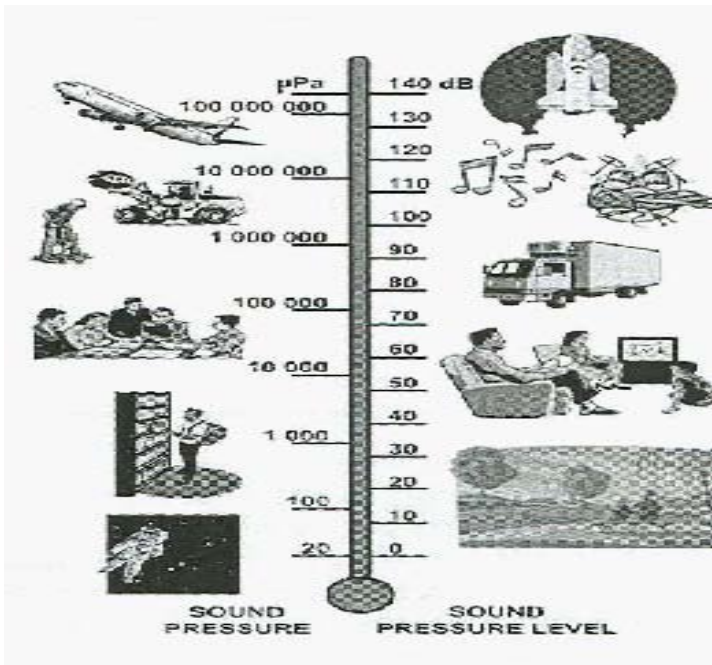


Traffic noise is an important consideration that must be taken into account when the Minnesota Department of Transportation (Mn/DOT) embarks on environmental studies that involve major highway improvements. For these projects, a noise study is required to assess existing noise levels and predict future noise levels (usually 20 years into the future) to determine noise impacts.

All traffic noise studies and analyses prepared for Mn/DOT projects must adhere to procedures and requirements as established by federal law, U.S. Department of Transportation regulations, MN Pollution Control Agency (MPCA) guidelines, and Mn/DOT noise analysis guidelines. This insures that the policies are uniformly and consistently applied statewide and provides equitable treatment for those impacted by highway traffic noise.

If noise impacts are identified during a traffic noise analysis, Mn/DOT is required to consider noise mitigation measures. If these measures are found to be feasible and reasonable in accordance with Mn/DOT-defined criteria, they must be included as part of the project.



### How are noise level changes perceived?

Studies have shown that changes in noise levels of three decibels or less are not typically detectable by the average human ear. An increase of five decibels is generally readily noticeable by anyone, and a 10-decibel increase is usually felt to be “twice as loud” as before.

### How do changes in traffic or roadway geometry affect noise levels?

Due to the nature of the decibel scale, a doubling of traffic will result in a three-decibel increase in noise levels, which would not normally be a perceived noise increase. Traffic would need to increase at least three times to result in a readily perceived (five-decibel) increase in noise.

Using the same reasoning, if a highway is moved half as close to existing homes (i.e. 200 to 100 feet), the noise levels will increase by four and one-half decibels. Conversely, if a highway is moved double the distance from existing homes, the noise levels will decrease by four and one-half decibels. Noise level increases caused by highway projects are usually due to a combination of increased traffic and changes in the roadway alignment.

### When is a noise analysis required?

A noise analysis is typically required for a proposed federal-aid project if the project consists of:

- A new highway built on a new location;
- An existing highway significantly altered by substantially changing the horizontal or vertical characteristics of the road;
- An increase in the number of through traffic lanes;
- The addition of an auxiliary lane (s); or,
- The addition or relocation of interchange lanes or ramps to a quadrant to complete an existing partial interchange.

Minor projects, such as normal roadway resurfacing or minor alterations (without adding lanes), usually do not require a noise analysis.

### Does Mn/DOT analyze noise levels on existing highways?

In the absence of a major highway project, as described above, Mn/DOT would base any determination for future noise barriers on its current Highway Noise Abatement Study (Metro District only).

### What constitutes a traffic noise impact?

A “noise sensitive receiver” (defined as homes, parks, schools, businesses, etc.) is considered impacted by noise if either the existing or future noise levels (generally a 20-year traffic projection) exceed the State Noise Rules and/or the FHWA noise abatement criteria, or if there will be a substantial increase in future noise levels due to a proposed Mn/DOT project, as described above. The noise levels used in any analysis are those that are experienced at commonly-used exterior areas of frequent human use.

For residential areas, a traffic noise impact occurs when the future noise levels would exceed the State Noise Standards of 65 decibels (L<sub>10</sub>) daytime or 55 decibels (L<sub>10</sub>) nighttime. For Federal aid projects, a substantial impact occurs when there is a projected five-decibel increase over existing noise levels. Impacts such as these require mitigation consideration and analysis, which may result in the construction of noise barriers if they are determined to be feasible and reasonable.

### What does Mn/DOT consider “feasible and reasonable”?

A noise barrier must be both feasible and reasonable if it is to be constructed with the highway project. Feasibility and reasonableness are determined by quantifiable criteria, but judgments for special and/or unusual circumstances are made on a case-by-case basis. As a result, noise mitigation is not automatically provided where noise impacts have been identified.

A barrier is feasible if it can be constructed without major engineering or safety issues and provides a substantial noise reduction to the adjacent receivers. Reasonableness addresses whether or not the barrier can be constructed in a cost-effective manner (equal to or less than \$43,500 per benefited home).

### **What is a “substantial noise reduction”?**

In order to be effective, a noise barrier must provide at least a readily perceptible decrease in noise levels to adjacent receivers. This is defined as a noise decrease of at least five decibels with at least one benefited receiver having a seven-decibel or greater reduction. Since a noise level change of three decibels or less is not generally perceptible, it is not prudent to construct a noise barrier that gives only a one- or two- decibel reduction to adjacent properties.

### **What types of noise barriers are constructed?**

Noise barriers are commonly constructed as walls, earthen berms, or a combination of the two. Walls are most common and are usually constructed out of dense material, such as wood, concrete, or block materials. Earthen berms are a natural alternative to walls but require much more land to construct. Walls can be constructed on top of berms in order to raise the overall height of the barrier.

### **How do noise barriers work?**

Noise barriers reduce noise by blocking the direct travel of sound waves from a source (highway) to adjacent homes or businesses, forcing them over the top or around the barrier. The barrier must be high enough and long enough to block the view (line of sight) of the highway.



This is the phenomenon that allows a noise barrier to provide a perceivable noise reduction. Noise barriers often do very little good for homes on a hillside overlooking a road or for buildings which rise above a barrier. Openings or gaps in barriers for driveway connections or street intersections greatly reduce barrier effectiveness. Noise barriers are most effective in reducing noise for areas that are within approximately 200-300 feet of the highway (usually the first or second rows of homes). Noise barriers cannot be designed to eliminate or block all of the noise.

### **Will planting vegetation help reduce noise levels?**

Vegetation is only effective for reducing noise levels if it is at least 100-200 feet deep, a minimum of 15 feet above the line of sight, and dense enough that it cannot be seen through. It is not feasible to plant enough vegetation along a highway to achieve this type of reduction. However, planting trees or shrubs can provide aesthetic benefit and visual screening.

### **How does pavement type affect noise levels?**

Research regarding the influence of pavement surface texture on the tire/pavement sound source has been ongoing throughout the years and continues. The benefits of new advances in paving, such as rubberized asphalt, the use of designed surface texturing, etc., are not easily determined. As a result, pavement type, in and of itself, cannot be considered as an alternative to conventional noise mitigation at this time.

### **Does Mn/DOT analyze noise mitigation for new developments?**

For a major highway reconstruction project, Mn/DOT will analyze an area if the building permit(s) were issued prior to the FHWA’s approval (date of Public Knowledge) of the environmental document. If development occurs after this date, any noise mitigation is the responsibility of the municipality as per MN State Rule 7030.0030.

# **Highway Traffic Noise: Assessment and Abatement**

