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Durisol
NOISE BARRIER SYSTEMS

SOUNDSTOP TECHNICAL GUIDE

TRANSPARENT NOISE BARRIER PRODUCTS BLOCK HIGHWAY NOISE WHILE PRESERVING VISIBILITY AND LIGHT ALLOWANCE

PERFORMANCE

DURABLE

LIGHTWEIGHT

LOW MAINTENANCE

HANDLING & MAINTENANCE

Storage

Soundstop Transparent Noise Barrier ships on pallets packaged in polyethylene film overwrap, protecting the panel from dirt and moisture. The overwrap should be left intact during storage. Pallets can be stacked to maximize storage space. If various sizes are stacked horizontally, stack larger panels at the bottom to avoid unsupported overhang.

Soundstop panel is supplied with a protective polyethylene masking on both surfaces. The masked panel must *not* be stored in direct sunlight, near radiators or steam pipes or other heat sources. Prolonged exposure to direct sunlight makes the masking brittle, which then causes it to tear upon removal. Storage temperature should not exceed 70˚C (160˚F). Also avoid storing panels near solvent vapours that may penetrate the masking and damage the surface.

Removing Masking

During fabrication and installation, the panel masking should be left in place to protect its surface. During installation, roll the masking back from the panel edge to avoid engagement in glazing channels. Do not use gasoline or sharp-edged objects such as razor blades to remove masking that is stuck to the panel too firmly.

Cleaning

As a result of the production process, soundstop has a smooth, non-porous surface that remains even after long-term outdoor exposure. Dirt will not readily adhere to this polished surface. As a result, rain or dew rinses the panel clean.

In most cases, Soundstop panels need no additional cleaning. Should special circumstances make it necessary, cleaning is best accomplished with water, using a high-pressure washer.

Remove grease, oil or tar with a good grade of hexane, aliphatic naphtha, or kerosene. Obtain these solvents at a paint or hardware store and use them in accordance with manufacturer's recommendations.

Removing Scratches

Many fine scratches that may occur on soundstop are only visible up close, not from distances typical of roadside installations. However, when necessary, fine scratches may be removed by hand polishing. Apply a plastic scratch remover to a soft flannel pad and rub. When the scratches disappear, remove all residue and polish. For deeper scratches, first wet the panel, then sand lightly with 400 grit "wet or dry" sandpaper, using plenty of water and rinsing the sandpaper frequently. Follow by buffing with a clean muslin wheel and a good polishing compound. For the highest gloss, use a clean-up wheel made of soft cotton or flannel sections, with no compound. An electric rotary buffer is ideal.

WARNING

DO NOT USE: WINDOW CLEANING SPRAYS, KITCHEN SCOURING COMPOUNDS OR SOLVENTS SUCH AS ACETONE, GASOLINE, BENZENE, ALCOHOL, CARBON TETRACHLORIDE, OR LACQUER THINNER. THESE CAN PERMANENTLY DAMAGE THE PANEL'S SURFACE AND/OR WEAKEN THE PANEL CAUSING SMALL SURFACE CRACKS CALLED 'CRAZING'.

MIAMI, FL - (ALUMINUM) READY-FIT FRAMES INSTALLATION

1. START OF TEST

2. 10 MINUTES AFTER REMOVER IS APPLIED

3. CLOSE-UP OF GRAFFITI

4. AFTER WATER RINSE WITH 2,300PSI PRESSURE WASHER

Graffiti Removal

Graffiti can be removed from an Soundstop using a graffiti remover designed for use on plastics. It is important to use a recommended graffiti remover—many traditional graffiti removers contain aromatic solvents that may damage the panel.

When using any graffiti remover it is important to follow the manufacturer's recommendations, and rinse thoroughly with clean water. Spray the graffiti remover on the surface, and allow it to soak for 2 to 30 minutes, depending on the manufacturer's recommendation. Then, rinse with water. High-pressure water is recommended for the rinse and will speed up the process. In some cases, such as when the temperature is below 12˚C (55°F), a second application or agitation of the graffiti with a clean soft cloth may be required to finish removing the graffiti. In situations where it is not permissable to rinse off the graffiti, remove it by wiping the panels with soft, non-abrasive cloths, such as shop or paper towels.

Above are pictures of an Soundstop panel that was defaced (or "tagged") with a solvent-based acrylic modified resin spray paint. Disappear™ Graffiti Remover was used for this test. It was sprayed on the graffiti and allowed to soak for 15 minutes, then removed with a 2,300psi pressure washer. The paint was allowed to dry for 25 days prior to removal.

IMPACT RESISTANCE

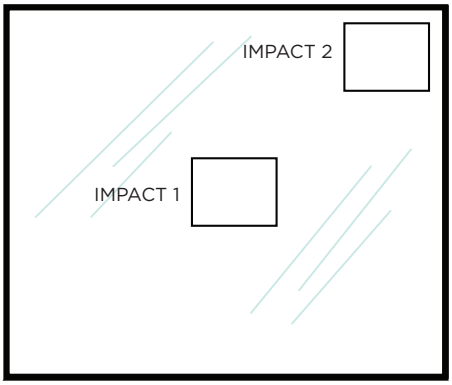
Noise barriers are often subject to impacts caused by stones and other debris thrown up by vehicle tires or even hurricane force winds. Therefore, it is important to construct a noise barrier from materials able to withstand these impact forces. The following tests methods are used to evaluate the impact resistance of Soundstop noise barrier panels:

1. MIAMI DADE COUNTY TEST

Large Missile Resistance Test Method

The panel is impacted by a piece of lumber weighing approximately 9lbs, measuring 2" x 4" x 8', and traveling at a speed of 50 feet per second (34 miles per hour).

Multiple impacts are recorded with at least one impact in the approximate center of a 4' x 4' panel and another near a corner of the panel.



Miami Dade County Test Configuration
Panel is impacted in two locations as depicted

ASTM E 1886-97 / ASTM E 1996-02
Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protection Systems Impacted by Windborne Debris in Hurricanes (also known as the Miami Dade County Large Missile Resistance Test)

Test Results

Each of the standard thicknesses of Soundstop (15mm, 20mm, and 25mm) passed the impact tests without damage.

2. MECHANICAL/CONCRETE

Hammer Testing Method

Testing with a mechanical hammer simulates the stone impacts. Three hammer strikes at 30Nm 31Nm (22 ft-lbs) are performed, which are roughly equivalent to a 77g (0.17lb) object traveling at 100kph (60mph). One of the test strikes must be near one corner of the test panel within a test area bounded by a margin of 125mm (5") from the edge of the panel, another must be near the center of the test panel, and the third is chosen at random.

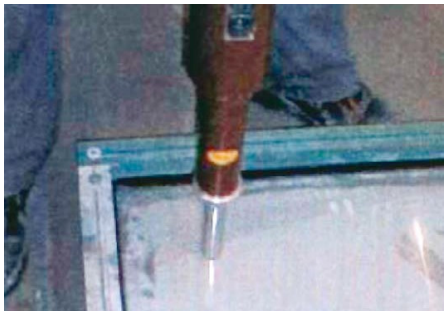
The exact position of the test point is chosen to represent the panel as a whole and to avoid places of local strength.

Test Results

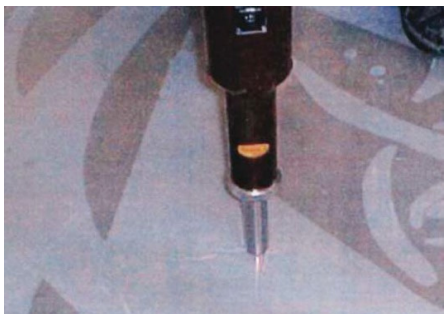
Three points of impact were marked on the panel. Point 1 was in the corner with a distance of 125mm (5") from the upper edge and 125mm (5") from the side edge. Point 2 was at the center of the panel and point 3 was chosen at random.

The test concluded with no evidence of penetration, destruction, formation of cracks or chipping on the Soundstop panel.

MECHANICAL / CONCRETE HAMMER TEST
Technical equivalent to the European Standard EN 1794-1, Appendix C, Resistance Against Damage by Stone Projectiles



POINT 1 – EDGE IMPACT WITH CONCRETE TESTING HAMMER



POINT 2 – CENTER IMPACT WITH CONCRETE TESTING HAMMER

CALGARY, AB - SOUNDSTOP NOISE BARRIER PANELS

CARMEL, IN - SOUNDSTOP NOISE BARRIER PANELS

CROSSTOWN, MN - SOUNDSTOP NOISE BARRIER PANELS

ANCHORAGE, AK - SOUNDSTOP NOISE BARRIER PANELS

LAGUNA HILLS, CA - SOUNDSTOP NOISE BARRIER PANELS

WINDSOR, ON - SOUNDSTOP NOISE BARRIER PANELS

FIRE PRECAUTIONS

Soundstop is a combustible thermoplastic. Precautions should be taken to protect this material from flames and high heat sources. Soundstop panel usually burns rapidly to completion if not extinguished. The products of combustion—if sufficient air is present—are carbon dioxide and water. However, in many fires sufficient air is not available and toxic carbon monoxide forms, just as when other common combustible materials burn. We urge good judgement in the use of this versatile material and recommend that building codes are followed carefully to assure its proper use.

COMPATIBILITY

Like other plastic materials, Soundstop panel is subject to crazing, cracking or discoloration if brought into contact with incompatible materials. Among others, these materials may include cleaners, polishes, adhesives, sealants, gaskets or packaging materials, or cutting emulsions.

BIRD GUARD

Soundstop with Bird Guard includes bird-deterring markings that are 2mm thick horizontal or vertical black stripes, spaced every 30mm that are integral to the panel. Therefore, the striping is protected and is not affected by weathering or graffiti removal activities.

GLARE

Soundstop is a lightweight, sound insulating panel that features outstanding optical clarity, long-term weatherability, and excellent impact resistance. A common misconception associated with transparent Soundstop noise barriers is the potential for glare due to the headlights of oncoming vehicular traffic.

For many years, transparent Soundstop noise barriers have been installed along highways across North America, Europe, Asia and other parts of the world. To our knowledge, reflected glare from a noise barrier has not created issues with traffic in any of these installations. Examining geometry and optics closely, we discover why:

The reflections are typically above the line-of-sight

In many noise barrier installations, the Soundstop only makes up a portion of the noise barrier panel material. It is very common for walls to have a concrete, wood or metal base, with transparent panels mounted above.

When the bottom of the transparent noise barrier panel is above the sight line of the driver, then all reflections will remain above the driver.

The intensity of light is significantly reduced as distance increases

In general, the intensity of light decreases proportionally to the square of the distance traveled.

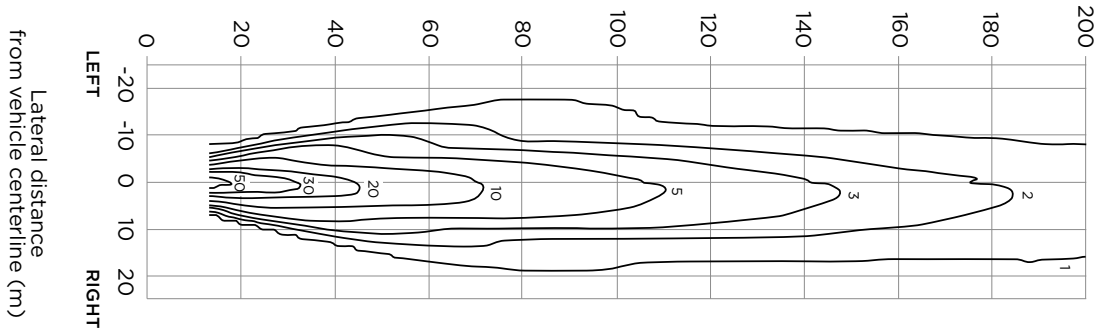
Hence, the intensity of the light reflected from a noise barrier is greatly diminished due to the distance it travels from the headlamp to the Soundstop wall, then from the Soundstop wall to the driver.

MUNICH, GERMANY - SOUNDSTOP WITH GS CC NOISE BARRIER PANELS

COLUMBUS, OH - SOUNDSTOP NOISE BARRIER PANELS

FOLSOM, CA - SOUNDSTOP NOISE BARRIER PANELS

FIGURE 1 - LONGITUDINAL DISTANCE FROM HEADLAMPS



SOURCE:
THE UNIVERSITY OF MICHIGAN TRANSPORTATION RESEARCH INSTITUTE, REPORT UMTRI-2001-19

Illuminance is the measurement of how bright a point source of light appears to the eye. Figure 1, above, shows the decrease in illuminance over distance for a typical automotive high beam headlamp directed into a 45° cone. It illustrates how significantly light's intensity diminishes over distance traveled.

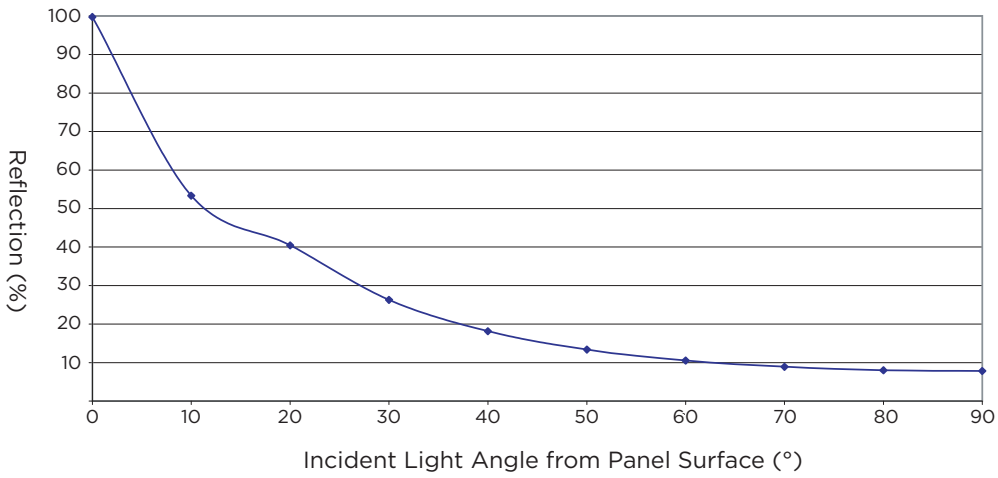
For example, at a distance of 20m a standard headlamp high beam brightness is measured at 50 vertical lux. At 110m distance, that same light source measures only 5 vertical lux. Simply stated, the brightness of a light source will diminish over greater distance, in the same manner that objects appear smaller as distance increases.

ADDITIONAL INFO

Iso-illuminance diagram (vertical lux) at the road surface from a pair of lamps having the median luminous intensities for the sales-weighted sample representing the high beam headlamps on current passenger vehicles in the U.S.*

* The University of Michigan Transportation Research Institute, Report No. UMTRI-2001-19, May 2001

FIGURE 2 - REFLECTION OF ACRYLITE® SOUNDSTOP



NOTE:
90° CORRESPONDS TO THE INCIDENT LIGHT STRIKING THE PANEL PERPENDICULAR TO THE SURFACE

Since Soundstop has a very smooth "high gloss" surface, it is assumed that it also has a very high reflectance; but this is not necessarily true. When light is projected at a Soundstop panel, a portion of the light passes through the panel while only the remainder is reflected. The percentages of light that are transmitted and reflected will vary according to the angle of projection.

At very low angles (see Figure 2, above) Soundstop reflects a majority of the incident light. The percentage of light reflected is high when projected at angles below 10°, but the intensity of light is greatly diminished due to the distance it travels from the headlamp to the barrier, reduced again according to the angle, and then further reduced over the distance to another driver.

As angles of reflection increase, the amount of light reflected diminishes sharply. In most cases, light projected directly from headlamps of an oncoming vehicle is significantly more intense than light reflected off the panels at any angle.

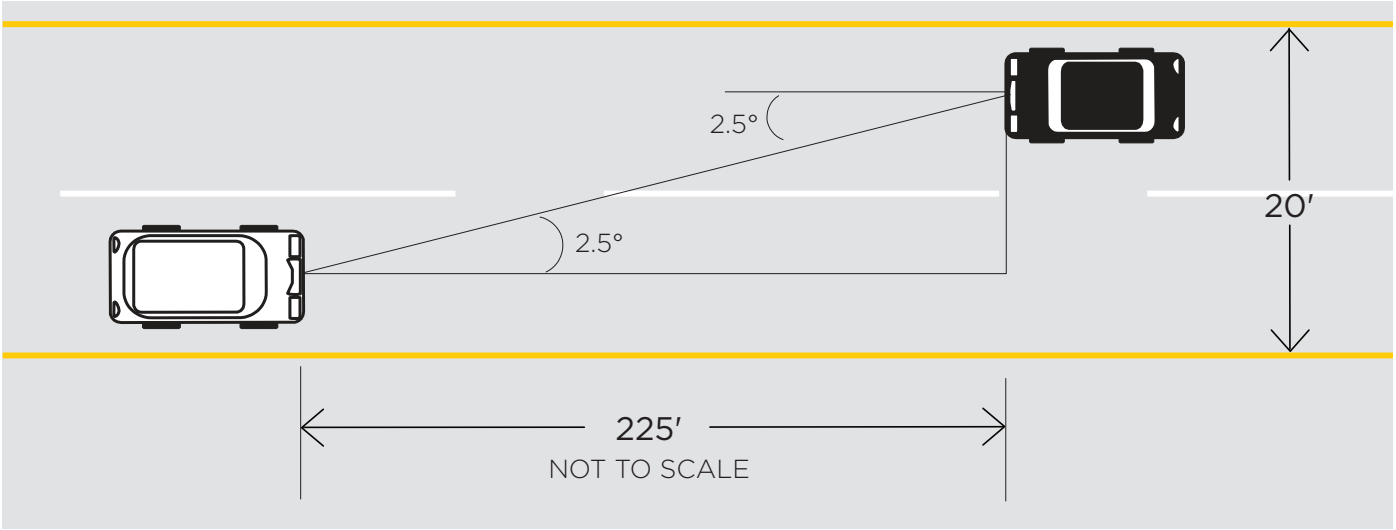
Disability Glare

Disability glare is created by a light so bright that its intensity results in a measurable reduction of a driver's ability to perform visual tasks. This is a direct result of stray light within the eye—the effects of this depend on the age of the driver. At night, vehicle headlamps produce direct and indirect glare—by shining towards approaching cars or by reflecting in rearview mirrors.

Typically, the effects of glare on drivers are much greater at night than during the day—at night, drivers are adapted to lower light levels. For example, lights that are barely noticeable by day may have an uncomfortable glare in the dark.

Here are two examples to help illustrate the differences between direct glare from an oncoming vehicle's headlamp, and indirect glare from a noise barrier constructed from Soundstop.

EXAMPLE 1



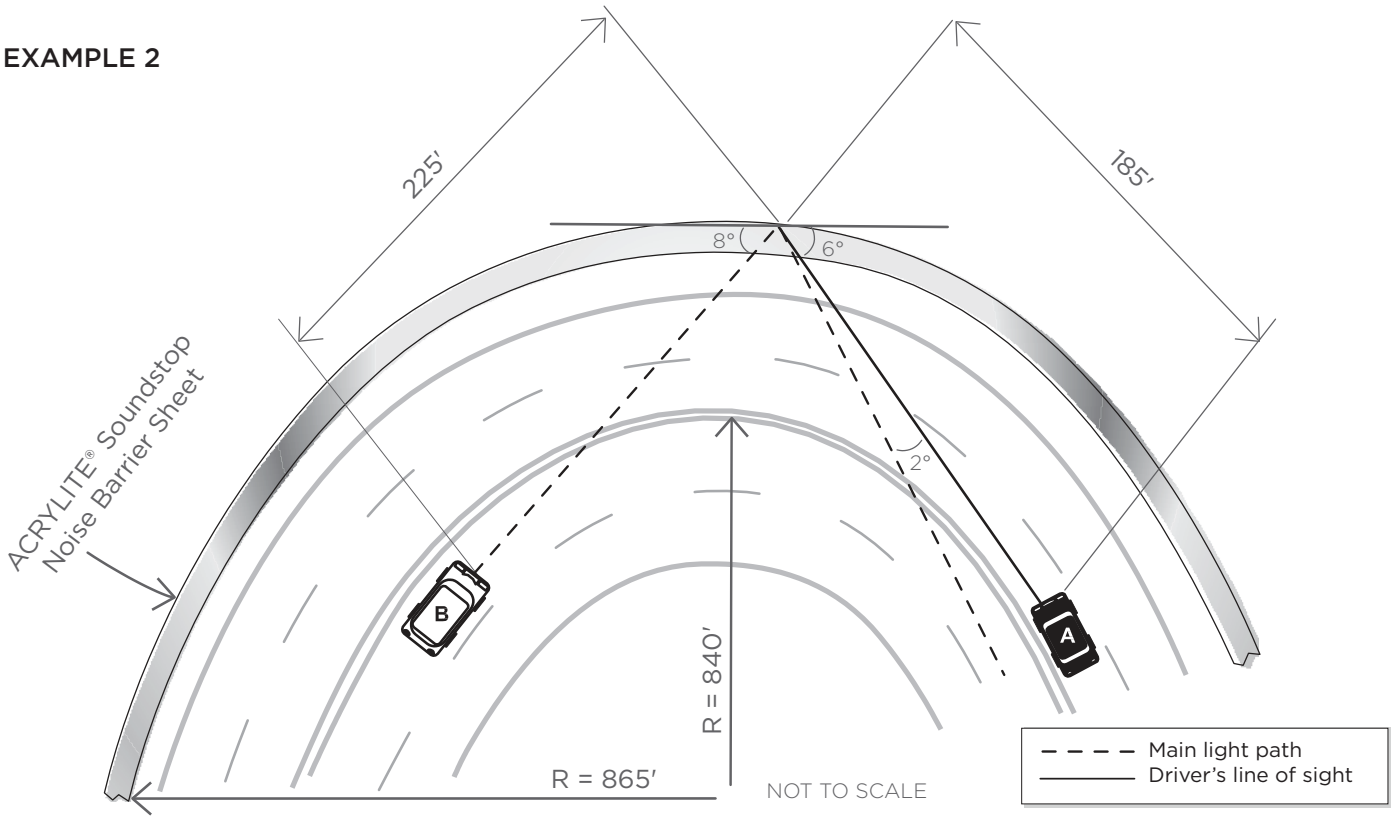
First, consider the glare from an oncoming vehicle with the following assumptions, as illustrated in the example above:

- One lane of traffic in each direction
- Each lane is 10′wide
- The driver is 50 years old and looking straight ahead along the middle of the lane
- The cars are separated by a distance of 225′
- A background luminance of 0.026cd/ft² (an unlit roadway at night)
- A headlamp luminous intensity of 42,500cd and 25,431cd at 2.5° left of center.

In this example, the luminance of the glare reaching the driver is calculated to be 0.50fc. Thus, an object on the roadway requires its luminance increased over 40-fold to be detected against the background luminance.

In other words, to be seen when there is glare from on oncoming headlamp 225' away, an object on the roadway will have to be about 40 times brighter than normal.

EXAMPLE 2



Consider a highway curve with the following geometry:

- Two lanes of traffic in each direction
- The approaching cars are on the inside lanes
- Each lane is 10ft wide
- The radius of curvature is 840′ (very tight for a highway)
- The driver is 50 years old and looking straight ahead along the middle of the lane
- A background luminance of 0.026cd/ft^2 (an unlit roadway at night)
- A headlamp luminous intensity of 42,500cd and 29,440cd at 2° left of center

The cars on the outside of the curve (represented above by vehicle A) will cross paths with reflected light (indirect glare) from the Soundstop noise barrier panels, coming from the cars on the inside of the curve (represented above by vehicle B). Then, vehicle A will experience direct glare from the same vehicle B. The light from vehicle B's headlamps will strike the Soundstop noise barrier after traveling a distance of 225′.

The incident light will reduce its intensity by 40% when it strikes the Soundstop panel at an 8° angle. The reflected light then travels a approximately 185′ and crosses the path of vehicle A at a 2° angle.

The illuminance of the glare reaching the driver's eye is .10fc—therefore, an object in the roadway will need to increase its luminance 13-fold in order to be seen.

Conclusion

Reflected light from an Soundstop Noise Barrier results in glare illuminance of approximately 0.10fc versus a glare illuminance or approximately 0.50fc for an oncoming vehicle. Based on this, it is understandable why glare from Soundstop panels has not created any known complaints.

Definitions

Glare	Occurs when the intensity of a light is greater than that to which the eyes are accustomed. It is usually defined as a bright light or a brilliant reflection. *Direct glare* is caused by light sources in the field of view and *indirect glare* is a bright reflection from a polished or glassy surface (for example, the vehicle's sideview mirror). *Disability glare* is caused by light scattered within the eye, causing a haze of veiling luminance that decreases contrast and reduces visibility.
Reflectance	A measure of the reflected incident light (illuminance) that is reflected away from a surface. Reflectance will depend on the surface properties of the material as well as the angle from which it is illuminated.
Luminous Intensity	The light-producing power of a source, measured as the luminous flux per unit solid angle in a given direction. It is a measure of the strength of the visible light given off by a source of light in a specific direction. In this guide, luminous intensity is expressed in terms of candles (cd).
Luminance	The amount of luminous flux reflected or transmitted by a surface into a solid angle per unit of area perpendicular to a given direction. It is a physical measure of the amount of light reflected or emitted from a surface and roughly corresponds to the subjective impression of "brightness". Luminance does not vary with distance. It may be computed by dividing the luminous intensity by the source area, or by multiplying illuminance and reflectance.
Illuminance	The amount of light incident per unit area of a surface at any given point on the surface. The illuminance E at a surface is related to the luminous intensity I of a source by the inverse square law $E = I/d^2$, where d is the distance between the source and the surface. In this guide, illuminance is expressed in terms of foot-candles (fc).

ALAMEDA, CA - SOUNDSTOP TL-4 SYSTEM

ST. CATHARINES, ON - SOUNDSTOP READY-FIT

LIONS BAY, BC - SOUNDSTOP TL-4 SYSTEM

NEWPORT BEACH, CA - SOUNDSTOP READY-FIT

UNIVERSITY OF PENNSYLVANIA, PA - SOUND-STOP NOISE BARRIER PANELS

BOW TRAIL, AB - SOUNDSTOP READY-FIT

EAGLE'S NEST GOLF CLUB, ON - SOUNDSTOP NOISE BARRIER PANELS

GOLDEN, CO - SOUNDSTOP NOISE BARRIER PANELS

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Durisol
NOISE BARRIER SYSTEMS

Durisol® is the market leader in the noise barrier wall industry. We manufacture and supply a series of unique panel and post wall systems – including our Durisol® precast sound absorption panels and transparent Soundstop sheets, as well as narrow footprint retaining walls and fire-rated barriers. Our first noise barriers were installed in Canada in 1977 and in the US in 1986 and are all still in service today. With over 40+ million square feet of wall installed to date, Durisol® noise barriers stop the noise of industrial warehouses, utility enclosure sites and urban infrastructure of all kinds right across North America.

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