11002 Transparent Noise Barriers

Index

Tables

11002-1 Scope

This Section covers the construction of transparent noise barrier panels for sound attenuation.

11002-2 General

Furnish materials and construct transparent noise barrier panels as shown on the plans and required by this specification.

11002-3 Materials

Use materials conforming to the pertinent requirements of the following:

The noise barrier shall be a rigid monolithic sheet, and comply with all requirements of this specification.

The structural components of the system shall be designed in accordance with either:

1. CAN/CSA-S6 Canadian Highway Bridge Design Code; or
2. AASHTO Guide Specification for the Structural Design of Sound Barriers, 1989 edition incorporating 1992 & 2002 amendments; or
3. AASHTO LRFD Bridge Design Specification 6th Edition (2012).

Materials will conform to applicable shop drawings.

Manufacturers must have certifications to ISO 9001:2008, ISO14001:2004 and RC 14001:2008. Evidence to be furnished upon request.

Manufacturers must have a minimum 10 year history of producing transparent noise barrier assemblies for highway noise barriers. Evidence of long term performance consisting of performance statement letters or personnel for contact shall be furnished upon request.

3.1 Source

Materials will be supplied as per Specification Section 15007 (Construction Materials – Noise Barriers).

3.2 Shop Drawings

Shop drawings shall be provided by the supplier, detailing all relevant aspects of sheet installation, and connection details, and bear the seal of a professional engineer registered in the Province of Saskatchewan, with permission to consult.

3.3 Transparent Panel Assemblies

If so required by the contract specifications and drawings, the transparent panel shall be assembled within a frame, to provide a Transparent Panel Assembly. All details of the Transparent Panel Assembly will be detailed on shop drawings and submitted to the Department's Representative for approval.

Additional requirements for Transparent Panel Assembly are found in Appendix 1

3.4 Color

Unless otherwise specified, the transparent noise barrier shall be colorless.

3.5 Dimensions

Dimensions of the transparent noise barrier panel shall be specified by the applicable drawings. Unless otherwise specified, the tolerance on length and width dimensions shall be –0, +0.25".

3.6 Performance Characteristics

The transparent noise barrier shall meet the performance requirements of Table 1 when tested in accordance with the associated ASTM test method (or equivalent industry standard).

Table 1: Performance Requirements

Property	Requirement	ASTM Test Method
Tensile Strength	> 9,250 psi	D638
Flexural Modulus	> 445,000 psi	D790
Rockwell Hardness	M-90	D785
STC	> 27	E90/E413

The transparent noise barrier shall meet the optical requirements of Table 2 when tested in accordance with the associated ASTM test method (or equivalent industry standard).

Table 2: Optical Requirements

Property	Requirement	ASTM Test Method
Light Transmission	> 90%	D1003
Haze	< 1.5%	D1003
Yellowness Index	< 1	E313
Self Ignition	> 650ºF	D1929

3.7 Resistance to Weathering

After exposure to outdoor weather for a period of ten years the noise barrier panels shall show no evidence of cracking or crazing and shall comply with the requirements of Table 3 when tested in accordance with the associated test method (or equivalent industry standard).

Table 3: Weathering Requirements

Property	Requirement	ASTM Test Method
Light Transmission	> 88%	D1003
Haze	< 10%	D1003
Yellowness Index	< 5	E313
Tensile Strength	> 80% of initial value	D638
Flexural Strength	> 80% of initial value	D790

3.8 Fire Resistance

The noise barrier shall meet the flammability requirements of Table 4 when tested in accordance with the associated test method (or equivalent industry standard).

Table 4: Flammability Requirements

Property	Requirement	ASTM Test Method
Resistance to brush fire	Minimum, Class 3	EN 1794-2
Horizontal burn rate	< 2.5 in/min	D635
Smoke density	< 50%	D2843

3.9 Shatter Resistance

When the panel is to be mounted on a structure or in such a way that if damaged they could pose a hazard to road users or others, the transparent panel be required to retain all broken pieces by employing an internal or external restraint system. Supplier shall show evidence of ability for panels to retain all broken pieces after ten or more years of outdoor exposure.

3.10 Impact Resistance

The noise barrier shall meet the requirements of EN 1794-1, Appendix C.

The noise barrier shall meet the requirements of ANSI Z97.1, safety glazing material.

The noise barrier shall pass the large missile impact test, ASTM E 1996-97/02.

3.11 Graffiti Resistance

Supplier shall recommend an effective, compatible graffiti remover and upon request, shall furnish a product sample and provide a graffiti removal demonstration.

PlexiClean (or equivalent approved graffiti remover for glass and plexiglass) may be used on transparent wall panels to remove graffiti. The PlexiClean product shall be used as per manufacturer's recommendations.

3.12 Bird Deterrence

Unless specified, all panels shall have the bird deterrence feature with a pattern capable of preventing in excess of 90% of bird impacts. The panel manufacturer shall possess and furnish evidence of the panel efficacy upon request. The bird deterring pattern must be an integral part of the panel, capable of withstanding graffiti removal efforts. Application of films in a secondary, post production process are not allowed due to the tendency of these films to delaminate, haze, or otherwise prematurely degrade the visual performance of the panel.

3.13 Wind Load Resistance

The maximum elastic deflection d_{max}, under the design wind load shall be less than 3 inches.

When a load factor of 1.5 is applied to the design wind load:

1. The sheet shall not show any symptoms of failure such as buckling or cracks.
2. The sheet shall not become detached from its supports or fittings.

3.14 Resistance to Roadside Chemicals

The transparent noise barrier shall be resistant to standard de-ice chemicals such as:

- Calcium Chloride, Magnesium Chloride, Potassium Acetate, Calcium / Magnesium Acetate, and Sodium Acetate

3.15 Resistance to Fungi

The transparent noise barrier shall undergo testing in accordance with ASTM G21 and have a zero rating, show no signs of fungi growth, after the standard 28 day test period.

11002-4 Testing

4.1 ASTM Standards

D635 – Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position

D638 – Test Method for Tensile Properties of Plastic

D785 – Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials

D790 – Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

D1003 – Test Methods for Haze and Luminous Transmittance of Transparent Plastics

D1929 – Test Method for Ignition Properties of Plastics

D2843 – Test Method for Density of Smoke from Burning or Decomposition of Plastics

E313 – Standard Practice for Calculating Yellowness and Whiteness Indices from Instrumentally Measured Color Coordinates

E90 – Standard Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions

E413 – Standard Classification for Determination of Sound Transmission Class

E1996-97/02 – Standard Test Method for the performance of exterior windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes

G21 – Standard Practice for Determining Resistance of Synthetic Polymer Materials to Fungi

G155 – Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials

4.2 Other Standards

ANSI Standard Z97.1 – Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test

EN 1793-2 / ZTV-Lsw 06 – Road Traffic Noise Reducing Devices – Test method for determining the acoustic performance.

EN 1794-1 – Road Traffic Noise Reducing Devices – Non Acoustic Performance

- Part 1 – Mechanical Performance and Stability Requirements
- Part 2 – General Safety and Environmental Requirements

ISO 9001:2008 – Quality Management System (Certification)

ISO 14001:2004 & RC 14001:2008 – Environmental Management System and Responsible Care (Certification)

ISO 527-2/1B/5 – Tensile tests on plastics

ISO 178 – Plastics – Determination of Flexural Properties

ISO 1183 – Plastics – Methods for determining the density of non-cellular plastics

ISO 306/B50 – Poly(methyl methacrylate) (PMMA) moulding and extrusion materials

DIN 53752-A – Testing of Plastics: Determination of the Coefficient of Linear Thermal Expansion

DIN 5036 – Radiometric and Photometric properties of Materials.

11002-5 Construction Methods

Install transparent noise barrier panels in accordance with manufacturer's recommendations or as directed by the Engineer.

11002-6 Measurement and Payment

6.1 Measurement

The item will be measured by the area in square feet between the top of noise barrier elevation and bottom of noise barrier elevation, as shown in the shop drawing schedule of quantities.

6.2 Payment

The work performed and the materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Transparent Noise Barrier Panels". This price will be full compensation for furnishing and installing all transparent noise barrier panels including framing, welding, fasteners, hardware, all labour, equipment, and incidentals necessary to complete the work.

Appendix 1 – Aluminum Framed Transparent Panel Assembly Requirements

Framing members shall:

- Consist of profile as approved by the Engineer unless otherwise defined and approved in the project design process.
- Comply with the requirements of ASTM B221 and be of grade 6061-T6.
- Meet tolerances as defined by ANSI H35.2-2006 – American National Standard Dimensional Tolerances for Aluminum Mill Products.

Welding:

For frame designs where welding is required:

- Welds on the bottom surface of the bottom framing member shall be ground flush.
- Welding shall comply with the requirements of AWS D1.2, Structural Welding Code – Aluminum.
- Visual inspection reports required.

Machining:

Removal of U channel section on side framing members should result in a smooth, flush surface. Limit of +0”, -0.030” is allowed only in the immediate area of the U channel.

Gasket:

EPDM gasket will use non migratory plasticizers, must be tested for compatibility with the transparent noise barrier panel.

Fasteners & Hardware:

- Bolts shall be of type 304/304L stainless steel conforming to ASTM A276.
- Washers shall be of type 304/304L of 316/316L stainless steel conforming to ASTM A276.

Coating (where applicable)

Anodize:

- Per AAMA 611-98 – Voluntary Specification for Anodized Architectural Aluminum Use a Class 1 anodized finish (requires minimum coating thickness of 0.7 mil).
- Coater shall perform and document crosshatch adhesion test results, in accordance with ASTM-3359, for each process batch.

Powder Coat:

- Per AAMA 2604-05 – Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings.
- Coater shall have current certification from the coating manufacturer for application of AAMA 2604 architectural powder coatings.
- Powder Coating thickness shall be 3-5 mils for exterior surfaces, wash coat in panel pocket.
- Coater shall perform and document crosshatch adhesion test results, in accordance with ASTM-3359, for each process batch.

Paint:

- Surface Preparation - Solvent Clean per SSPC-SP1.
- Surface Preparation - Abrasive blast per SSPC-SP7 brush blast cleaning with DuPont Starblast non-metallic fine abrasive or equivalent.
- Apply one seal coat of CarboCoat 120 water based bonding primer, or equivalent, thickness 1-2 mils.
- Apply finish coat of Carboline 133hb polyurethane, or equivalent, thickness 3-5 mils. Color to be specified.
- Perform crosshatch adhesion test in accordance with ASTM-3359.

Assembled Panels:

Following assembly, the manufacturer shall perform an inspection on each panel to ensure the panels have the following characteristics:

<u>Dimension, Assembled Panels</u>

- Length Target ± 0.25”
- Height Target ± 0.25”

- Squareness No more than 0.25” difference between the two diagonals
- Waviness ± 0.25” out of flat

Hardware, Torque Setting:

- Bolts shall be tested to confirm a torque of at least 30 ft-lbs or as approved by the Manufacturer and the Engineer.
- Bolts shall be fully engaged (no exposed threads).
- Bolts shall not be cross threaded.

Other Criteria:

- When assembled, film is not under gasket.
- Gasket is installed to the full length, less up to ¼” at each end, of the U channel section in which the sheet edge resides.
- Hardware (where applicable) is coated to match.
- Coating (where applicable) is not damaged or flaking.
- Touch-up coating (where applicable) is available for inclusion with shipment.

Documentation Requirements:

The City may request documentation from the contractor related to fabrication/supply of transparent sound wall products.

Typical documentation required of the assigned fabricator include:

1. Aluminum Profile – Certification to ASTM B221, Grade 6061-T6.
2. Aluminum Bar – Certification to ASTM B221, Grade 6061-T6.
3. Hardware – Certification of test to ASTM A276.
4. Coating – Documentation of cross hatch test & certifications as required above.
5. Welding – Visual inspections report per AWS D1.2.
6. Machining – Inspection report to verify requirements of Appendix 1.
7. Final Product – Inspection report to verify requirements of Appendix 1.

End of Specification 11002