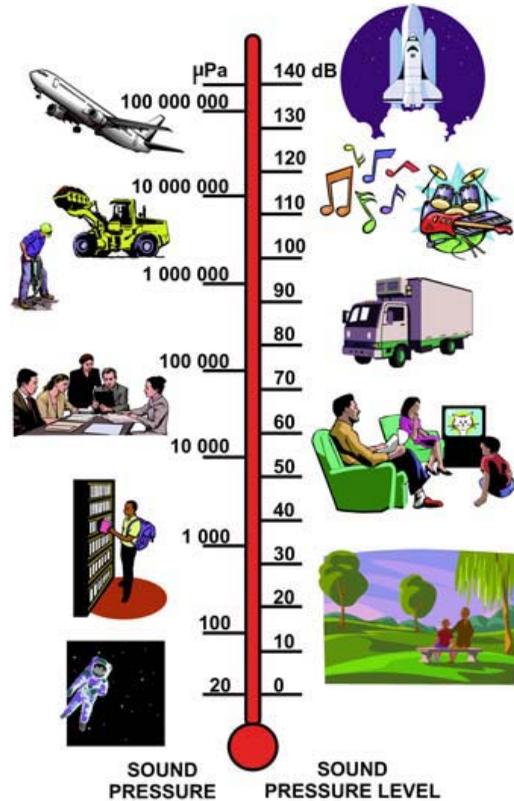


Traffic noise is an important consideration that must be taken into account when the Colorado Department of Transportation (CDOT) embarks on environmental studies that involve major highway improvements. For these projects, a noise study is required to assess existing noise levels and predict future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

All traffic noise studies and analyses prepared for CDOT projects must adhere to procedures and requirements as established by Federal law, US Department of Transportation regulations and CDOT noise analysis guidelines. This assures that the policies are uniformly and consistently applied and provided equitable treatment for those impacted by highway traffic noise.

If noise impacts are identified during a traffic noise analysis, CDOT is required to examine and consider noise mitigation measures. If these measures are found to be feasible and reasonable in accordance with CDOT 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 in 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 in and of itself would not normally be a perceivable noise increase. Traffic would need to be increased at least three times to result in a readily perceivable (five decibel) increase in noise.

Using the same reasoning, if a highway is moved to half as close to existing homes (i.e. 200 to 100 feet), the noise levels will increase by three decibels. Conversely, if a highway is moved double the distance from existing homes, the noise levels will decrease by three decibels. Noise level increases due to 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 required for a proposed CDOT project if that project consists of:

- A new highway built on a new location,
- An existing highway is significantly altered by substantially changing the horizontal or vertical characteristics of the road, or
- The number of through traffic lanes is being increased.

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

Does CDOT analyze noise levels on existing highways?

In the absence of a major highway project as described above, CDOT does not perform noise studies or mitigate noise for existing highways.

What constitutes a traffic noise impact?

A “noise sensitive receiver” (defined as homes, parks, schools, business, etc.) is considered to be impacted by noise if either future (generally a 20-year projection) noise levels approach or exceed the CDOT *Noise Abatement Criteria*, or if there is a substantial increase in future noise levels over existing noise levels from a proposed CDOT project as described above. These are the noise levels that are experienced at the commonly used exterior portions of the property on the lowest ground level for each home or individual unit.

For residences, schools and parks, impact is defined when the *hourly equivalent sound level* (essentially the average noise level over a time period), or **Leq** is 66 decibels or higher, and 71 decibels for businesses and other commercial properties. A substantial increase impact occurs when there is a projected 10-decibel increase over existing levels. Impacts such as these require mitigation consideration and analysis, which will construct noise barriers if they are determined to be feasible and reasonable.

What does CDOT 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 criteria that are quantifiable but flexible, and judgements 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 provide a substantial noise reduction to the adjacent receivers. Reasonableness deals with whether or not the barrier can be constructed in a cost-effective manner, the percentage of residential-type development, overall noise level increases and the desire of the community.

What is a “substantial noise reduction”?

A noise barrier must provide at least a readily perceptible decrease in noise levels to adjacent receivers to be effective. This is defined as a noise decrease of at least five decibels. As noise level changes of three decibels or less are not generally perceptible, it is not prudent to construct a noise barrier that only gives a one-or-two decibel benefit to adjacent properties.

What types of noise barriers are constructed?

Noise barriers are commonly constructed as walls, earth berms, or a combination of the two. Walls are most common, and are usually constructed out of dense material, such as concrete or masonry block. Earth 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 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 reduce barrier effectiveness. Noise barriers are most effective for the first one or two rows of homes at distances up to 200 to 300 feet from the barrier. As noise levels decrease with distance, there is a point away from the highway at which noise barriers are no longer effective. They are not designed to eliminate or block all noise.

Will planting vegetation help reduce noise levels?

Vegetation is only effective for reducing noise levels if it is at least 100 to 200 feet deep, high enough that it cannot be seen over, 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 effect noise levels?

Research regarding pavement influence on noise levels has been an ongoing process. In general, the use of certain types of asphalt pavements or texturing of concrete pavements can give an initial noise reduction benefit to properties 200 to 300 feet from the highway. Over a long period of time, however, it is not known if these benefits continue to be realized. As a result, pavement type, in and of itself, cannot be considered as an alternative to conventional noise mitigation measures at this time.

For more information about highway traffic noise and the environment, please visit the FHWA Web site at <http://www.fhwa.dot.gov/environment/noise/index.htm> or visit the CDOT noise Web site at <http://www.dot.state.co.us/environmental/CulturalResources/Noise.asp>.

Highway Traffic Noise: Assessment and Abatement

