber

The exposure chamber shall contain a frame carrying specimen holders if necessary, with provision for passing air over the specimens for temperature control.

E.2.3 Radiometer

A radiometer which complies with the requirements outlined in I.S EN ISO 9370 may be used to measure the irradiance or spectral irradiance and the radiant exposure or spectral radiant exposure on the specimen surface.

The radiometer shall be mounted so that it receives the same radiation as the specimen surface. If it is not positioned in the specimen plane, it shall have a sufficient field of view and be calibrated for irradiance at the specimen distance.

The radiometer shall be calibrated in the emission region of the light source used. Calibration shall be checked in accordance with the manufacturer’s instructions for the radiation measuring instrument.

E.2.4 Black-panel temperature sensors

A black-panel temperature sensor shall be used to measure and control the temperature within the test chamber. Two types of black-panel temperature sensor may be used:

a) Black-standard thermometers complying with Clause 5.2.2.1 of I.S EN ISO 4892-1.

b) Black-panel thermometers complying with Clause 5.2.2.2 of I.S EN ISO 4892-1.

The black-panel temperature sensor shall be mounted on a support within the specimen exposure area so that it receives the same radiation and experiences the same cooling conditions as a flat test panel surface using the same support.

E.2.5 Humidity control device

Depending on the type of apparatus, the test chamber shall be air-conditioned by adding moisture to the air using an ultrasonic humidifier or by means of water atomized by an aerosol device and fed into the air stream. The relative humidity in the test chamber shall be measured and controlled using either a capacitative sensor or a contact hydrometer.

The sensors used to measure the humidity shall be placed within the test chamber air flow and shielded from direct radiation and water spray.

Any device intended to simulate the effects of moisture shall have a means to programme intervals with and without wetting of the specimens.

E.2.6 Spray system

The specimens shall be sprayed with distilled or demineralised water (having a conductivity below 5 µS/cm and containing a maximum of 1 µg/g of solids and a maximum of 0.2 µg/g of silica) intermittently with spray cycles as specified below in E.4.4. The spray system shall be made from inert materials that do not contaminate the water employed. The water shall leave no observable stains or deposits on test specimens. In addition to distillation, a combination of deionization and reverse osmosis can be used to produce water of the required quality. The pH of the water used shall be reported.

Recirculation of water used for specimen spray is not recommended and shall not be done unless the recirculated water meets the purity requirements listed above.

If bacterial contamination is detected, the entire system used for specimen water spray shall be flushed with a chlorination solution such as sodium hypochlorite and thoroughly rinsed prior to resuming exposures.

E.2.7 Specimen holders

Specimen holders may be in the form of an open frame, leaving the back of the specimen exposed. They shall be made from inert materials that will not affect the test results, for example non-oxidizing alloys of aluminium or stainless steel. Brass, steel or copper shall not be used in the vicinity of the test specimens. Provision of solid backing shall be avoided and can only be used with prior agreement of the Administrator.

Depending on the apparatus, the specimen holders can be designed to be mounted on a vertical or inclined cylindrical frame or rack which is rotated 1 rpm around the lamp which is centred both horizontally and vertically with respect to the exposure area in the sample holders.

E.2.8 Temperature control device

The temperature control device shall consist of a ventilation system which provides a constant stream of air through the test chamber and over the test specimens. The temperature of the air is automatically controlled by recirculating warm air from the test chamber mixed with cooler room air.

The device shall incorporate temperature sensors shielded from direct radiation and water spray and shall be able to control the temperature of the black temperature sensors to within ± 3°C of the desired temperature. They shall be designed such that the temperature of a black panel temperature sensor placed anywhere within the specimen exposure area is within ± 5% of the desired celsius temperature.

E.3 Specimen

A minimum of three replicate specimens shall be selected from each batch of transparent / plastic panels, two of which shall undergo accelerated exposure tests. The third specimen shall be properly protected and maintained at its original condition and shall be taken as control specimen for comparison with the other two specimens after the exposure test.

The form and shape of the test specimens shall be those specified in the appropriate test method for the properties to be measured after exposure. The method used for the preparation of the test specimens shall be submitted to the Administrator for approval.

E.4 Test condition

E.4.1 Irradiance

The irradiance on the specimen surface shall comply with E.2.1.

Exposure devices shall be designed such that the radiance at any location in the area used for specimen exposures is at least 70% of the maximum irradiance measured in this area. Procedures for measuring irradiance uniformity shall be in accordance with Appendix B of I.S EN ISO 4892-1.

If the irradiance at any position in the area used for specimen exposure is at least 90% of the maximum irradiance, periodic repositioning of the specimens during exposure is not necessary.

If irradiance at any position in the area used for specimen exposure is between 70% and 90% of the maximum irradiance, the specimens shall be periodically repositioned during the exposure period to ensure that each receives an equal amount of radiant exposure. The repositioning schedule shall be agreed by the Administrator.

E.4.2 Temperature

The black-panel temperature shall be 65°C ± 3°C.

If water spray is used, the temperature requirements shall apply to the end of the dry period. If the thermometer does not attain equilibrium during a short cycle, the specified temperature shall be established without water spray and the maximum temperature attained during the dry cycle shall be reported. Even if the exposure apparatus is opened in an alternating mode, measurement by black-standard / panel thermometer shall be carried out in the continuous mode.

E.4.3 Relative humidity

The relative humidity shall be 75% ± 5%.

E.4.4 Spray cycle

Duration of spray: 18 min ± 0.5 min

Dry interval between spray: 102 min ± 0.5 min

E.5 Submission

Prior to commencement of the test, the supplier shall submit the following information to the Administrator for approval:

- detail of all apparatus used in the test including but not limited to shop drawings, Catalogue, user manuals and so on
- calibration reports of all measuring devices
- proposed method statement and test procedures with calculations to substantiate the specified period of exposure based on meteorological data obtained from the Queensland Observatory
- form and shape of the specimens, and
- method used for the preparation of test specimens.

E.6 Procedure

E.6.1 Mounting the test specimens

Attach the specimens to the specimen holders in the equipment in such a manner that the specimens are not subject to any applied stress. Identify each test specimen by suitable indelible marking, avoiding areas to be used for subsequent testing.

When instructed by the Administrator, a portion of the test specimen shall be shielded by an opaque cover throughout the test with a view to obtaining an unexposed area adjacent to the exposed area for comparison.

E.6.2 Exposure

Before placing the specimens in the test chamber, ensure that the apparatus is operating under the specified test conditions and maintain these conditions throughout the specified exposure period.

Exposure the test specimen for the specified period of exposure. It is desirable to vary the position of the test specimens in the apparatus from time to time to reduce any local inequalities of exposure. When the specimens are so adjusted, they shall remain in the same orientations as when initially mounted.

If it is necessary to remove a test specimen for a periodic inspection, care shall be taken not to handle or disturb the test surface. After inspection, the test specimen shall be returned to its holder or to the test chamber with its test surface in the same orientation as before.

The period of exposure shall follow Table E.6.2 and shall be worked out based on the power of the proposed fluorescent lamp.

Table E.6.2 – Exposure time

Lamp Irradiance in W/m²	Exposure Time in Hours
550	8300
600	7600
650	7000
700	6500
750	6100
800	5700

E.6.3 Measurement of radiant exposure

Mount the light-dosage measurement instrument so that the radiometer indicates the irradiance at the exposed surface of the test specimen.

The exposure interval shall be expressed in terms of incident spectral radiant energy/m² of the exposure plane, in Joules/m², for the range of wavelength selected.

E.7 Test report

The test report shall contain the following information:

1. **Specimen description**
    a. A full description of the specimens and their origin.
    b. Compound details, cure time and temperature where appropriate.
    c. A complete description of the method used for preparation of the test specimens.
2. **Description of exposure test conducted including:**
    a. A description of the exposure device and light source, including:
        i. type of device and light source
        ii. description of the filters used
        iii. irradiance at the specimen surface (including the range of wavelength in which the radiation was measured), and
        iv. number of hours that the filters and the light source had been used prior to commencement of the exposure.
    b. The type of black panel temperature sensor used and the exact position of the sensor.
    c. The type of instrument used to measure the humidity.
    d. The type of thermometer, and the way in which it is mounted on the specimen holder, and the selected temperature of operation.
    e. A complete description of the exposure cycle including:
        i. the mean and the tolerance limits for the temperature recorded
        ii. the mean and the tolerance limits for the relative humidity of the air passing over the specimens, and
        iii. the duration of the water spray and whether the water was sprayed on the exposed face, the back or both surfaces of the specimens, if the total solids of the water used for the spray is greater than 1 µg/g, report the total solids and the silica content.
    f. A description of the method used to mount the specimens in the exposure in the exposure frame, including a description of any material used as backing for the test specimens.
    g. The procedure for test specimen repositioning, if used, and
    h. A description of the radiometer used for measuring the light dosage.
3. **Test results**
    a. A complete description of the test procedure used for measurement of any properties reported.
    b. The results, presented in accordance with ISO 4582, and including:
        i. the results of property measurements on the test specimens
        ii. the result of property measurements on control specimens, and
        iii. the exposure period (the time in hours, the radiant energy in J/m² and the range of wavelength in which it was measured).
4. **The date of the test**

Appendix F – Self-weight

F.1 General

The self-weight of panel is used in two distinct ways. The dry weight is needed to make an approximation of the noise insulation value of the panel. Where panel can absorb water, the wet weight is an important consideration in the design of the panel. Limits on deflections are necessary to avoid acoustical leakage, diminution of the height or overloading of the supporting structure.

Dry weight, wet weight and reduced wet weight are defined. The mechanical requirements due to weight of panel, acting alone and in combination with wind load, are specified. Method of determining compliance with these requirements by means of calculation or testing are given.

F.2 Determination of self-weight

F.2.1 Dry weight of panel

The dry weight of the panel shall either be measured directly or calculated from the specific gravity and the dimensions of the materials used. The weight per unit of surface area of a panel shall be calculated as the minimum value, by ignoring frames and local reinforcement.

F.2.2 Wet weight of panel

The wet weight takes account of the fact that cavities and porous materials may become filled with water, all parts of the panel which absorb water shall be considered as acting with the weight of water added.

F.2.3 Reduced wet weight

Provided that the design of the construction and the panels are such that water is neither discharged from panels at the top of a device into panels below, nor retained in supporting structures, the wet weight of the panel shall be measured as follows; the panel shall be completely immersed under water for 24 hours; it shall be removed and left to drain for no more than 10 minutes in the in-use position before weighing.

F.3 Mechanical requirements

F.3.1 Panel under their own weight

The panel shall support its own weight or reduced wet weight (as appropriate) and the appropriate wet weight of the panel which may be permitted to rest upon it without showing distress in accordance with the following criteria:

Local torsional instability:

horizontal deflection d_{hmax} in mm, shall be not greater than $d_{hmax} = h_{av} / 50$

Vertical deflection: with the panel supported as it is used in practice:

the maximum deflection d_{vmax} mm, shall be not greater than $d_{vmax} = L / 400$

Note: The roadside environment can be severely corrosive. Therefore, cracking should be limited because it can lead to corrosion.

F.3.2 Combined weight, wind and static loads

Elements shall withstand without failure the combined loads multiplied by the given factors of their own weight as defined in B.3.1 and wind and static load (pressure or suction) calculated in accordance with MRTS15 *Noise Fences*.

Load factors shall be applied as follows:

S_G = 1.35 for the weight, and

S_W = 1.5 for wind and static loads.

F.4 Calculation and test report

F.4.1 Assessment of performance by calculation

The calculation report shall include full details of assumptions and parameters used, including:

a) identification of the tested panel and the name and address of the manufacturer

b) full description of the material used, together with their elastic moduli, elastic limits and other relevant data

c) a drawing showing dimensions, including cross section and thickness

d) the theoretical basis of calculations

e) the name and address of the certifier of the calculation, with date and signature, and

f) results of tests; and assessment as to whether these indicate satisfactory performance.

F.4.2 Assessment of performance by testing

The test report shall include a full description of the test arrangements, including details of supports, procedures and loading arrangements.

It shall also include:

a) the name and address of the testing institute with a dated signature of the person responsible

b) exact identification of the tested panel and the name and address of the manufacturer

c) full description of the material used, together with their elastic moduli, elastic limits and other relevant data

d) weight of the panel both wet and dry

e) a drawing showing dimensions, including cross section and thickness

f) the result of tests; and assessment as to whether these indicate satisfactory performance, and

g) number of samples tested.