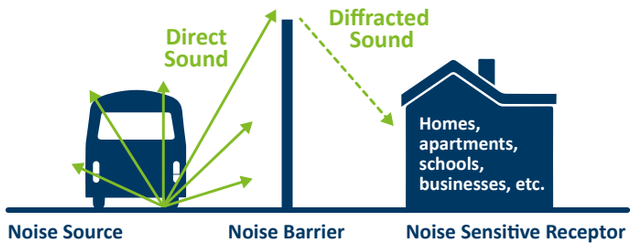
How do noise barriers reduce noise?

Noise barriers do not eliminate all noise. Noise barriers block the direct path of sound waves between the source (highway) and the receptor (home or business). In order for a noise barrier to work, it must be high and long enough to block the view (line of sight) of the highway. MnDOT studies various engineering designs to determine the barrier height, length, and location that provides the greatest level of noise reduction. The maximum height of a MnDOT noise barrier is 20 feet.



How effective are noise barriers?

Receptors located near a noise barrier receive the greatest reduction of noise. Receptors located directly behind a 20 foot tall noise barrier typically receive a 10 dBA reduction of noise. Noise barriers are most effective in reducing noise for receptors located within 300 feet of the road (usually first and second row homes behind the noise barrier). Openings or gaps in noise barriers greatly reduce its effectiveness in reducing noise.

Does a noise barrier increase noise on the opposite side of the highway?

Residents whose homes are facing a noise barrier across a highway sometimes believe the noise barrier has caused noise levels to increase at their home. However, field studies commonly show less than a 2 dBA increase in noise levels due to noise reflected off an opposing barrier. In theory, if all noise striking a noise barrier were reflected, the noise level increase would be limited to 3 dBA. In reality, not all noise is reflected. Some of the noise goes over the barrier, some is reflected in other directions, some is scattered by vegetation, and some noise is lost due to the longer path it must travel. Residents whose homes are facing a noise barrier across a highway may perceive the change in the quality or frequency of sound as an increase in noise levels.

MnDOT's Noise Barrier Programs

MnDOT has two noise barrier programs:

- **Federal program**

  Major road construction projects that include new roads, additional traffic lanes, or substantial changes to the alignment of a road or interchange. These projects typically use federal funding and are referred to as "Type I" projects.

- **Stand-alone program**

  Qualifying areas where major construction projects are not planned are prioritized by existing noise levels and by the cost effectiveness of potential noise barriers. The list of qualifying areas is used to determine future stand-alone noise barrier projects. This program is state funded.

Noise Barrier Funding

MnDOT and the federal government pay for noise walls constructed under the federal program. For stand-alone projects, MnDOT pays 90% of the costs and the city where the noise barrier is located pays 10%. Individual properties are typically not assessed for noise walls.

Additional Information

MnDOT: www.dot.state.mn.us/environment/noise/
MPCA: www.pca.state.mn.us/air/noise-pollution
FHWA: www.fhwa.dot.gov/environment/noise/

DEPARTMENT OF TRANSPORTATION

HIGHWAY TRAFFIC NOISE

AND NOISE BARRIERS

Measuring Sound

Sound travels in waves and produces sound levels that are measured in A-weighted decibels (dBA), which is an adjustment of the high-and-low pitched sound that reflects the way that the average person hears.

Traffic noise is typically measured using the average sound levels over one hour (Leq).

Changes in Noise levels

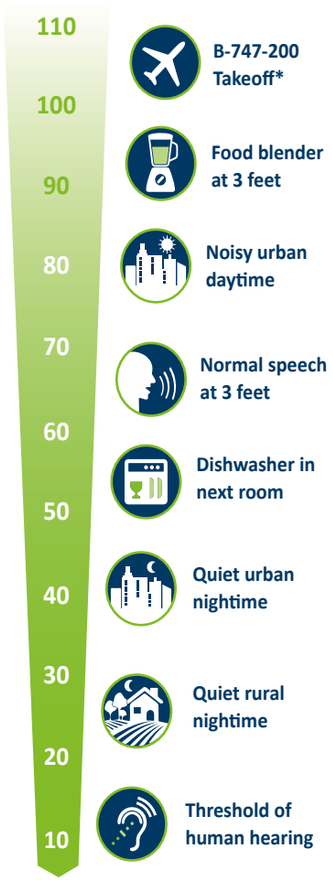
Increase or decrease in noise level:

- <3 dBA- not perceptible
- 3 dBA- barely perceptible
- 5 dBA- easily perceptible
- 10 dBA- perceived as twice as loud

Due to the nature of the decibel scale, a doubling of traffic will result in an approximately 3 dBA increase in noise levels. If a highway is moved half as close to homes (e.g., 300 feet to 150 feet away), noise levels will increase by approximately 4.5 dBA assuming a grassy surface between roadway and homes.

COMPARISON OF NOISE LEVELS

Measured in dB(A)



* As measured along the takeoff path 2 miles from the overflight end of the runway

Identifying Noise Impacts

Receptors (defined typically as homes, apartments, parks, trails, schools, businesses) are impacted by noise if existing or future traffic noise levels approach or exceed Federal Noise Abatement Criteria. For residential land uses, noise levels must be at least 66 dBA (hourly Leq) or predicted to increase by 5 dBA or more. The analysis is based on noise levels experienced at commonly used outdoor areas. If noise impacts are identified as part of a project noise study, then MnDOT is required to evaluate noise reduction measures such as installing noise barriers.

MnDOT Traffic Noise Requirements

MnDOT is required by the Federal Highway Administration (FHWA) and the Minnesota Pollution Control Agency (MPCA) to establish traffic noise requirements that comply with federal and state regulations.

MnDOT's Noise Requirements document describes the procedures for completing a traffic noise study, including how traffic noise impacts are defined and how decisions regarding noise barriers are made. The document ensures noise requirements are applied uniformly and consistently across the state to provide equitable treatment for people impacted by traffic noise. MnDOT's Noise Requirements document is available on MnDOT's website at **http://www.dot.state.mn.us/environment/noise/policy/index.html**

Minnesota Noise Regulations

The MPCA oversees the Minnesota noise rules (see Minn. Rules Ch. 7030). These rules set statewide noise standards based on land use categories. Some roads may be exempt from the state noise standards (see Minn. Statute 116.07 Subd. 2a). MnDOT is exempt from state noise standards if all reasonable noise reduction measures are applied. "Reasonable noise reduction measures" are based on specific reasonableness and feasibility criteria set by MnDOT and MPCA. See definitions listed under "Determining feasible and reasonable noise barriers."

Determining feasible and reasonable noise barriers

A noise barrier is considered feasible if at least one receptor behind the noise barrier will experience a 5 dBA reduction in noise levels. Other engineering and site factors are also considered, such as safety, drainage, utilities, and maintenance needs.

There are three criteria that MnDOT uses to determine if a noise barrier is reasonable:

- **Noise design goal**- at least one receptor behind the noise barrier must experience at least a 7 dBA reduction of noise.
- **Cost effectiveness** - the cost of the noise barrier cannot exceed $78,500 per benefitted receptor. A benefitted receptor is a property that will experience at least a 5 dBA reduction in noise levels. MnDOT uses a noise barrier cost of $36 per square foot for estimating noise barrier costs. For example, if a barrier costs $700,000 and would reduce noise levels by at least 5 decibels for 10 homes, the total calculated cost per benefitted receptor would be $70,000, which would meet the cost effectiveness criteria.
- **Input from benefitted receptors** – If a noise barrier provides one benefitted receptor at least a 7 dBA reduction of noise and if the cost of the noise barrier does not exceed $78,500 per benefitted receptor, then the property owners and residents who experience a 5 dBA reduction in noise get to vote on the noise barrier.

Vegetation as a noise barrier

Trees and vegetation can provide visual screening, but they provide very little benefit in reducing noise. In order for trees to provide a significant reduction in noise there must be at least 100 feet of dense trees that are at least 15 feet high.