BRITISH COLUMBIA EXPROPRIATION ASSOCIATION
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TERMINAL CITY CLUB, VANCOUVER

"Mitigating the Effects of Project-Related Noise on Communities"

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We will Discuss:

- Noise and it Effects
- Noise Limits and Regulations
- Noise Control Approaches
- Noise Barrier Examples
- Questions?

NOISE AND ITS EFFECTS

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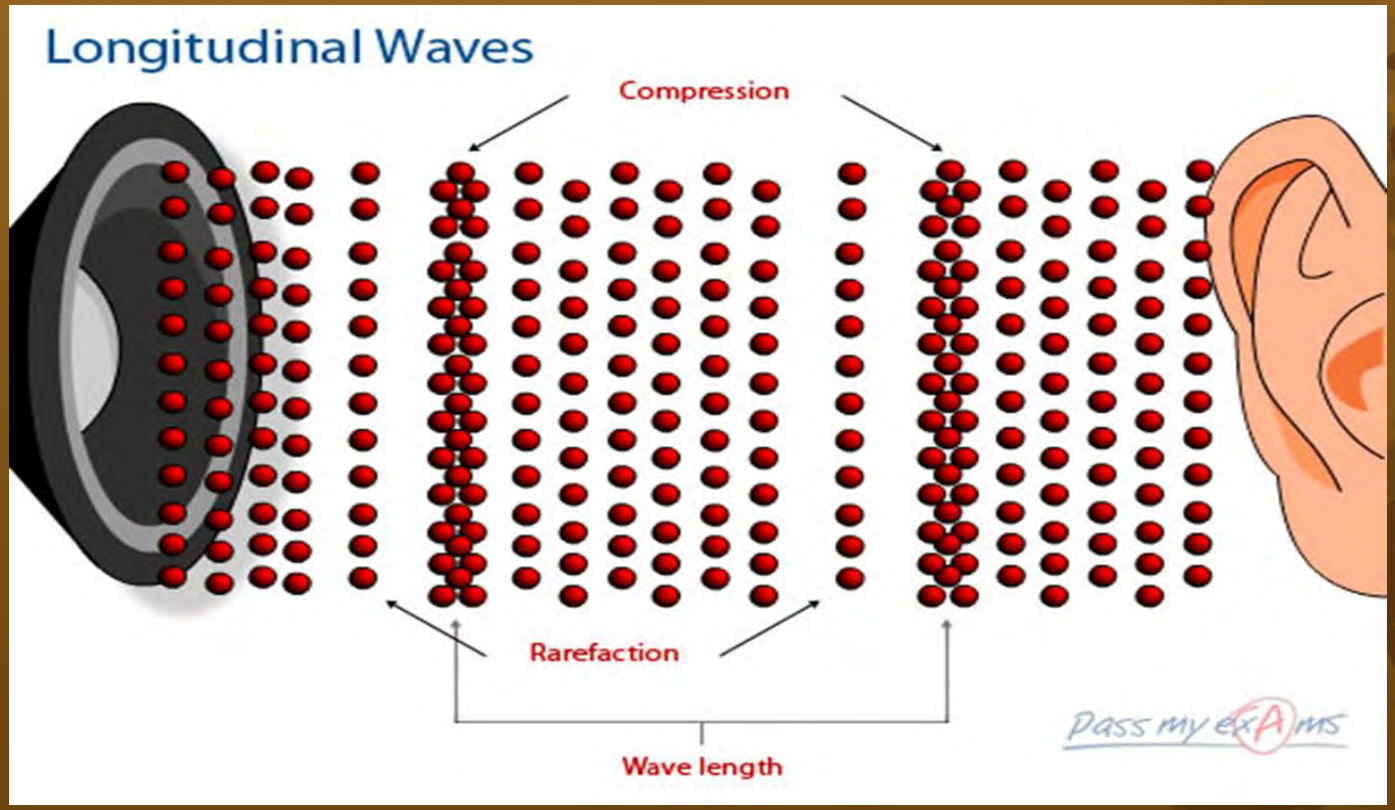
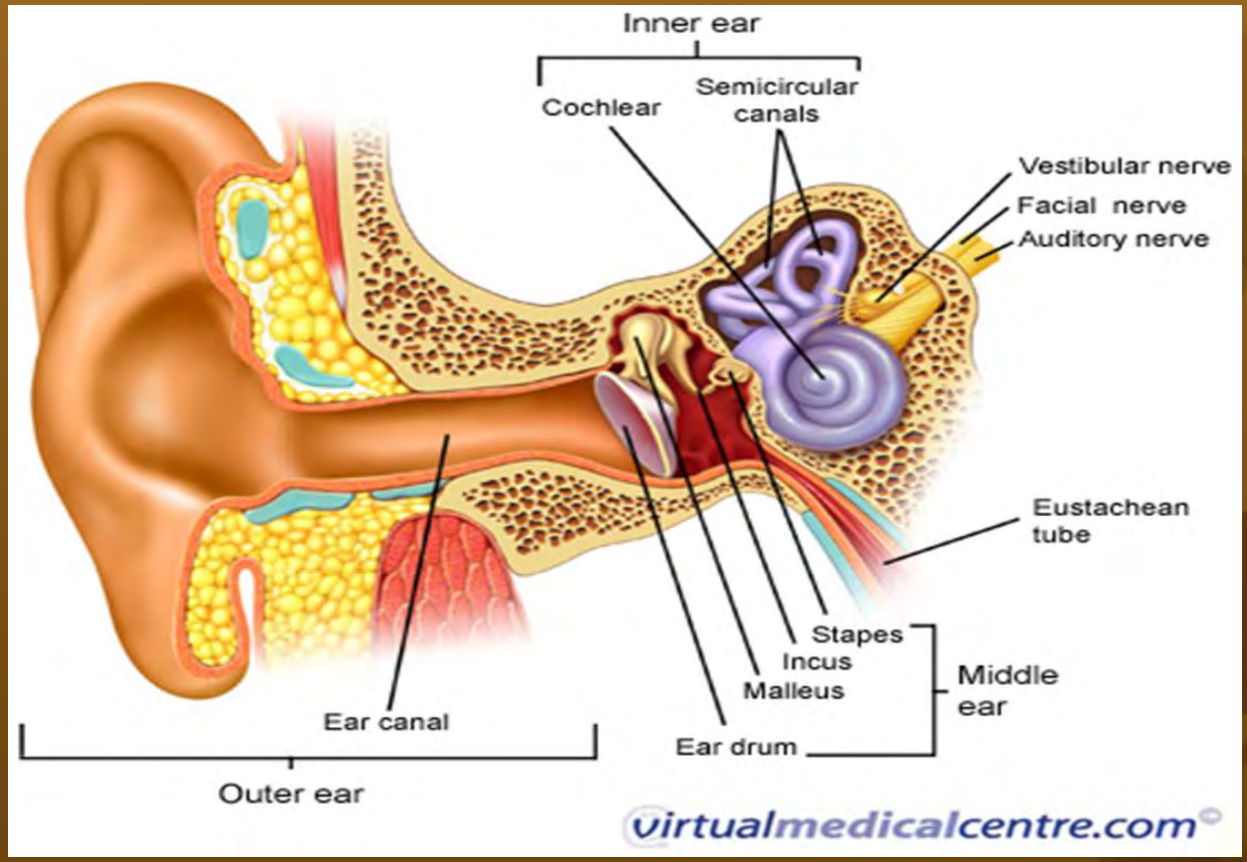
Sound is a “Wave Phenomenon” like “Ripples on a Pond”.

Sound Waves - tiny fluctuations in air pressure caused by vibrating surfaces and moving fluids.



How do we Perceive Sound?

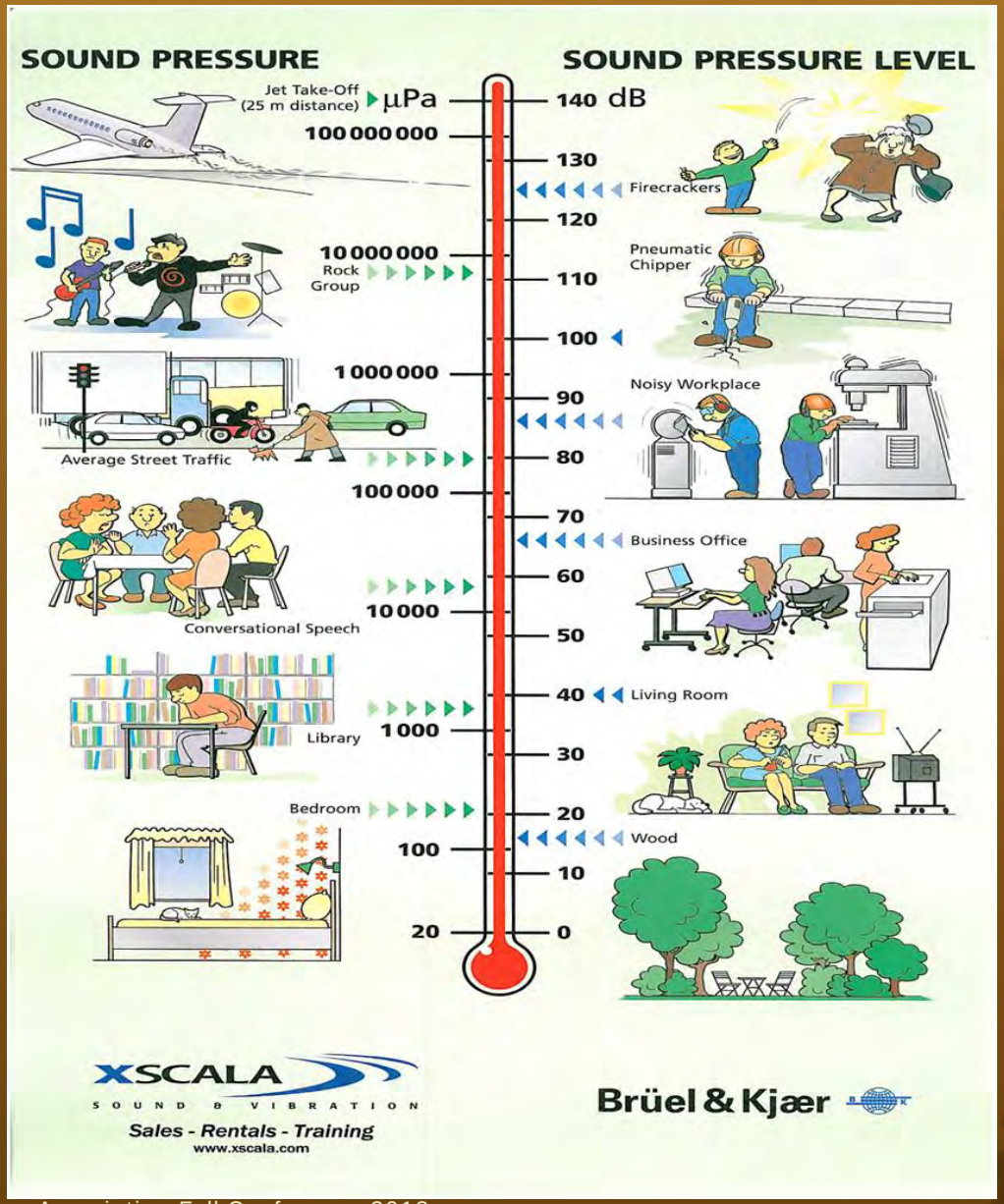


How do we Quantify Sound?

- Our ears can perceive an enormous range of sound intensities – ***10 million or more*** – between the "Threshold of Hearing" and the "Threshold of "Pain".

- ***Logarithmic (Decibel) Scale*** adopted to compress this huge range to a more manageable one.

- Similar to ***Richter Scale*** of Earthquake Intensity.



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Effects of Noise in the Community

- Interferes with important activities – speech, listening to media, sleep, relaxation,
- Deprives people of full use and enjoyment of property,
- Can negatively affect property values,
- At higher levels can effect health – is a stressor.

How much Noise is Too Much for our Ears?

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Thresholds of Hearing, Pain and Damage

- ***Threshold of Hearing*** – nominally zero dB at 1,000 Hz. for young, healthy ears,
- ***Threshold of Pain, Tickling*** – approx 120 dBA,
- ***Instantaneous Hearing Damage*** – 130 dBA.,
- ***Occupational Hearing Damage*** – ***85 dBA*** over working life (WorkSafe BC)., and ***135 dBA Peak***,

How Much Noise is Too Much in the Community?

- ***55 dBA*** – daily average noise level **OK** (CMHC, U.S. EPA)
- ***65 dBA*** – "twice as loud" - **definite noise problem.**
- ***75 dBA*** –"four times as loud" - **severe noise problem**.

REGULATING & CONTROLLING NOISE

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How is Community Noise Regulated in B.C. and Canada?

- ***Municipal Noise Bylaws*** - limit noise emissions from property, excluding streets and highways,
- ***B.C. MoT*** - Noise Policy addresses noise impacts related to Provincial Highway projects.
- ***Light Rapid Transit Projects*** (e.g. Evergreen Line) – project –specific limits for train pass-by noise, construction and station noise,
- ***Police*** – can ticket excessively noisy vehicles.

Noise Regulation (continued)

- ***The B.C. Ministry of Energy and Mines*** **-** specific noise limit (40 dBA) for Wind Turbines.

- ***Transport Canada*** - provides guidance for land use around airports based on cumulative aircraft noise exposure.

- ***Health Canada*** - 1986 "National Guidelines for Environmental Noise Control". HC no longer has own guidelines or standards.

Three Opportunities to Control Noise

- **Noise can be controlled**:
  - At the ***Noise Source***,
  - Along the ***Noise Path***,
  - At the ***Noise Receiver***.

Controlling Noise at Source

Construction Noise

- Selection of ***quieter equipment*** and processes,
- Close-fitting ***enclosures or screens***,
- Regular equipment ***maintenance***, e.g. exhaust mufflers
- Operator ***training,***
- Limitation of ***hours of work***.
- Restrict nosiest activities to ***daytime***.

Controlling Noise at Source

Industrial, Power, Water and Sewage Plants

- ***Select quieter equipment*** and processes,
- Building ***wall, window, roof assembly*** design,
- Noise ***enclosures or screens*** for external, rooftop equipment,
- Air intake & discharge ***silencers or acoustic louvers***,
- ***Mufflers*** on exhaust stacks,
- ***Minimize nighttime*** activities,
- ***Adequate maintenance***.

Acoustic Louvers on Top of a Noise Enclosure

Traffic Noise Control at Source; "Low-Noise Pavements"

- Open-Graded Asphalt (OGA), Rubberized Asphalt & others,
- Porous surfaces permit air and sound to enter,
- First developed to improve surface drainage,
- Surface pores defeat suction-cup effect of tire treads,
- Reduce traffic noise by 4 to 7 dBA at source.

Open-Graded Asphalt being Laid

Controls along the Sound Path

- ***Noise barriers***:
  - Walls,
  - Earth berms,
  - Berm-wall combinations,
  - Buildings,
  - Land forms.

- ***Buffer Zones*** - increased setback distance (at least 3 to 6 dBA per doubling of distance).

- ***Mature Forest Belts***. – up to 10 dBA max.

Temporary Noise Barrier around Construction Site

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A Tidier Construction Site Barrier

Light Rapid Transit Noise Barrier

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Controls at the Receiver

- ***Building layout*** - floor plan and building orientation,
- ***Building Façade Enhancements:***
  - Windows – double-glazed, air-tight, storm windows,
  - Upgrade doors – solid wood or insulated steel, with perimeter seals,
  - Upgrade walls and roof (near airports).
- ***Noise Screens*** near residence, e.g., around patio.

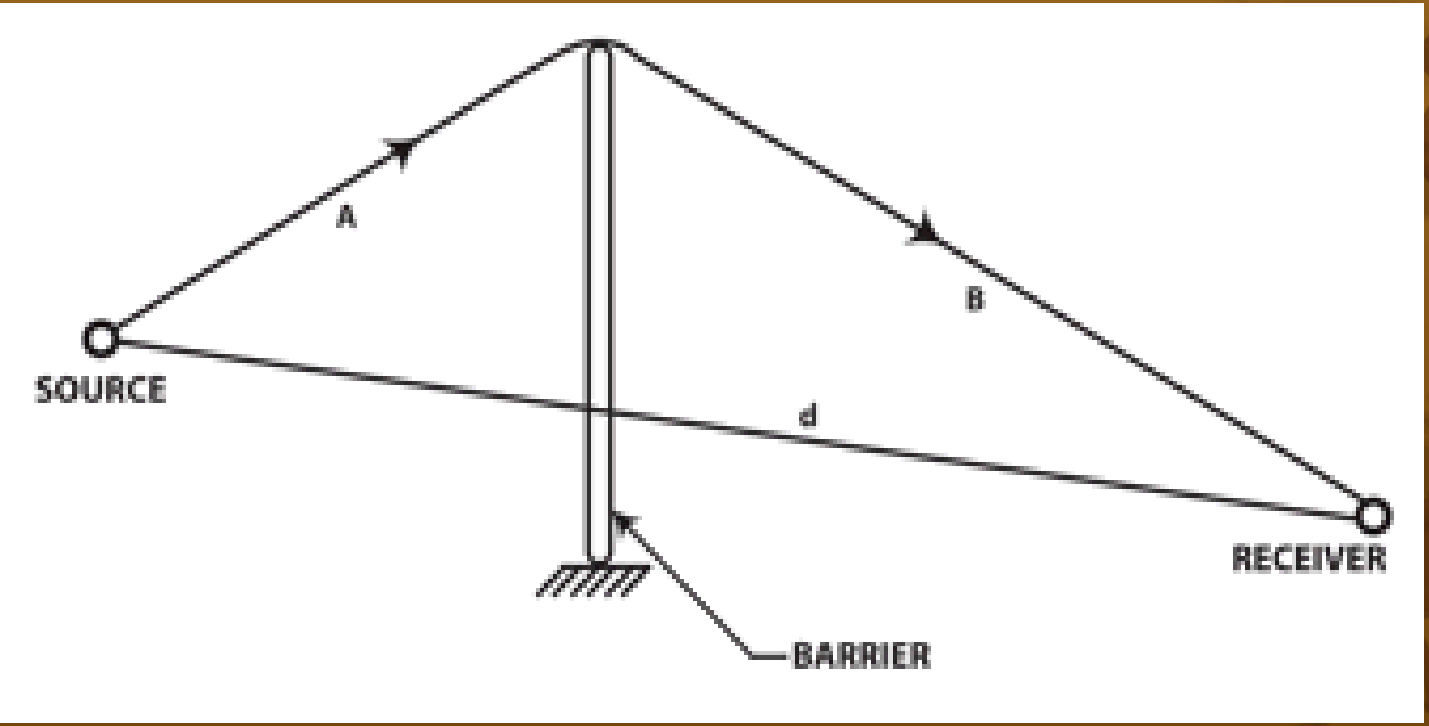
How much Noise Reduction Can be Achieved?

- ***5 dBA –*** minimum significant noise reduction (30% reduction in loudness),
- ***10 dBA –*** halving of loudness,
- ***Source controls –*** reductions of 10 to 30 dBA (1/2 to 1/8th as loud),
- ***Path Controls*** - ***Noise barriers*** can achieve reductions:
  - 5 dBA – quite easy,
  - 10 dBA – must have favourable conditions,
  - 15 dBA – very challenging – need very high barrier.
- ***Controls at the Receiver –*** can achieve reductions of 10 to 20 dBA (1/4 to 1/2 as loud).

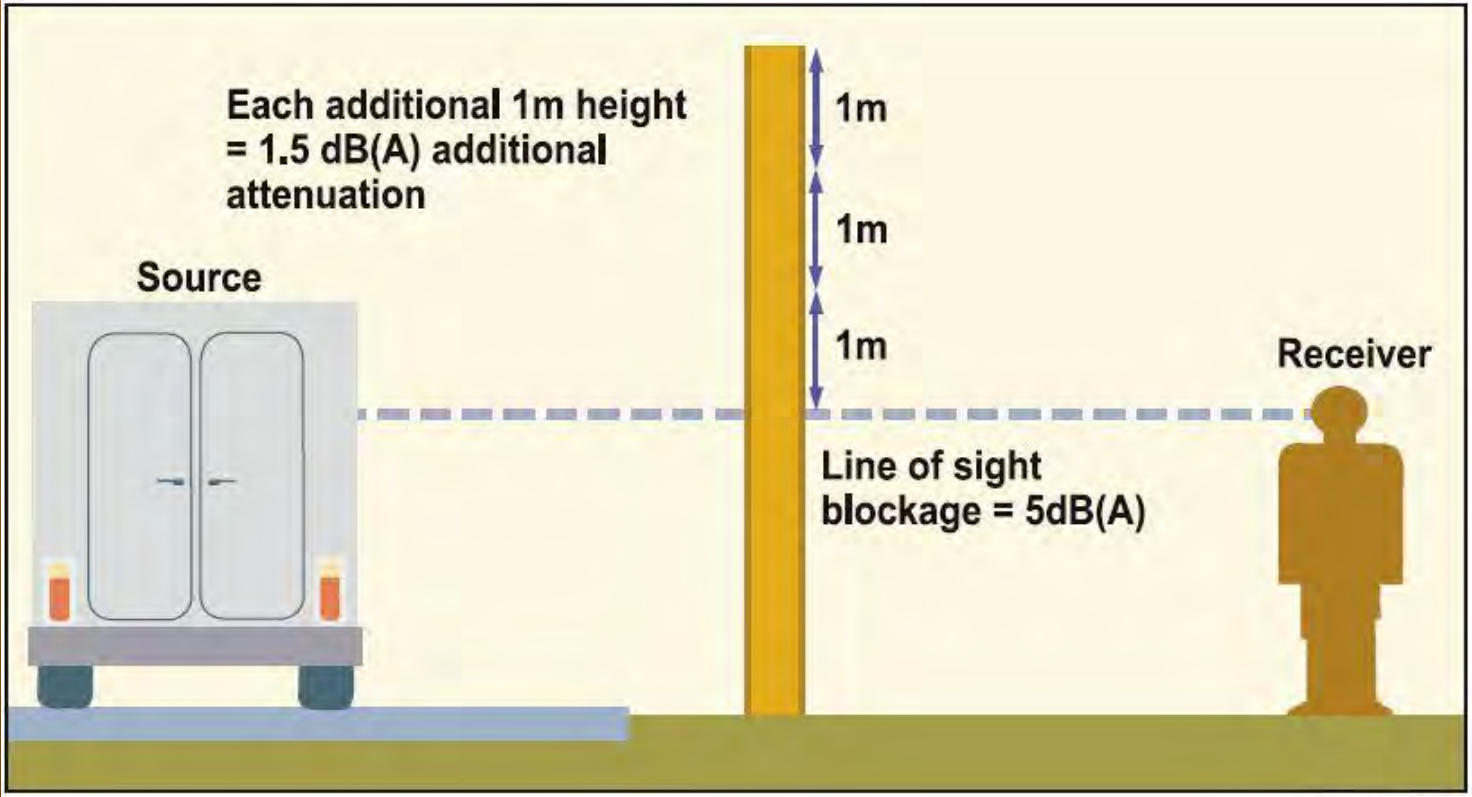
What Controls the Effectiveness of Noise Barriers?

- ***Height*** – location of barrier top relative to elevation of noise so,
- ***Length*** – must extend well beyond (or wrap around) noise source zone, or receiver zone
- ***Barrier location*** - close to either source or receiver,
- ***Density*** - 10 kg/m^2 or (2 lb./ft^2) or more,
- ***Free from gaps or cracks***,
- ***Sound absorptive surface*** – slightly better than sound reflective barrier

How Do Noise Barriers Work?



Effect of Increasing Barrier Height



Noise Barrier Materials

- ***Pre-cast concrete*** posts and panels,
- ***Concrete blocks*** or brick,
- ***Corrugated steel*** panels,
- ***Timber*** posts and planks (treated),
- ***Plastics***, recycled rubber,
- ***Transparent panels*** (Plexiglas, Lexan, plate glass),
- ***Earth-filled green walls***, or crib-walls,
- ***Earth Berms*** and berm-wall combinations.

Noise Barrier Examples

Concrete Post and Plank Noise Wall Common in B.C. (2.5-3.5 m high)

5 - 6 m High Pre-Cast Concrete Wall

Erecting a 6 m Noise Wall

Recycled Plastic Noise Barrier

Transparent Noise Wall

Curved, Sound-Absorptive Wall

Now we're Talking!
May feature Quiet Pavement as Well.

A Noise Tunnel

Earth Berm Noise Barrier

Berm-Wall Combination Barrier

“Green Wall”

An Extremely Green Wall!

Noise Barriers don’t need to be Boring!

Noise Wall Samples

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Noise Barriers can Earn their Keep

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But they Don’t Work Nights!

That's it! Thank You

Questions?