



OFFICE OF THE LEGISLATIVE AUDITOR
STATE OF MINNESOTA

EVALUATION REPORT

MnDOT Noise Barriers

OCTOBER 2013

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OFFICE OF THE LEGISLATIVE AUDITOR

STATE OF MINNESOTA • James Nobles, Legislative Auditor

October 2013

Members of the Legislative Audit Commission:

Traffic noise is often a concern of residential communities near Minnesota's highways. To address this concern, the Minnesota Department of Transportation (MnDOT) has built noise barriers using federal funding since the 1970s and through a small state-funded program since 1997.

At your request, we evaluated MnDOT's noise barrier activities and policies, looking at both federal and state projects. We found that Minnesota is more likely to build noise barriers than similar states due to MnDOT policy choices and state noise standards that are stricter than federal standards. Additionally, MnDOT's procedure for assessing community support on federal projects favors the building of noise barriers. We also concluded that the state program's geographic restrictions and its method of ranking potential projects are not fair to some communities affected by highway noise. We recommend that MnDOT make several changes to address our findings.

Our evaluation was conducted by David Kirchner (project manager), with assistance from Judy Randall and Laura Logsdon. The Minnesota Department of Transportation cooperated fully with our evaluation, and we thank them for their assistance.

Sincerely,

James Nobles
Legislative Auditor

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Summary

The Minnesota Department of Transportation (MnDOT) should improve some of its highway noise barrier policies and practices.

Major Facts and Findings:

- Federal regulations require that states evaluate the need for noise abatement, such as building noise barriers, when receiving federal funding to construct new roads or expand existing roads. ([pp. 8-11](#))
- Between 2007 and 2012, the Minnesota Department of Transportation (MnDOT) spent \$30 million building new noise barriers on federal highway projects; state contributions to noise barrier costs are proportional to its spending on other parts of a federal project. ([pp. 19-20](#))
- Minnesota is more likely to build noise barriers on federal projects than other states we selected for comparison. ([pp. 18-19](#))
- On federal projects, MnDOT's procedure for assessing public support favors the building of noise barriers. ([pp. 20-23](#))
- MnDOT spends \$2 million annually on a state-funded noise barrier program available only in the Twin Cities metropolitan area. ([pp. 26-28](#))
- MnDOT's method for prioritizing potential state-funded noise barrier projects does not fairly rank some locations. ([pp. 30-32](#))
- MnDOT has no ongoing schedule or funding mechanism for noise barrier maintenance. ([p. 36](#))

- MnDOT has made key noise barrier policy decisions with limited outside input and has not always documented the reasons for its choices. ([pp. 41-42](#))

Key Recommendations:

- MnDOT should change its procedure for assessing public support for noise barriers on federal projects. ([p. 22](#))
- MnDOT should create a pathway for communities outside the metropolitan area to become eligible for state-funded noise barrier projects. ([p. 28](#))
- MnDOT should revise its method of prioritizing state-funded noise barrier projects. ([p. 33](#))
- MnDOT should develop long-term schedules and funding plans for noise barrier maintenance. ([p. 38](#))
- MnDOT should increase transparency in its noise barrier policy decision making. ([p. 45](#))

Minnesota is more likely to build noise barriers than other states.

MnDOT's method of deciding where to build state-funded noise barriers is not fair to some communities.

Report Summary

As required by state and federal laws, the Minnesota Department of Transportation (MnDOT) evaluates and, if necessary, mitigates the effects of traffic noise. Noise barriers are the most common means to reduce the traffic noise heard at neighboring residences.

Federal regulations require each state to set criteria for building noise barriers on federally funded highway construction projects. These criteria, which include such factors as noise reduction amount and barrier cost, differ from state to state. The federal regulations are triggered only when highways are built or expanded; federal regulations do not address noise from existing highways.

State-level policy choices cause Minnesota to build noise barriers on federal highway projects more frequently than other states.

We compared Minnesota's criteria with those adopted by nine states we selected for comparison. Our analysis showed that Minnesota will build noise barriers in circumstances where the other states would not. This difference is due in part to MnDOT policy choices and in part to stringent noise standards set by the Minnesota Pollution Control Agency.

Under federal regulations, MnDOT must assess whether local property owners and residents support the construction of a noise barrier. MnDOT's procedure for doing so favors the building of barriers. MnDOT's approach assumes that property owners and residents support noise barriers unless they explicitly vote otherwise. As a result, noise barrier opponents often must

assemble supermajorities to prevent barriers from being built. MnDOT should reassess and redesign its procedures.

MnDOT should modify its state-funded noise barrier program.

Since 1997, MnDOT's Metro District, which administers department operations in the Twin Cities metropolitan area, has run a state-funded program to build noise barriers on existing highways.

Because the funding (\$2 million annually) comes from district-level discretionary funds, it is only available for locations inside the metropolitan area. We think the program's geographic restrictions are inappropriate. Since the program uses state money, all locations in Minnesota meeting MnDOT's criteria should be eligible.

MnDOT uses mathematical formulas to assess potential noise barrier locations and rank them on a priority list. Locations move up the list very slowly; MnDOT built only eight state-funded barriers in the six years from 2007 to 2012.

MnDOT's ranking method is not fair to some communities. Locations with very similar characteristics can be separated by 20 or more places on the list, a difference that can mean an extra wait of more than a decade. Additionally, MnDOT's ranking method does not give appropriate weight to locations that experience exceptionally loud traffic noise.

MnDOT has no ongoing schedule or funding mechanism for noise barrier maintenance.

Noise barriers have been a low priority for MnDOT maintenance

MnDOT should open its policy-making activities to greater outside involvement.

teams. Metro District's maintenance staff have not kept a comprehensive list of all noise barriers in their jurisdiction. MnDOT prioritizes repair projects that affect public safety; noise barrier deterioration rarely meets that threshold.

A recent study commissioned by MnDOT found that its older noise barriers were in good condition. Nonetheless, as long as MnDOT is building new noise barriers, it should identify a funding mechanism to ensure it can keep up with maintenance needs.

MnDOT has developed its noise policies administratively with insufficient transparency.

Despite demonstrated public and legislative interest in noise barrier issues, MnDOT has not sought public input when revising its noise

abatement policies. However, MnDOT has involved local governments, unlike other states.

MnDOT has not documented the rationale for some key decisions, making it difficult to later determine why a certain approach was taken. For example, MnDOT has built noise barriers primarily out of wood since the 1970s without ever fully investigating the costs and benefits of alternative materials. Few other states routinely build wooden noise barriers.

Given the ongoing public interest in MnDOT's noise barrier activities, the department should open up its policy-making activities to greater outside involvement and scrutiny. Doing so would improve public communication and limit the department's reliance on the institutional memories of key staff.

Introduction

Highway traffic noise has been a source of concern for Minnesota residents and legislators for many years. In Minnesota, most efforts to limit traffic noise in residential areas involve the construction of highway noise barriers by the Minnesota Department of Transportation (MnDOT).

In April 2013, the Legislative Audit Commission directed the Office of the Legislative Auditor to evaluate MnDOT's noise barrier policies. Our evaluation addressed the following questions:

- **What policy choices has MnDOT made regarding noise barriers on federal projects and how do these choices compare to those made by other states?**
- **How does MnDOT prioritize state-funded noise barrier projects on existing highways? Does MnDOT's approach unduly favor some projects over others?**
- **Do MnDOT's noise barrier maintenance activities adequately address needed repairs and replacement?**

To answer these questions, we reviewed federal regulations, Minnesota laws and rules, Minnesota's federally approved traffic noise abatement policy, and the policies of nine selected comparison states. We also conducted brief telephone interviews with noise policy staff in the selected comparison states.

We spoke with MnDOT noise policy staff, particularly in MnDOT's Metro District (which administers agency activities in Anoka, Carver, Chisago, Dakota, Hennepin, Ramsey, Scott, and Washington counties). We also spoke with other MnDOT staff, including project engineers, environmental specialists, maintenance supervisors, and administrators familiar with project financing. In addition, we sent a brief questionnaire to the county engineers of the eight counties listed above and interviewed several other stakeholders, including noise and air quality staff at the Minnesota Pollution Control Agency.

We reviewed a number of agency documents regarding MnDOT's noise abatement activities, including a large 2012 study of older noise walls and the 1997 study on traffic noise that led to the creation of MnDOT's state-funded noise barrier program.¹ We also analyzed the spreadsheet formulas that underlie MnDOT's prioritization of state-funded noise barrier projects. Finally, we

¹ As we discuss in Chapter 2, noise barriers built on federally funded projects usually include some state funding. In this report, we use the shorthand "state-funded projects" to refer to projects that do not use federal funding or require federal approval. Some of these projects also receive local funding.

examined noise analyses and financial data from all projects let for bids in the last decade that included a noise barrier component.

We limited our evaluation to MnDOT's activities. Local jurisdictions are also bound by federal and state regulations, and some have built noise barriers on locally managed projects as a result. However, we did not look at their activities; most noise barriers in Minnesota are built by MnDOT. Further, although we briefly discuss other possible methods of noise reduction in our background chapter, we focused on noise barriers. We did not, for example, evaluate whether MnDOT is appropriately building noise barriers in comparison to other possible alternatives, such as reducing speed limits or more strictly enforcing truck noise-emission limits. Lastly, we examined only efforts to address traffic noise. We did not evaluate any issues related to aircraft noise or noise from any other source.

Background

Highway noise is a function of vehicle speeds, traffic levels, and the ratio of heavy trucks to other vehicles.

Both state and federal laws require the Minnesota Department of Transportation (MnDOT) to evaluate and, if necessary, mitigate the long-term environmental effects of road construction projects. One such effect is noise, defined simply as unwanted sound. Highway changes that allow more traffic or faster traffic also allow that traffic to produce more noise. Traffic noise can interfere with sleep, work, and leisure, and is associated with increased risks for some health conditions.

Below, we provide a brief introduction to what causes traffic noise, how noise is measured, and the steps that can be taken to limit its effects. We then describe federal and state legal requirements that affect the management of highway noise in Minnesota and conclude with an overview of state agencies' work in this policy area.

CHARACTERISTICS OF TRAFFIC NOISE

Traffic noise is mostly a combination of engine, tire, and exhaust noise. Its loudness is a function of several factors: how close the listener is to the roadway, how many vehicles are on the roadway, how fast they are traveling, and the proportion of traffic consisting of heavy trucks. However, each location has its own particular characteristics—for example, a steep hill may cause engines to work harder and make more noise. Noise levels are generally worse for locations within 500 feet of a highway. Locations farther away, or shielded from the highway by structures or natural features of the terrain, experience lower noise levels.

Noise is measured in decibels, a logarithmic unit.¹ The amount of perceived noise approximately doubles for every increase of 10 decibels. Thus, 70 decibels is twice as loud as 60 decibels, and 60 decibels is twice as loud as 50 decibels. Noise at 70 decibels is eight times louder than at 40 decibels. It is widely accepted that most people in everyday environments cannot distinguish sound level changes of less than 3 decibels. Exhibit 1.1 shows decibel levels for some everyday activities.

Increases in the amount of traffic are not always associated with increases in perceptible noise. Doubling the amount of traffic on a roadway increases the sound level by only 3 decibels, assuming that speed and the percentage of trucks remain the same. To increase road noise as much as 10 decibels (to become twice as loud), one would need approximately ten times the amount of traffic without decreasing speed.

¹ Because not all sounds can be heard by the human ear, traffic noise is usually measured on a weighted scale (the “A scale”), which prioritizes the sounds that can be heard by most humans. All uses of the term “decibels” in this report refer to decibels on the A scale.

Exhibit 1.1: Example Sound Levels

Source	Sound Level (in decibels)
Jet aircraft at 300 feet	130
Rock concert	120
Jet overflight at 1,000 feet	105
Jackhammer at 3 feet	100
Chainsaw at 3 feet	90
Garbage disposal at 3 feet	80
Vacuum cleaner at 10 feet	70
Common TV volume	60
Library	50
Empty theater	40
Secluded woods	30
Whisper	20
Recording studio	15

NOTE: Decibel levels shown are decibels on the “A scale,” a weighted measurement that prioritizes sounds that can be heard by the human ear.

SOURCES: Center for Environmental Excellence, “Noise,” http://www.environment.transportation.org/environmental_issues/noise/, accessed August 13, 2013; and Minnesota Pollution Control Agency, *A Guide To Noise Control in Minnesota* (St. Paul, 2008).

Analyzing Noise

The measurement of noise is a technical field involving specialized equipment and knowledge. Generally, sensors that measure noise are set up in several locations along a highway and noise levels are monitored during the loudest times of day. (The targeted times may not be during the heaviest traffic—when highways are congested, traffic slows and noise levels are reduced.) The measurements are fed into computer programs that not only estimate current noise levels, but also forecast noise levels for projected traffic conditions decades into the future.

We did not evaluate the quality of MnDOT’s noise measurements or the extent of its noise monitoring. Department staff told us that follow-up measurements taken shortly after noise barrier construction have shown that the barriers reduce as much noise as predicted, and often more. Such follow-up measurements have been relatively informal; there are no requirements or standard criteria for when or where they should be conducted.

Approaches to Abatement

Noise barriers are only one of several ways to reduce the levels of highway noise experienced on surrounding properties.

Effective Approaches

Planning appropriate land uses. The most straightforward way to limit traffic noise in residential areas is to avoid building highways next to residences or residences next to highways. However, highway planners generally have limited influence over local land-use decisions. To discourage the building of residences next to existing highways, both federal regulations and Minnesota policies specifically prohibit the funding of noise barriers for such residences unless the highway is later reconfigured or expanded.²

Changing road alignments. Roads can sometimes be routed farther away from nearby residences or the roadbed can be raised or lowered in ways that reduce noise levels. This method is usually limited to new road construction.

Reducing speeds or limiting traffic. Highway noise can be reduced by limiting travel speeds. However, this approach may not be popular with drivers, as illustrated by the continuing controversies surrounding the speed limit on Interstate 35E in the southern part of St. Paul. Noise can also be reduced by placing restrictions on truck traffic or changing traffic controls to limit decelerations and accelerations.

Insulating buildings. Buildings can be insulated to reduce the levels of sound experienced inside. Such insulation can be effective, but it is generally only considered appropriate for buildings that do not have areas of frequent outdoor use, such as hospitals or libraries. Federal regulations prohibit the use of federal funds to insulate residences against highway traffic noise.

Making vehicles quieter. The Federal Environmental Protection Agency issues noise emission standards for medium and heavy trucks, and states may set their own noise emissions standards for motor vehicles. The Minnesota Pollution Control Agency sets maximum noise emissions requirements for automobiles, motorcycles, and trucks.

Building noise barriers. Because the above approaches are usually unavailable or insufficient, noise barriers are the most commonly used form of highway noise abatement. Standard noise barriers do not diminish the overall amount of noise, but they do redirect noise away from nearby residences. Federal Highway Administration (FHWA) regulations require that states must, at a minimum, consider the use of noise barriers to meet federal noise mitigation requirements.

Ineffective or Unproven Approaches

Planting vegetation. Though trees and other vegetation between highways and nearby residences may be prized by local communities for aesthetic reasons, they usually do not provide meaningful noise reductions. It takes a strip of dense vegetation approximately 200 feet thick to provide a noise reduction of

Noise barriers are the most common method of reducing traffic noise.

² Both federal and state noise policies allow for exceptions if the construction in question happened long ago, before traffic noise policies were developed. Also, Minnesota may fund noise barriers if traffic noise did not exceed Minnesota daytime noise standards at the time of residential construction, but noise levels later increased.

10 decibels. Such a wide buffer is rarely available within the highway right-of-way controlled by MnDOT; further, it may take years for vegetation to grow dense enough to form an effective noise barrier. Planting of vegetation may have other beneficial effects, such as visual screening, privacy, and aesthetic enjoyment, but it cannot be used to satisfy federal or state noise abatement requirements.

Choosing alternative road surfaces. In 2010, FHWA concluded that not enough was known about the effectiveness of alternative pavements for the agency to approve their use for noise abatement on federal highway projects.³ However, research into quieter road surfaces is ongoing, and FHWA has recently invited suggestions from states and other stakeholders on whether to reconsider its approach, perhaps through pilot projects.⁴

NOISE BARRIERS

Noise barriers typically provide noise reductions of 5 to 10 decibels for residences immediately behind the barriers, thus cutting in half the level of perceived traffic noise in the best circumstances. Noise barriers provide the most noise reduction to residences within approximately 200 feet of the highway. Residences farther from the barriers receive less benefit, but their initial noise levels were likely also lower.

To be effective, barriers must stand between the source of the noise and the listener. Noise barriers are generally ineffective for homes on hillsides overlooking a highway or for the upper floors of multistory buildings. Houses near the end of a barrier generally get a smaller noise reduction than houses in the middle (if both are the same distance from the highway) because some noise comes around the end of the barrier. Similarly, openings in noise barriers to allow for intersecting streets, driveways, or other types of access reduce the barriers' effectiveness.

Materials/Types

Earthen berms. Earthen berms provide a “softer” surface than a wall, absorbing some noise and providing more attenuation than a wall of the same height. Since they are constructed of earth, they are much less expensive to build than any other type of noise barrier, and there are practically no ongoing maintenance costs. In fact, MnDOT has occasionally built noise-reducing berms where none were required because it was cheaper to use excavated dirt for this purpose than to haul it away. However, berms require a lot of space between the highway and nearby residences; thus, they usually cannot be constructed within the available highway right-of-way.

Noise barriers can cut traffic noise levels in half for nearby residences.

³ Procedures for Abatement of Highway Traffic Noise and Construction Noise, 75 *Fed. Reg.* 39,831 (2010).

⁴ Including Specific Pavement Types in Federal-Aid Highway Traffic Noise Analyses, 78 *Fed. Reg.* 26,847 (2013).

Standard noise walls.

When berms are not feasible, noise barriers consist of tall walls.⁵ States build noise walls using concrete, concrete blocks, wood, fiberglass, composites, and a variety of other materials.

**Absorptive walls.**

Some surfaces absorb noise better than others. While hard concrete and wood walls deflect noise in other directions, certain panel materials and surface treatments have been developed that enable noise walls to absorb some noise. Such walls are often used in areas where a noise wall shielding one group of residences may deflect sound toward another group of residences. A few states, such as Wisconsin, build all of their walls out of absorptive materials.

Specialized walls. Some specialized noise barriers exist for specific situations; for example, transparent noise barriers can be built when maintaining visibility is an important criterion. Two such barriers exist along Interstate 35W in Minneapolis where it crosses Minnehaha Creek.

Size

Noise barriers shield groups of residences; they would have little effect if built on a house-by-house basis.

Height. In order to disrupt the path of sound between vehicles and neighboring properties, noise barriers must be tall enough to block the line of sight to highway traffic. Taller noise barriers generally provide greater noise reductions than shorter barriers. MnDOT's noise policy sets a maximum height of 20 feet, and department staff told us that most walls are built to that height.⁶ MnDOT sometimes builds shorter walls due to technical limitations of the terrain, or because a 20-foot wall is too expensive and a shorter wall will still provide adequate noise reduction.

Length. Generally, noise barriers are built to shield groups of residences from traffic noise. Because of the leakage of noise around the ends of barriers, little useful sound reduction would be expected from barriers built on a house-by-house basis. Thus, a noise barrier is an all-or-nothing proposition—every residence in a cluster of houses is shielded by a single barrier or none are.

⁵ In this report, we use the term “barrier” to refer to any noise barrier, including earthen berms or berm/wall combinations. We use “noise walls” as a more specific term that does not include berms.

⁶ Walls built on bridges are generally no more than 10-feet tall due to engineering and safety constraints.

At both the federal and state level, noise standards allow higher noise levels on commercial and industrial properties than on residential properties. Due to these differences, barriers are rarely built to shield nonresidential areas from traffic noise. Usually, noise barriers stop at the point that residences end and a commercial, industrial, or undeveloped area begins.

LEGAL FRAMEWORK

Both federal and state laws regulate MnDOT's noise barrier activities. Minnesota law also assigns some noise barrier responsibilities to the Minnesota Pollution Control Agency (MPCA), though in practice its involvement is primarily advisory.

Federal Requirements

Beginning in 1970, federal law required FHWA to develop and enforce highway noise traffic standards.⁷ The standards, laid out in federal regulations, apply to all highway construction projects that use federal money or require federal approval ("federal projects").⁸ The federal regulations were most recently updated in 2010.

Applicability

Federal regulations are triggered for any federal project that (1) builds a new highway, (2) moves a highway in a way that substantially increases noise for nearby properties, or (3) adds a lane to an existing highway or otherwise increases traffic flow.⁹ Thus,

- **Because federal noise abatement regulations are triggered by construction projects, they do not affect existing highways—no matter how high the levels of noise—if no construction is planned.**

Enforcement of the regulations is tied to construction. In order for states to receive federal funding or approval for highway construction projects, those projects must follow federal noise regulations. Federal regulations do not require states to address noise levels on existing highways until the highways are expanded. Even if substantial increases in traffic flow over time increase noise levels, no abatement is required to meet federal noise requirements. However,

⁷ 23 *U.S. Code*, sec. 109(i) (2011).

⁸ 23 *CFR*, sec. 772.7(a) (2013). Highway projects that do not use federal funds but that require federal approval are rare. One current example is a planned new entrance ramp to Interstate 35W at 4th Street SE in Minneapolis. Although the project is funded entirely by state and local sources, FHWA approval is required to add an entrance or exit ramp to any interstate.

⁹ Specifically, the regulations are triggered by federal projects that add a through-traffic lane (including a lane that functions as a high-occupancy vehicle lane); add an auxiliary lane; add an interchange ramp; restripe existing pavement to create a through-traffic lane or auxiliary lane; or add a weigh station, rest stop, ride-share lot, or toll plaza. Federal regulations refer to projects that meet these criteria as "Type I" projects; we simply refer to projects that "expand" a highway. 23 *CFR*, sec. 772.5 (2013).

States must follow federal noise regulations to receive federal funding or approval for highway projects.

once expansion is planned, the federal regulations apply—even if no increase in noise is likely.

A Minnesota example can be found along Interstate 94 in Avon, which we also discuss in Chapter 3. Homes next to the highway experience noise levels well above both federal and state maximums. Federal regulations have not required the state to consider building a noise barrier in this area because there has been no construction project on this roadway that would trigger a noise analysis. However, if an additional lane were added to Interstate 94 at this location, MnDOT would be required to build a noise barrier to shield the neighborhood.¹⁰ Because current noise levels already exceed federal and state standards, it would not matter whether the lane addition would produce additional noise.

Criteria

Although the federal regulations set maximum noise levels, they do not require states to ensure those noise levels are met. In fact,

- **Federal regulations do not specifically require states to build noise barriers when noise levels are high—rather, they require states to set criteria for when barriers will be built and then consistently follow those criteria.**

Each state's criteria must be approved by FHWA. If a project meets those criteria, the state must build a noise barrier or find another way to abate the projected traffic noise (such as reducing the speed limit or prohibiting truck traffic). Thus, for federal projects, states cannot pick and choose which barriers to build based on political pressure, the availability of funding, or the preferences of department staff. Further, a state cannot use outside funding (for example, from local governments) to build barriers that would not otherwise be built. A state may, however, choose to set hard-to-meet criteria so that it builds very few noise barriers. Alabama, for example, had built no noise barriers at all as of 2010.

States set their own criteria for building noise barriers on federal projects.

FHWA requires states to set multiple criteria that combine together to determine whether noise abatement must be added to a federal project. Due to the complexity of the criteria, we do not attempt to explain all of them here.¹¹ However, we summarize some of the most important criteria below.

The minimum amount of noise reduction the barrier will provide. Federal regulations require states to set two criteria related to noise barrier effectiveness. The first is the minimum amount of noise reduction a residence must receive to

¹⁰ We assume that local residents and property owners would support noise wall construction in a voting process; MnDOT staff found that many residents supported a wall when preparing an unsuccessful funding application for this site.

¹¹ For a comprehensive discussion, see Federal Highway Administration, *Highway Traffic Noise: Analysis and Abatement Guidance*, FHWA-HEP-10-025 (Washington, DC, December 2011).

be “benefited” by the barrier.¹² The designation of benefited residences is important because cost-effectiveness calculations are based on the number of residences that receive the benefit. The second criterion is a “noise reduction design goal,” set between 7 and 10 decibels, for how well the barrier performs where it is most effective. Minnesota’s policy sets the lowest possible amount for each of these criteria.

The minimum number of residences that must receive the minimum noise reductions. For each of the two criteria described above, states define the number of residences that must receive that reduction for a barrier to be built. For example, a state could set its policy so that a noise barrier is built only if at least one residence meets the noise reduction design goal of at least 8 decibels and at least half of the residences are “benefited” by at least a 5-decibel reduction. Some states set these criteria so that the lower criterion becomes meaningless—Minnesota’s policy, for example, requires that at least one residence meet the design goal of a 7-decibel reduction and at least one residence (i.e., the same one) be benefited by receiving a 5-decibel reduction.

State-defined criteria include a maximum cost per residence and a certain level of public support.

The maximum cost allowable per benefited residence (or other cost-effectiveness figure). States must set a maximum noise barrier cost adjusted for the number of residences, so that the same cost standard can be used for both long walls that shield many residences and short walls that shield only a few homes. Although cost per residence is the most common approach used by states, FHWA regulations allow states to use other measures as well. Prior to 2011, for example, MnDOT used cost per decibel of sound reduction per residence. Currently, Minnesota’s maximum cost is \$43,500 per residence.

The level of public support required. When FHWA updated its noise abatement regulations in 2010, one of the most noteworthy changes was its requirement that states assess public support for noise barriers. The new regulations specifically required states to solicit the opinions of property owners and residents directly affected by the proposed barrier.¹³ In its discussion of this provision, the FHWA clearly indicated that states could not substitute the preferences of other stakeholders (such as local elected officials).¹⁴

Although federal regulations require states to seek the views of affected property owners and residents, they do not specify a required level of public support. States are required to define (with FHWA approval) how many responses are needed and how the responses will be tallied in order to reach a conclusion about

¹² Throughout this report, we often refer to all locations receiving noise reductions as “residences” for the sake of simplicity, and because houses, duplexes, apartments, and other residential buildings make up the vast majority of properties shielded by noise barriers in Minnesota. In fact, noise levels are measured and future noise reductions are predicted for all properties that would be shielded by a proposed barrier. However, federal and state noise policies treat properties with other uses (retail stores, libraries, playgrounds, etc.) differently from residences and different standards may apply.

¹³ In Minnesota, directly affected properties are those projected to receive at least a 5-decibel noise reduction from the proposed barrier.

¹⁴ “It is FHWA’s position that this provision prevents entities other than benefiting residents from vetoing noise abatement on public right-of-way.” Procedures for Abatement of Highway Traffic Noise, 75 *Fed. Reg.* 39,828 (2010).

the owners' and residents' support or opposition. We discuss Minnesota's implementation of this provision in greater detail in Chapter 2.

Technical feasibility. Notwithstanding the criteria above, a state is not required to build a noise barrier that otherwise meets its criteria if the barrier is not feasible or unreasonably costly due to topography, drainage, interference with utilities, access requirements, or other technical obstacles.

State Requirements

In addition to the federal regulations, Minnesota state laws and rules have several provisions that affect MnDOT's noise barrier activities. To begin with,

- **Unlike other states, Minnesota has its own noise standards applying to highway noise, which are stricter than the federal standards.**

Most states have simply adopted the maximum allowable noise levels set by FHWA. However, under Minnesota law, MnDOT must compare projected traffic noise levels not only to the federal standards, but also to state noise standards. According to FHWA officials, California is the only other state to use its own traffic noise standards in addition to the federal standards. Because of Minnesota's strict standards, a neighborhood can have noise levels below the federal threshold for noise abatement but still qualify for noise barriers because levels are above the state threshold.

MnDOT must consider both federal and state noise standards.

Minnesota law requires the Minnesota Pollution Control Agency (MPCA) to set maximum outdoor noise levels.¹⁵ These maximum noise levels apply to all noise, including industrial plants, rail yards, construction equipment, and even loud concerts. The law exempts highways from the state noise standards, but only "provided that all reasonably available noise mitigation measures...are employed to abate noise."¹⁶

Thus, MnDOT must take any reasonably available steps to reduce highway traffic noise levels until they meet state standards. If such steps are taken and the noise level still exceeds state standards, MnDOT and MPCA can jointly determine that the highway is exempt, and no further action needs to be taken.¹⁷ "Reasonably available" is not defined in law, and thus its meaning is left to agency interpretation.

In practice, MnDOT and MPCA have defined "reasonably available" noise measures to be those that meet the criteria set in MnDOT's noise policy. That is, if state noise standards are exceeded and a noise barrier would reduce sound levels, the noise barrier is reasonably available if it meets the sound reduction, cost, technical feasibility, and other criteria set by MnDOT's noise policy.

¹⁵ *Minnesota Statutes* 2013, 116.07, subd. 2(c). MPCA's noise standards are codified in *Minnesota Rules* 2013, 7030.0040.

¹⁶ *Minnesota Statutes* 2013, 116.07, subd. 2a.

¹⁷ *Ibid.*

The state noise standards set by MPCA differ from the federal standards in two ways. First, Minnesota uses a different approach to measuring noise. Rather than use the average noise level across the entire period monitored (the approach used by every other state), Minnesota's standards require sound to be measured for the peak six minutes in a one-hour period.¹⁸ Because of Minnesota's continuing use of this measurement, FHWA sets two federal noise standards—one based on the Minnesota measurement, and one based on the measurement all other states use. FHWA has noted that the measurement used by Minnesota "is not the most applicable metric to use on highway projects."¹⁹

Second, Minnesota's maximum noise levels are dramatically lower than the FHWA level of 70 decibels for residential areas.²⁰ Minnesota's maximum allowable noise levels for residential areas are 65 decibels in the daytime and 55 decibels at night (defined as 10 p.m. to 7 a.m.).²¹ Since the time period for the lower night standard includes a portion of the morning rush hour, MnDOT staff said that most residences near a highway in the metropolitan area experience noise levels that exceed state standards, whether shielded by a noise barrier or not.

STATE AGENCIES

As required by federal regulations, MnDOT has developed a state traffic noise policy, most recently updated in 2011. The noise policy applies to all roads built by MnDOT with state or federal funds. It spells out the criteria under which MnDOT will build barriers; we discuss these criteria further in Chapter 2. By federal regulation, MnDOT must consistently implement this noise policy statewide. Local units of government must follow the same criteria as MnDOT when they serve as the project sponsors of federal projects.

MnDOT has a separate state noise barrier program to build barriers on existing highways.

In addition to the noise analyses and noise barrier construction associated with federal projects, MnDOT's Metro District also has a small program to build "stand-alone" barriers.²² These barriers are built to address existing noise levels. Unlike the barriers built due to federal regulations, they have no connection to roadway construction projects. The program does not use federal funding and thus is not required to follow federal regulations. We summarize the differences between barriers built under this program and barriers built on federal projects in Exhibit 1.2.

¹⁸ Minnesota also uses another measurement based on the loudest 30 minutes in a one-hour period. No other state uses this measurement for highway noise, and FHWA has set no standards using this measurement.

¹⁹ Procedures for Abatement of Highway Traffic Noise, 75 *Fed. Reg.* 39,822 (2010). MnDOT staff noted that Minnesota's choice of measurements is based on a study conducted for MPCA in the early 1970s.

²⁰ All noise levels in this paragraph use Minnesota's method for measuring noise.

²¹ *Minnesota Rules* 2013, 7030.0040. The maximum levels we cite here use the measurement based on the loudest 6 minutes in a one-hour period (which is directly comparable to federal levels). The rule also sets a maximum level based on the loudest 30 minutes in a one-hour period.

²² MnDOT divides the state into eight districts. Most day-to-day operations, including highway construction projects, are managed at the district level. Metro District includes Anoka, Carver, Chisago, Dakota, Hennepin, Ramsey, Scott, and Washington counties.

Exhibit 1.2: Types of Noise Barrier Projects in Minnesota

	Federal Projects	State Projects
Locations	Statewide	Twin Cities metropolitan area
Possible funding sources	Federal, state, local	State, local
Scope of project	Noise barrier is part of a larger highway construction project	Noise barrier is main purpose of project
Developer of noise abatement criteria	State, with approval by Federal Highway Administration	State
Initial eligibility	Larger project meets federal criteria for conducting a noise analysis	Location meets state criteria to be placed on priority ranking list
Threshold for barrier to be proposed	Noise analysis shows one or more barriers will meet state criteria	Project reaches top of priority list and analysis confirms barrier meets state criteria
Required public support	Voting by property owners and residents who will receive a noise reduction	City council approval

NOTES: The state projects we refer to above are “stand-alone” projects, where a noise barrier is built without any associated changes to the highway. Because MnDOT’s noise barrier policy applies to all projects under MnDOT authority, a state highway construction project without any federal involvement could also trigger the construction of noise barriers under the process in the first column.

SOURCE: Office of the Legislative Auditor.

The state program builds noise barriers only in the eight-county Twin Cities metropolitan region.

Metro District funds stand-alone barriers using monies allocated to MnDOT districts to spend on district-level priorities. As a result, stand-alone barriers are only built within the eight counties Metro District comprises. No other MnDOT district has chosen to use discretionary funds on noise barrier construction. We discuss these barriers in greater detail in Chapter 3.

MnDOT is also responsible for maintaining all noise barriers it has built over time. Once a fairly minimal responsibility, maintenance needs have increased as the first walls built in the state (in the 1970s) have aged beyond their expected lifespan. We discuss MnDOT’s maintenance of noise walls in Chapter 4.

MPCA currently plays a very minor role in the analysis of highway noise and noise abatement planning. In recent years, MPCA has assigned only one or two staff people to address noise issues, and that work has made up only a fraction of their overall responsibilities. These staff review some project plans to ensure that MnDOT is following its MPCA-endorsed noise policy. MPCA staff have been satisfied with MnDOT’s adherence to the noise policy and have raised few concerns.

Federal Projects

MnDOT has built noise barriers on federally funded highway projects since the 1970s.

As explained in Chapter 1, federal traffic noise regulations govern all construction projects that use federal funding or need federal approval to build, expand, or reconfigure highways. The federal regulations allow each state to determine its own criteria, subject to federal approval, for building noise barriers as part of such projects. In Minnesota, those criteria were developed by the Minnesota Department of Transportation (MnDOT). In this chapter, we describe MnDOT's policy choices in implementing the federal regulations and compare these choices to those made by other states.

HISTORY

Minnesota has built barriers tied to federally funded or federally approved highway construction projects ("federal projects") since the 1970s. Our review of MnDOT's recent activities found that:

- **From 2007 to 2012, MnDOT solicited bids for 13 highway construction projects that included new noise barriers.**

Information on each of these projects is displayed in Exhibit 2.1.¹ The smallest noise barrier installation was the upgrading of a single existing wall from 10- to 20-feet high along Highway 169 in Osseo. The largest installation was 10 new walls for the "Crosstown Commons" project at the intersection of Interstate 35W and Highway 62 in Minneapolis and Richfield; that project also removed and replaced 11 existing walls that lay within the construction area. All of the barriers built in this time period were located in the Twin Cities metropolitan area.² Most barriers were noise walls, but two projects—the construction of Highway 610 and the reconstruction of three Highway 169 interchanges in Bloomington, Eden Prairie, and Edina—used walls built on top of earthen berms.

Minnesota has been very active in building noise barriers compared with other states. Using data compiled by the Federal Highway Administration (FHWA), we compared states' noise barrier construction records from 1995 to 2010, as shown in Exhibit 2.2. In that period, Minnesota ranked seventh among all states in the linear miles of noise barriers constructed on federal projects when levels of federal spending were taken into account.

¹ If a barrier must be demolished because it is in a construction area, MnDOT's standard practice is to replace the barrier with a new one shielding the same residences. The numbers in Exhibit 2.1 and the funding numbers in the next section include only new noise barriers in locations where no barrier existed previously. Some projects include both new barriers and replacement barriers.

² The last noise barriers built outside the metropolitan area were constructed in 2005 in Rochester as part of the expansion of Highway 52.

Exhibit 2.1: Noise Barriers Built on Federal Projects, 2007-2012

Project	Project Location	Year ^a	Number of Barriers	Total Length (in feet)	Construction Cost from Winning Bid ^b (in thousands)	Number of Residences Benefited by Barriers
Interstate 35W – Highway 62 “Crosstown Commons” reconstruction	Minneapolis, Richfield	2007	10	20,518	\$7,699	409
Highway 65 – 125th Avenue interchange	Ham Lake, Blaine, Coon Rapids	2007	6	11,001	574	189
Highway 212 – expansion	Eden Prairie, Chanhassen, Chaska	2007	9	15,780	3,800	165
Highway 169 – 85th Avenue N interchange ^c	Brooklyn Park, Osseo	2008	1	2,554	952	16
Interstate 35W – MnPASS lane	Minneapolis	2009	9	11,136	2,366	220
Highway 10 – lane addition	Coon Rapids	2009	1	3,385	1,114	62
Highway 169 – Interstate 494 and two other interchanges	Bloomington, Edina, Eden Prairie	2010	1	1,185	1,258	20
Interstate 494 – lane addition	Woodbury, Maplewood	2010	1	3,120	931	42
Highway 610 – construction	Maple Grove	2010	7	13,856	4,395	186
Interstate 94 – lane addition	Minneapolis, St. Paul	2011	4	5,183	1,667	82
Interstate 35W – MnPASS lane extension	Burnsville	2011	2	11,300	4,034	140
Highway 169 – 93rd Avenue N interchange	Brooklyn Park, Osseo	2012	1	1,118	348	11
Interstate 35E – Cayuga Street interchange	St. Paul	2012	2	2,390	951	26

NOTES: Costs are not adjusted for inflation. Barriers shown above represent only those walls built where no barrier previously existed; some of these projects also involved the replacement of existing barriers due to construction needs.

^a Because highway construction projects have such long timelines, we chose the year that MnDOT solicited bids for a project as the best date for comparison. However, for the two design-build projects (Highways 212 and 610), we use the approximate date of noise barrier construction. In design-build projects, the bidding process often takes place several years prior to actual construction.

^b Noise barrier construction was not bid separately; the winning bid was the low bid for the entire highway construction project. The lowest bid for the entire project may not have offered the lowest bid for noise barrier portion. Construction cost is only the cost of building the barrier itself, and does not include related expenses such as clearing vegetation or traffic control.

^c This wall replaced an existing wall, but the replacement wall was twice the height of the old one and provided a much greater noise reduction. Hence, we count it as a “new” wall.

SOURCE: Office of the Legislative Auditor, analysis of Minnesota Department of Transportation data.

Exhibit 2.2: Noise Barrier Construction by All States on Federal Projects, 1995-2010

Minnesota ranked seventh in noise barriers constructed on federal projects.

State	Combined Noise Barrier Length (in miles)	Total Federal Highway Administration Expenditures (in billions)	Miles of Barriers per Billion Dollars of Federal Funding
Utah	51.3	\$ 3.3	15.8
Arizona	89.4	6.5	13.8
Virginia	83.3	8.7	9.6
Ohio	117.4	13.4	8.8
Colorado	43.6	5.2	8.4
Nevada	18.5	2.8	6.5
Minnesota	43.3	6.7	6.4
Washington	47.8	7.5	6.4
Indiana	46.9	9.1	5.2
Oregon	23.2	4.9	4.7
New Hampshire	8.3	2.0	4.2
Maryland	27.5	6.7	4.1
Florida	78.0	19.5	4.0
New Mexico	12.6	3.6	3.5
Missouri	29.5	9.5	3.1
Idaho	8.9	3.0	3.0
California	90.2	33.5	2.7
New York	49.3	19.3	2.5
Louisiana	16.2	7.0	2.3
Pennsylvania	35.8	16.4	2.2
North Carolina	19.1	11.0	1.7
Illinois	21.0	12.8	1.6
Texas	44.8	29.8	1.5
Georgia	14.0	11.7	1.2
Oklahoma	6.6	5.8	1.1
Hawaii	2.5	2.2	1.1
Michigan	12.3	11.8	1.0
Iowa	4.8	4.7	1.0
Connecticut	5.5	6.1	0.9
Tennessee	6.8	7.8	0.9
Nebraska	2.4	2.9	0.8
New Jersey	8.0	9.7	0.8
Kansas	3.3	4.4	0.7
Massachusetts	5.8	9.8	0.6
Alaska	2.3	4.6	0.5
Wisconsin	3.5	7.6	0.5
North Dakota	1.0	2.6	0.4
Maine	0.7	2.1	0.3
Montana	0.8	4.0	0.2
Arkansas	1.0	5.1	0.2
Mississippi	1.2	5.9	0.2
Kentucky	0.9	6.5	0.1
South Carolina	0.5	6.2	0.1

NOTES: Federal Highway Administration expenditure totals are not adjusted for inflation. Alabama, Delaware, Rhode Island, South Dakota, Vermont, West Virginia, and Wyoming did not build any noise barriers on federal projects during this period. Expenditure data is for federal fiscal years 1995-2010, except that expenditure data for fiscal year 2007 was unavailable.

SOURCE: Office of the Legislative Auditor, analysis of Federal Highway Administration data.

**We compared
MnDOT's noise
barrier policies
with those of nine
other states.**

CURRENT POLICY

As explained in Chapter 1, FHWA published new noise abatement regulations in 2010 and required each state to rewrite its criteria for building noise barriers associated with federal highway projects.³ We compared MnDOT's new noise policy to the policies of nine other states: Colorado, Illinois, Maryland, Michigan, New Hampshire, New York, Ohio, Pennsylvania, and Wisconsin. We chose comparison states based on the following criteria: (1) states that completed at least 50 noise barrier projects from 1980 to 2010, (2) states that built at least 10 noise barrier projects on existing highways during that time, (3) states that built at least some walls out of wood since 1980, and (4) states that routinely experience humid summer weather and snowy winter weather. Not all of our comparison states met all criteria; all are true of Minnesota.

We found that:

- **Compared to the nine states we selected for comparison, Minnesota will build some noise barriers that other states would not.**

As discussed in Chapter 1, FHWA requires states to establish criteria that, when taken together, determine whether a noise barrier will be built. Seen as a whole, Minnesota's criteria are easier to meet than those of the other states we analyzed. Thus, under the same circumstances, Minnesota noise policies are more likely to require that a barrier be built than the policies of the other states we examined. In comparison to the other nine states, Minnesota's policies include, for example: (1) separate, stricter state noise standards; (2) a relatively high allowable cost per residence; (3) a relatively low assumed cost per square foot of wall; and (4) relatively low thresholds for how much noise reduction a barrier must provide.⁴

Exhibit 2.3 demonstrates the combined effect of these and other criteria by comparing how states would assess a hypothetical proposed wall 20-feet high and one-quarter mile long. Assuming that there were no technical obstacles or community opposition, Minnesota's noise criteria would require such a wall to be built for 13 or more residences if all residences received a 7-decibel reduction. Among the comparison states, only Maryland would build a noise wall of this size for fewer residences at this noise reduction level.

Although Exhibit 2.3 suggests that Maryland, Minnesota, New York, and Pennsylvania are closely matched among the states more likely to build barriers, Minnesota would actually build barriers in circumstances where the three other states would not. Minnesota requires that only one residence receive at least a 7-decibel reduction in order to build a barrier, assuming that the cost per residence is acceptable. Maryland and New York require that half of the affected residences receive a 7-decibel reduction.

³ Procedures for Abatement of Highway Traffic Noise and Construction Noise, 75 *Fed. Reg.* 39,831 (2010), codified in 23 *CFR*, sec. 772 (2013).

⁴ We described Minnesota's stricter noise standards in Chapter 1.

Exhibit 2.3: Minimum Number of Residences That Must Receive Noise Reductions for a Noise Wall to be Built Under Selected States' Criteria, 2013

For a hypothetical 20-foot tall, quarter-mile long noise wall associated with a federal highway project:

State	Minimum Number of Residences	
	If Wall Provides a 7-Decibel Sound Reduction	If Wall Provides a 10-Decibel Sound Reduction
Maryland	10	10
Minnesota	13	13
New York	14	14
Pennsylvania	14	14
Wisconsin	no wall	16
New Hampshire	18	18
Illinois ^a	no wall	18-28
Colorado	25	18
Ohio	19	19
Michigan	no wall	28

NOTES: We assumed that (1) all locations affected by noise are residences, (2) all residences received the same decibel reduction, and (3) there are no unusual construction circumstances. Some states listed above frequently build noise walls shorter than 20-feet high; shorter barriers generally provide less noise reduction. Decibel levels shown are decibels on the "A scale," a weighted measurement that prioritizes sounds that can be heard by the human ear.

^a In Illinois, the minimum number of houses varies depending on whether optional criteria are met.

SOURCE: Office of the Legislative Auditor, analysis of state noise policies.

Minnesota's strict noise standards cause MnDOT to build barriers that other states would not build.

Further, Minnesota's separate state noise standards would prompt it to build barriers in circumstances where all nine comparison states would rule that the highway noise is below the federal threshold. Of the 54 noise barriers shown in Exhibit 2.1, 12 were built in locations not projected to exceed the maximum acceptable noise levels defined in federal regulations.⁵

FUNDING

On federal projects, all funding sources are merged to provide financing for the overall project. Thus, the percentages of local, state, and federal funding going toward noise barrier construction are generally the same as the percentages for road paving or any other part of the project. The state's share of funding for highway construction projects is generally between 10 and 20 percent of the total project cost.

Including funding from all sources, MnDOT spent approximately \$30 million constructing new noise barriers for the 13 projects listed in Exhibit 2.1, not

⁵ In some of the comparison states, a few of these 12 walls would have been built due to a separate state-defined criterion for the increase in noise from pre-construction levels, which applies even if the federal threshold is not exceeded.

adjusting for inflation.⁶ For large projects, noise barriers usually made up a small portion of total project costs. For example, noise barrier construction costs for the Interstate 35E/Cayuga Street interchange in St. Paul were approximately \$951,000, less than 1 percent of the winning bid of \$116 million. On smaller projects, though, noise barrier costs may constitute a substantial portion of the whole. For the expansion of MnPASS lanes in Burnsville, noise wall costs of approximately \$4.0 million constituted 28 percent of the project's total \$14.6 million cost.

MEASURING PUBLIC SUPPORT

Prior to 2011, MnDOT's noise policy contained no formal mechanism for the assessment of public support, although it required MnDOT to "give the highest consideration to the concerns and noise reductions of" affected property owners and residents.⁷ MnDOT did require formal city council approval for barriers to be built. In recent years, increasing numbers of city councils have decided against noise barriers, as we describe further in Chapter 3.

In 2010, federal regulations regarding the measurement of public support changed, and states had to adjust their policies accordingly. Under the new regulations, FHWA required states to:

...solicit the viewpoints of all of the benefited receptors and obtain enough responses to document a decision on either desiring or not desiring the noise abatement measure.⁸

As a result, MnDOT's 2011 noise policy changed how local opinion should be assessed for federal projects. On reviewing MnDOT's new policy, we found that:

- **MnDOT's procedure for assessing public support favors the building of noise barriers.**

Under Minnesota's policy, each residence receives a certain number of votes based on its proximity to the proposed barrier. If the residence is not owner-occupied, the residence's votes are split between the renter and the owner. A barrier is built unless more than 50 percent of all possible votes (not just those that are cast) oppose its construction. This method of vote counting has the effect of treating all nonvotes as votes in favor of the proposed noise barrier.

⁶ We estimated the noise barrier construction costs shown in Exhibit 2.1 by looking at the amounts specified for noise barrier construction in the detailed bids submitted by contractors. Although final costs may change after the bidding process, MnDOT staff told us that contract amendments based on noise barrier costs are rare. Our cost figures include only the construction of the walls themselves; associated costs, such as traffic control and clearing vegetation, are not included.

⁷ Minnesota Department of Transportation, "Old MnDOT Noise Policy for Type I and Type II Federal-aid Projects as per 23 CFR 772," <http://www.dot.state.mn.us/environment/noise/policy.html>, accessed August 9, 2013.

⁸ 23 CFR 772.13, sec. d(2)(i) (2013). "Benefited receptor" is a term meaning a property that would receive at least a 5-decibel noise reduction from the construction of a wall.

Federal regulations require MnDOT to assess public support for noise barriers.

MnDOT's vote-counting process assumes that all nonvoters support building a noise barrier.

The MnDOT noise policy does not require that potential voters be informed that not voting is, in effect, a vote in favor of a noise barrier. In fact, a sample notification letter included in the MnDOT noise policy makes no mention of how votes are counted, nor does it indicate that votes cast in opposition can essentially be outvoted by those who do not vote at all.

In Exhibit 2.4, we show how this method for counting votes and nonvotes has produced different percentages than would be obtained by simply counting the votes received. For example, in a noise wall vote connected with a federal project on Highway 100 in St. Louis Park, votes cast were evenly split between supporters and opponents of a proposed noise wall.⁹ However, nonvotes dwarfed the 50 percent of votes cast opposing the wall. MnDOT's vote-counting method ascribed only 9 percent to wall opponents, and the wall will be built.

Exhibit 2.4: Voting Outcomes for Federal Projects, 2011-2013

Barrier	Barrier Location	Voting Turnout (by votes)	Percentage of Votes Cast Opposing Barrier	MnDOT's Count of Percentage Opposing Barrier	Outcome
Highway 100 lane addition, Wall E	St. Louis Park	90%	100%	90%	Do not build
Interstate 35W entrance ramp, Wall G	Minneapolis	57	100	57	Do not build
Interstate 35W entrance ramp, Wall I	Minneapolis	78	92	72	Do not build
Interstate 35W entrance ramp, Wall E	Minneapolis	60	91	55	Do not build
Highway 100 lane addition, Wall A2	St. Louis Park	68	78	53	Do not build
Interstate 35W entrance ramp, Wall F	Minneapolis	76	76	58	Do not build
Interstate 494 auxiliary lane addition, Wall C	Richfield	77	68	53	Do not build
Highway 100 lane addition, Wall G	St. Louis Park	18	50	9	Build
Highway 100 lane addition, Wall B	St. Louis Park	60	37	22	Build
Highway 100 lane addition, Wall C	St. Louis Park	63	34	22	Build
Highway 100 lane addition, Wall F	St. Louis Park	70	15	11	Build
St. Croix River bridge	Oak Park Heights	41	0	0	Build
Highway 169 interchange at 93rd Avenue	Osseo	19	0	0	Build
Highway 10 interchange at Country Road 2	Rice	61	0	0	Build
Interstate 94 auxiliary lane	Monticello	67	0	0	Build
Interstate 35W entrance ramp, Wall K	Minneapolis	(still voting as of October 1, 2013)			
Interstate 35W entrance ramp, Wall L	Minneapolis	(still voting as of October 1, 2013)			

NOTES: All figures above refer to percentages of votes, not voters. Many voters cast more than one vote because each residence receives multiple votes. The votes are divided between owners and residents; an owner-resident casts all the votes for a particular residence. An individual owning multiple residences near a barrier (such as an apartment building owner) receives votes for each unit owned that would get a noise reduction benefit. "MnDOT's Count" is the percentage of all possible votes, not just of votes cast, that oppose a barrier.

SOURCE: Office of the Legislative Auditor, analysis of Minnesota Department of Transportation data.

⁹ The examples discussed in this section do not appear in Exhibit 2.1 because MnDOT did not solicit bids for these projects before the end of 2012.

A recent controversy over noise walls in Minneapolis centered on MnDOT's method of vote counting. Because an analysis showed that noise walls would meet the criteria in MnDOT's noise policy, MnDOT and Hennepin County were required to propose noise walls as part of a federal project to build an entrance ramp on Interstate 35W at 4th Street SE in Minneapolis. Community activists opposed to the walls were unhappy that the voting process would count nonvotes as votes supporting the walls. They contended that neighborhoods near the proposed walls contained a lot of student housing, and that many students were unlikely to vote. Acknowledging that these neighborhoods presented unusual challenges, MnDOT and the county suspended their first public information and voting process on this project and started again from scratch to ensure the highest possible response rate from property owners and residents.

Despite this restarted process and outreach efforts by community organizations, many potential voters did not vote, as can be seen from Exhibit 2.4. For one wall—"Wall E"—91 percent of the votes cast opposed construction of the wall. But due to the large number of nonvotes, opponents won only a narrow victory with 55 percent of the possible votes.

In every MnDOT voting process save one, less than 80 percent of the available votes have been cast; the average percentage has been 60 percent. Under MnDOT's policy, a voting process with 60-percent turnout would mathematically require that more than 83.3 percent of those voting oppose a wall to prevent it from being built. In some instances, turnout has been very low. Only 2 of 11 possible voters cast votes regarding a proposed noise wall on Highway 169 in Osseo. For a proposed noise wall in Monticello, 67 percent of the possible votes were cast, but they were all cast by a single voter, the owner of an apartment building.

MnDOT's method of vote counting is not required by federal regulations.

MnDOT's vote-counting procedure is a state choice, not a federal policy. There is no federal requirement to count votes in this manner, and most other states have chosen different methods. FHWA staff told us Minnesota's approach to counting votes was unlike nearly all other states. Of the nine comparison states whose noise policies we examined, eight did not count nonvotes, as is shown in Exhibit 2.5. In fact, most will only build a noise barrier if a majority of the votes cast *support* construction.

RECOMMENDATION

MnDOT should change its procedure for assessing public support for noise barriers on federal projects.

MnDOT has not, so far, built a noise barrier where a majority of votes cast opposed the barrier. However, it has nearly done so several times. On one of the walls proposed on Interstate 35W in Minneapolis—"Wall G"—100 percent of the votes cast opposed its construction. However, the votes were barely sufficient to prevent the wall from being built; had two less people voted, MnDOT would have built the wall because the nonvotes would have equaled or outnumbered the 100-percent opposition among those voting. Nonvotes have

Exhibit 2.5: Thresholds of Voting Support Needed to Build a Noise Barrier in Selected States, 2013

State	Default Action	Threshold of Support Needed	
New York	Do not build	Build only if at least 50 percent of potential votes are cast and more than 50 percent of votes cast favor construction.	Less likely to build ↑ ↓ More likely to build
Illinois	Do not build	Build only if at least 33.3 percent of potential votes are cast and more than 50 percent of votes cast favor construction.	
Colorado	Do not build	Build only if more than 50 percent of votes cast in two separate ballots favor construction.	
Ohio	Do not build	Build only if more than 50 percent of votes cast favor construction.	
Wisconsin	Do not build	Build only if more than 50 percent of votes cast favor construction.	
Pennsylvania	Do not build	Build only if more than 50 percent of votes cast favor construction.	
New Hampshire	Do not build (unless no vote)	Build if no opposition is voiced during initial public information period (no vote). Otherwise, build only if at least 51 percent of potential votes favor construction.	
Maryland	Build	Build unless more than 50 percent of votes cast oppose construction, except if all opposing votes are cast by a single individual.	
Michigan	Build	Build unless more than 50 percent of potential votes oppose construction.	
Minnesota	Build	Build unless more than 50 percent of potential votes oppose construction.	

NOTE: Procedures apply to noise barriers built as part of federal projects. We assume that potential walls meet all other state-defined criteria for construction.

SOURCE: Office of the Legislative Auditor, analysis of state noise policies.

Most other states we examined build a barrier only if a majority of votes support it.

consistently made up a significant portion of the total available votes, requiring wall opponents to assemble supermajorities in order to block walls. MnDOT should reassess whether its process for counting votes accurately reflects the preferences of property owners and residents, develop a new voting procedure, and submit the revised policy for FHWA approval.

In addition, MnDOT should consider taking steps to address the very low voter turnouts that have sometimes occurred. We noted that some states have instituted a requirement for a minimum response rate from voters—for example, as shown in Exhibit 2.5, New York will only build a noise barrier if at least 50 percent of potential votes are cast and more than 50 percent of those votes favor construction. Illinois requires a 33.3 percent response rate. Although we are intrigued by this approach, we are also cautious. Requiring a minimum response rate could be particularly burdensome for a large project like the “Crosstown Commons” reconstruction, which involved 21 noise walls affecting more than 600 residences.

However, MnDOT could set a target for the percentage of responses to be received in noise barrier voting without instituting a formal requirement. A target would prompt MnDOT project managers to pursue additional outreach efforts when initial voting response is poor. It could also provide a clearer standard of due diligence for project managers in contentious situations.

State Projects

In Minnesota, federal funding is used to build noise barriers only when there is an associated road construction project. Thus, in Minnesota, there is a clear distinction between noise barriers connected to federal projects and barriers built at the state's initiative. Noise barriers built on federal projects are always one part of a larger road construction project. For most state projects, barriers are built next to highways where no roadway changes are made ("stand-alone" noise barriers).

HISTORY

Minnesota first began building noise barriers next to existing highways in 1975, after the Legislature directed the Minnesota Department of Transportation (MnDOT) to build such barriers and allocated funds for this purpose from the motor vehicle gas tax.¹ However, the Legislature removed the funding and suspended this program within three years.² From 1980 to 1994, no stand-alone noise barrier projects were initiated along existing highways, though MnDOT continued to build new noise barriers associated with federal projects.

In 1995, the Legislature directed MnDOT to conduct a study of noise levels along Minnesota highways.³ In response, MnDOT issued a report in 1997 that identified 571 residential areas where daytime noise levels exceeded Minnesota state standards.⁴ MnDOT estimated that 48 metropolitan-area locations and 6 greater-Minnesota locations had noise levels and residential densities high enough that noise abatement would be cost-effective under the MnDOT noise policy then in effect. The study ranked all of the locations using a complicated formula to place at the top of the list those locations where noise barrier projects would provide the most noise reduction to the most residences at the lowest cost.

MnDOT initiated a state noise barrier program in 1997.

When the study was released, MnDOT Metro District made a commitment to use district discretionary funds to build noise barriers in the first seven residential areas on the priority list over the next few years. No other MnDOT district made a commitment to fund noise barriers. Since the release of the 1997 report and the initial financial commitment, MnDOT Metro District has continued to set funds aside each year (currently \$2 million) for state-funded noise barriers under the MnDOT Metro District Highway Noise Abatement Program. As we show in Exhibit 3.1, MnDOT Metro District built eight stand-alone noise walls on existing roads from 2007 to 2012.

¹ *Laws of Minnesota* 1975, chapter 203, sec. 20.

² *Laws of Minnesota* 1977, chapter 454, secs. 13 and 49; *Laws of Minnesota* 1978, chapter 791, sec. 19.

³ *Laws of Minnesota* 1995, chapter 265, art. 2, sec. 16.

⁴ Minnesota Department of Transportation, *Minnesota Highway Noise Abatement Study: Legislative Report* (St. Paul, 1997).

Exhibit 3.1: Stand-Alone Noise Barrier Projects, 2007-2012

Project Location	Year	Number of Barriers	Total Length (in feet)	Construction Cost from Winning Bid (in thousands)	Number of Residences Benefited by Barriers
Interstate 35W, west of Sunset Avenue, Blaine	2007	1	1,783	\$ 528	19
Interstate 694, north of 40th Street, Oakdale	2008	1	1,752	499	20
Interstate 694, north of 15th Street, Oakdale	2008	1	2,192	625	31
U.S. Highway 10 near Long Lake Road, Mounds View	2008	1	856	289	unclear
Highway 280, north of Larpenteur Avenue, Lauderdale	2008-09	1	2,975	1,137	22
Interstate 35W east of Sunset Avenue, Lino Lakes	2009	1	2,382	697	31
Highway 169 from 36th Avenue N to Rockford Road, New Hope	2011	1	3,261	1,118	39
Interstate 35E near Meadowlark Road, Eagan	2011	1	1,447	442	51

NOTES: "Stand-alone" barriers are built on existing highways with no associated changes to the highway. Costs are not adjusted for inflation. Only barrier construction costs are included; associated costs, such as traffic control and clearing vegetation, are omitted. Year is the date that MnDOT solicited bids for the project.

SOURCE: Office of the Legislative Auditor, analysis of Minnesota Department of Transportation data.

CURRENT POLICY

MnDOT ranks potential noise barrier locations on a priority list.

MnDOT Metro District has continued to update the priority ranking list first introduced as part of the 1997 study. Each time the list has been updated, there have been changes. The availability of better data has altered the rankings of some locations.⁵ Locations are removed from the list if they receive noise barriers, either through state or federal projects. Some locations have been removed from the list because local communities did not support noise barriers (as occurred, for example, along Interstate 94 in the Rondo neighborhood of St. Paul). Finally, as MnDOT Metro District receives complaints about noise, it assesses new locations, determines their ranking, and adds them to the list at the next update.

There are currently 284 locations on Metro District's noise barrier priority list. Available funding enabled Metro District to build only eight state-funded noise barrier projects in the past six years. Thus, locations very far down on the list are unlikely to receive a state-funded noise barrier for decades.

Not all metropolitan area neighborhoods experiencing loud traffic noise are eligible to be added to the priority list. For example, a developer cannot simply build houses next to a highway and then get the new neighborhood placed on the list. Housing units built next to roadways after 1997 are excluded from the list unless noise levels were below state standards when the houses were built.

⁵ For example, the increasing availability of computerized property tax data has improved the accuracy of MnDOT's count of affected housing units.

Under the current process, when a location nears the top of the list, MnDOT staff conduct a noise analysis to confirm that the proposed barrier meets the state's criteria. If it does, MnDOT staff design a barrier for that location so that it can be built as soon as money becomes available from the funds allocated annually. MnDOT staff also contact city staff to alert them that the project is reaching the top of the list. Unlike federal projects, property owners and residents do not formally vote for or against state-funded barriers. Although nearby residents' and owners' opinions are solicited, the final decision on building a state-funded barrier rests solely with the local government.⁶ Because the stand-alone program receives no federal funding, it does not have to meet FHWA requirements. Were the program to use federal funds, MnDOT would have to solicit votes from affected property owners and residents instead of relying upon city council support.⁷

Local government rejections of stand-alone noise barriers—usually due to lack of neighborhood support—have substantially increased in the last few years. Between 1997 and 2006, only two communities refused proposed stand-alone noise barriers. From 2007 to 2012, there was an average of one refusal per year. As a result, MnDOT staff are considering requiring cities to actively request noise barriers nearing the top of the list before MnDOT begins design work.

FUNDING

MnDOT allocates \$2 million per year to the state noise barrier program.

Metro District currently allocates \$2 million per year, drawn entirely from state funds, to build stand-alone noise barriers.⁸ At current costs, that amount funds approximately one linear mile of wooden plank/concrete post noise walls (MnDOT's standard type). Until recently, MnDOT paid the entire cost of constructing stand-alone noise barriers. In fiscal year 2013, MnDOT began requiring local governments to pay 10 percent of the construction costs.⁹

MnDOT officials told us that although MnDOT could use federal funding for the stand-alone noise barrier program, doing so would not increase the total amount of federal money the state receives. It would simply mean that some of the federal money now spent on other priorities would be taken away to use for noise abatement. MnDOT has instead chosen to use only state funding for stand-alone noise barriers.

Cities or counties may choose to spend money to advance projects on the priority list. There are two possibilities. First, if a noise barrier project falls within Metro

⁶ A local government may also defer the barrier until later if it is not ready to pay the local share of the project; see the next section of this chapter on funding.

⁷ Specifically, MnDOT would have to solicit votes from property owners and residents projected to receive at least a 5-decibel noise reduction due to the barrier.

⁸ MnDOT will be implementing a new funding framework in fiscal year 2017. Under the new framework, the amount of discretionary money over which districts have autonomy will substantially decrease. In response, Metro District administrators seriously considered reducing the amount of money allocated for stand-alone noise barriers, but eventually decided to keep the funding at the same level and reduce spending on other district-level programs.

⁹ MnDOT continues to pay all design and contract administration costs.

District's ten-year workplan, a local government can advance it up the priority list by paying the full construction cost immediately. MnDOT will build the barrier, then pay the construction cost back to the city in the year the barrier would have been built had the city not provided early funding. Second, if the project is not within the ten-year workplan, a local government can advance the project by agreeing to pay the full construction cost without reimbursement. In either case, MnDOT would provide the design work, staff resources permitting. To date, no local government has used either of these policies to have a barrier built earlier than scheduled.

AVAILABILITY

The discussion above describes only the situation in the counties served by Metro District: Anoka, Carver, Chisago, Dakota, Hennepin, Ramsey, Scott, and Washington. We found that:

- **Although areas with high noise levels exist outside of the metropolitan area, MnDOT does not build stand-alone noise barriers outside of Metro District.**

Because the stand-alone noise barrier program is funded with district-level funds, rather than department-wide funds, barriers are only built within Metro District's jurisdiction. Because no other MnDOT district chose to fund noise barriers on existing roads, all areas in other MnDOT districts were removed from the priority list when it was initially updated.

Some areas with loud traffic noise are not eligible for the state program.

However, there are areas outside of the metropolitan area where traffic noise levels are very loud. As we noted above, the initial 1997 study identified six locations outside of Metro District where noise barriers appeared cost-effective. Noise barriers have been built in only one of those locations (in Rochester, as part of a federal project). Another location with high noise levels is along Interstate 94 in Avon, where traffic has increased dramatically since the initial construction of the highway. Some homes next to the highway now experience noise levels as high as 76 decibels, well above both federal and state standards for acceptable noise levels. At our request, Metro District staff calculated that a noise wall project at this location would now be cost-effective and would rank approximately 21st on the current priority list if it were eligible. However, this location cannot be considered for a state-funded noise wall project because it is not within the Metro District area.

RECOMMENDATION

MnDOT should create a pathway for communities outside of the metropolitan area to become eligible for state-funded noise barrier projects.

Traffic noise is a negative environmental outcome resulting from MnDOT's highway construction activities. This negative outcome exists in locations both inside and outside the metropolitan area. Yet MnDOT funds mitigation in some locations and not others. According to the director of the MnDOT Office of

MnDOT's state noise barrier program should treat all Minnesota communities equally.

Environmental Stewardship, it is the only form of environmental mitigation provided by MnDOT that is available to residents in one part of the state but not another.

As the 1997 study demonstrated, the vast majority of neighborhoods affected by loud traffic noise are in the metropolitan area. Thus, it may make organizational and logistical sense for Metro District to conduct and fund its own noise abatement program. However, the end result is that state money—not local money—is being used to provide a benefit in a way that favors some Minnesota residents based solely on their county of residence.

MnDOT should establish a process by which any community in the state can become eligible for a state-funded noise barrier. Because of the way this program has been previously funded—as a district-level discretionary choice—such a change will not be trivial. However, MnDOT staff report that they receive very few complaints from nonmetro locations, suggesting that only a small number of outstate cities will seek to add locations to the priority list.

MnDOT may elect to keep the stand-alone noise barrier funding mechanism at the district level; if so, the existence of the priority list would provide long-term predictability for MnDOT districts. If, for example, MnDOT District 3 were required to fund a noise wall in Avon once that location reaches the top of the priority list, under the current priority list formula it would likely have at least a decade to set such funds aside.

MnDOT'S PRIORITY RANKING CRITERIA

In order to rank potential projects without performing a complete noise analysis and cost estimate on each one, the priority list relies on a number of approximations and simplifications. The formulas used to rank projects are based on the following criteria.

Existing noise levels. MnDOT has conducted preliminary noise level measurements at each location on the priority list; two measurements are taken and their results averaged.¹⁰ Locations are given a score of 0, 10, 20, or 30 points based on their resulting noise level estimate, ranging from 0 points (less than or equal to 65 decibels) to 30 points (more than 70 decibels). More points lead to a higher position on the list.

Housing density. MnDOT has used aerial photography and tax records to determine how many housing units that would lie behind a noise wall are within 500 feet of the highway, excluding units that are shielded by another house or building. MnDOT combines the number of units and the length of the potential noise wall and calculates the number of housing units per half mile. This number is also converted into a score of 0, 10, 20, or 30 points, ranging from 0 points (less than 10 units per half mile) to 30 points (more than 31 units per half mile). More points lead to a higher position on the list.

¹⁰ If the two measured levels are more than 3 decibels apart, additional measurements are taken.

**MnDOT's
priority list ranks
potential noise
barrier locations
based on noise
levels, housing
density, and cost.**

Cost-effectiveness. Using several simplifying assumptions, MnDOT uses mathematical computations to roughly estimate the amount of sound reduction housing units will receive if a wall is built. On the current priority list, that estimate is then combined with the square footage of the potential noise wall to produce an estimate of the wall cost per decibel reduction per residence. Lower cost leads to a higher position on the list.

In its 2011 noise policy, MnDOT shifted its cost-effectiveness criterion to cost per residence. MnDOT plans to reflect this policy change in the next revision of the priority list, currently scheduled for 2016. Under the old criterion, walls providing big noise reductions were favored over those providing smaller reductions—for example, a wall shielding 30 houses that reduced noise levels by 10 decibels would get a better cost-effectiveness number than a wall of the same length shielding the same number of houses that reduced noise levels by just 7 decibels. Under the new policy, both walls would have the same cost-effectiveness number.

Incorporating this change into the priority list will cause many locations on the list to shift either up or down. Some will make major leaps; our calculations suggest that if MnDOT makes this change to the priority list formula without any other changes, 21 locations will move more than 50 spots on the list and a handful will move more than 100 spots.

After examining the formulas used to construct the priority list, we concluded that:

- **MnDOT Metro District's noise barrier priority list does not fairly rank some locations.**

We have three separate concerns with MnDOT's method of calculating priority list rankings.

(1) Projects with very similar characteristics may be ranked more than 20 places apart—which likely translates into a wait of at least a decade longer for a noise barrier. As described above, priority list locations are divided into four noise level categories (given 0, 10, 20, or 30 points), and four density categories (again given 0, 10, 20, or 30 points). The scores for these two categories are added, combined into an overall high, medium, or low score, and then locations are ranked within each score grouping by cost-effectiveness. This ranking method magnifies tiny differences between locations that fall right above and right below the category boundaries, as shown in Exhibit 3.2.

For example, one location on Highway 169 in Edina has a measured noise level of 70.5 decibels, a density of 26.2 houses per half mile of wall length, and an estimated cost of \$2,853 per decibel reduction per residence. Another location on the list, on Olsen Memorial Highway in Minneapolis, has a slightly lower noise level, a slightly higher housing density, and a slightly lower cost. Given the similarity in these measurements, these locations should have rankings very close to one another. However, because the second location's noise level is below the 70-decibel cutoff, it gets 20 points

Exhibit 3.2: Examples of MnDOT Metro District Priority List Locations with Similar Characteristics but Divergent Rankings, 2011

MnDOT's priority list sometimes ranks locations with nearly identical characteristics very differently.

Location	Noise Level in Decibels	Residences per Half Mile of Wall Length	Estimated Cost per Decibel Reduction per Residence	Rank
Highway 169 near Sioux Trail, Edina	70.5	26.2	\$2,853	21
Olsen Memorial Highway near Logan Avenue N, Minneapolis	69.5	27.8	\$2,752	38
Highway 36 near Sherren Street, Roseville	70.5	25.6	\$2,985	24
Highway 65 near Brookview Drive NE, Fridley	70.0	30.0	\$3,006	51
Interstate 94 near Western Avenue, St. Paul	71.0	23.0	\$3,208	30
Interstate 35W near 4th Street SE, Minneapolis ^a	70.5	23.1	\$3,223	31
Hwy 36 near Lexington Avenue, Roseville	70.0	23.8	\$3,021	52
Highway 169 near Lancaster Lane, Maple Grove	70.0	23.0	\$3,079	53

NOTE: Decibel levels shown are decibels on the "A scale," a weighted measurement that prioritizes sounds that can be heard by the human ear.

^a Due to a federal project currently planned at this location, this listing will likely be removed when the priority list is next updated.

SOURCE: Minnesota Department of Transportation Metro District Priority List.

for noise level in MnDOT's ranking formula instead of the 30 points received by the first location. That difference is enough to drop it 17 places further down the list, which means the residents in that location will probably wait at least a decade longer than the residents in the first location for MnDOT to fund a noise wall.

The end result of these distinctions is that a community may wait an extra 15 years or longer for a noise barrier because (as in the second pairing in Exhibit 3.2) its estimated noise level was 70.0 decibels instead of 70.5 decibels, a difference that cannot be heard by the human ear outside of a controlled laboratory setting. Further, we suspect MnDOT's measurements are not precise enough to accurately distinguish such small differences. In a document addressing questions raised while preparing its 2011 noise policy,

MnDOT commented that “the results of [a noise impact] analysis should...be assumed to be inherently imprecise.”¹¹

The priority list does not give high rankings to some locations with very loud noise levels.

- (2) Locations with very loud noise levels are not appropriately weighted in the rankings.** As noted above, the priority list formula uses four noise level categories: less than or equal to 65 decibels (0 points), more than 65 but less than or equal to 67 decibels (10 points), more than 67 but less than or equal to 70 decibels (20 points), and more than 70 decibels (30 points). However, some locations on the priority list have much higher noise levels. For example, two neighborhoods next to Interstate 35 in Lakeville have estimated noise levels of 77 decibels and 76.5 decibels, and a location next to Interstate 35E in Eagan has a noise level of 76 decibels.

The lack of additional categories for such loud noise levels means these levels are treated no differently than noise levels of 70.5 or 71 decibels. Consequently, the Lakeville location with a 77-decibel noise level is below 15 other locations with noise levels of 67 decibels or less—that is, its traffic noise is *twice* as loud as 15 locations that rank above it on the priority list. While some of the locations ahead of it have more residences, we question whether all of them should have greater priority than the Lakeville location.

- (3) The current priority list contains two spreadsheet formula errors that affect the rankings of many locations.** The first error appears in a complicated formula used to estimate the amount of noise reduction each wall is projected to provide. As a result of the error, walls that are unusually short in length are estimated to be more cost-effective than they would be using the correct formula. The second error uses an incorrect method of rounding in a formula that estimates the number of residences that would receive the maximum possible noise reduction from the wall. MnDOT has acknowledged the errors.

In most instances, the errors had fairly small effects on rankings; nearly half of the incorrectly ranked locations would shift less than three spots up or down if corrected formulas were used. However, a few locations would jump more significantly; eight locations would move more than 10 spots up or down with corrected formulas, and three of those would move more than 20 spots. When combined, the errors affected the rankings of 75 percent of the locations on the priority list.¹² Our analysis of older versions of the priority list showed that the errors occurred at least as early as 2002.

¹¹ Minnesota Department of Transportation, “Initial Comments Received 10-19-2010 from Noise Policy Committee Members on the Following Noise Policy Documents: Final Rule updating 23 CFR 772 Procedures for Abatement of Highway Traffic Noise and Construction Noise; Highway Traffic Noise: Analysis and Abatement Guidance; Draft State Highway Agency Noise Policy Template; Mn/DOT Noise Policy; MPCA Noise Standards; Minnesota State Statute 116.07” (St. Paul, October 19, 2010), 6.

¹² If we limit the analysis to those locations where a noise barrier was estimated to be cost-effective under MnDOT’s pre-2011 criteria (in use when the priority list was last updated), the errors affected 55 percent of the rankings. For three locations, fixing the errors changed whether they met the cost-effectiveness threshold; these are the locations that moved more than 20 positions.

RECOMMENDATION

MnDOT should revise its priority list ranking formula for state-funded noise barriers and re-rank locations on the list.

Because the annual amount of funding is small, it is crucial to rank locations as fairly as possible.

Because the annual amount of money MnDOT spends on state-funded noise barriers is small, the individual priority list rankings matter a great deal. A difference of 20 positions on the list can mean a difference of more than a dozen years in waiting for a barrier.

For that reason, it is crucial that MnDOT rank projects in as fair a manner as possible. The current formula does not do so. In particular, the use of categories produces distinctions that cannot be justified when affected locations are compared side by side. Additionally, MnDOT's formula inappropriately discounts the impact of very loud noise levels.

Before it moves any more projects from the priority list into the project planning stage, MnDOT should develop a new priority list formula and re-rank the locations on the list. The formula should use continuous variables rather than categories for noise levels, housing density, and cost-effectiveness. That is, a noise level of 70.5 decibels should be treated as slightly larger than 70, slightly smaller than 71, and much smaller than 77. MnDOT should also fix the spreadsheet errors identified above.

Maintenance

Unlike most other components of Minnesota’s transportation infrastructure, noise barriers have little effect on highway users. In comparison to the thousands of drivers that can be affected by a deep pothole within a few days, a damaged noise wall may affect only a handful of residents over months at a time. Nonetheless, noise barriers are MnDOT-built structures, and it is MnDOT’s responsibility to keep them in working order.

According to MnDOT Metro District administrators, several staff within Metro District began raising concerns in the late 2000s about the deterioration of older noise walls. As a result of these internal discussions, Metro District commissioned a study of the area’s older noise walls.

- **A recent study found that overall, metropolitan area noise walls are in good condition.**

The study, completed in 2012, suggested that, “considering their age and performance, many of the walls should be expected to be in service 50-100 years.”¹ Although older walls tended to show more deterioration than newer walls, some older walls were performing very well. Of the 22 best-rated walls in the metropolitan area, 7 had been built in the 1970s. The study confirmed observations made by MnDOT staff who examined some walls dating to the early 1970s that were torn down as part of the “Crosstown Commons” project.² Those walls were found to be in good condition, both structurally and acoustically.

A 2012 MnDOT-funded study found most older noise barriers were in good condition, but some needed repairs.

However, the 2012 study also found some noise walls in poorer condition; we show some examples in Exhibit 4.1. Many, but not all, were older walls built in the 1970s. In particular, wooden walls built using wooden posts instead of concrete posts had not aged as well as other walls, although the report said that many were still performing “surprisingly well.”³ Additionally, the study authors found a few safety hazards, which they recommended that MnDOT address immediately.

Though the study did not point to location as a factor in noise wall longevity, the study’s data suggest that noise walls in some locations fared better than others. For example, Interstate 94 heading north from downtown Minneapolis is bordered by a series of noise walls built in 1979. The study found that the walls closer to downtown—mostly on the west side of the highway—were generally

¹ URS Corporation, *Metro Area Noise Wall Assessment Report*, report conducted under contract from the Minnesota Department of Transportation (Minneapolis, January 2012), 70.

² The walls were removed because they were in the construction area. Previously existing walls were replaced with new walls (in slightly different locations).

³ *Metro Area Noise Wall Assessment Report*, 6.

Exhibit 4.1: Examples of Damage to Noise Barriers



SOURCE: URS Corporation, *Metro Area Noise Wall Assessment Report*, report conducted under contract from the Minnesota Department of Transportation (Minneapolis, January 2012).

performing well, with most rated “average,” “above average,” or “best condition.” However, the walls north of 42nd Avenue North—mostly on the east side of the highway—were only in fair shape, with ratings of “average,” “below average,” or “worst condition.” Other areas with clusters of “below average” or “worst condition” walls included Interstate 694 in New Brighton and Fridley, Interstate 94 east of downtown St. Paul, Interstate 35E south of downtown St. Paul, and Highway 52 in St. Paul, West St. Paul, and South St. Paul.

We spoke with MnDOT Metro District administrators regarding noise wall maintenance and found that:

- **MnDOT has no ongoing maintenance schedule for noise walls in the Twin Cities metropolitan area.**

MnDOT has no separate maintenance program for noise walls. Noise wall maintenance in the Metro District is handled by crews that also address bridge and retaining wall repair needs. MnDOT prioritizes maintenance and repair projects that could impact public safety. Since noise walls are usually located away from roadways, routine noise wall maintenance needs are given low

Because MnDOT prioritizes repair projects based on public safety concerns, noise barriers get little attention.

priority and are nearly always crowded out by higher priority needs. In a written response to questions from our office, MnDOT Metro District administrators wrote that “bridge and other structural maintenance needs do not allow the crews to address routine, aesthetic, or preventive maintenance for noise walls.”⁴ However, MnDOT considers removing graffiti a matter of public safety because of its possible links to gang violence. MnDOT Metro District has a unit that spends much of its time on graffiti removal from various MnDOT structures, including noise walls.

The 2012 report on older walls coincided with the cancellation of a planned stand-alone noise wall project due to lack of support from a local government. The cancellation enabled Metro District to divert funds from the stand-alone noise barrier program to address several pressing repair needs identified in the report. Additionally, MnDOT Metro District was allocated an additional \$2.35 million for noise wall repairs in August 2013 through a competitive funding process within MnDOT. However, both of these funding decisions were one-time events, and no ongoing dedicated funding for noise wall maintenance exists.

As one means to address this gap, Metro District administrators told us that they hope to start fitting in small, lower-priority maintenance projects if some money is left over at the end of a fiscal year, but not enough to address higher priorities. It is unclear how often money might be available in such circumstances and how frequently noise wall maintenance would be prioritized ahead of other possible uses for such funds. Further, a Metro District maintenance administrator noted that many noise wall repairs require advance planning, and it would be difficult to arrange them in the short time period that this process would provide.

The 2012 study also showed that:

- **MnDOT maintenance staff have not kept track of how many noise barriers exist or where they are located.**

The authors of the study on older noise walls described the substantial difficulties they encountered due to the poor quality of the data they received from MnDOT Metro District on the noise walls they had been asked to study. They wrote that:

(1) Several wall locations were different than the wall locations supplied by MnDOT on the inventory list. (2) Several wall lengths were substantially different than the wall lengths supplied by MnDOT. (3) Many of the walls supplied by MnDOT were made up of several smaller walls—many of different types and perhaps different ages. (4) Some of the actual wall types were different than the wall types supplied by MnDOT. (5) Some of the walls supplied by MnDOT no longer existed. They were either replaced or removed. (6) Some newer walls were located between the older walls, sometimes confusing

⁴ Untitled document provided at an interview with MnDOT Metro District administrators Pat Bursaw, Brian Isaacson, and Tom O’Keefe (June 4, 2013).

the inspection team. (7) The inspection team noticed several walls in the field that appeared to be MnDOT's, and constructed before 2001, but were not on the inventory list.⁵

By the time of our study, the Maintenance Division had updated its data with information gained from the 2012 study on older noise walls. However, its data on more recent barriers were incomplete. Data that we received from Metro District's Maintenance Division contained no record of several of the noise barriers listed in Exhibits 2.1 and 3.1, including barriers on Highway 65 in Blaine, on Interstate 694 in Oakdale, and on Highway 169 in Bloomington and Osseo.

RECOMMENDATION

MnDOT should develop long-term schedules and funding plans for routine noise barrier maintenance.

If MnDOT cannot fund routine noise wall maintenance, it should reexamine its spending on new barriers.

The 2012 study of older noise walls gave Metro District a clear picture of the current condition of its noise walls and detailed information on each wall. It also assisted Metro District's Maintenance Division to identify and address pressing needs. Additionally, the study provided the good news that many older noise walls continue to perform well and are likely to last long beyond their initially expected lifespan. Nevertheless, we are concerned by the lack of maintenance schedules, funding mechanisms, and accurate records for noise barriers. As Minnesota's noise walls continue to age, maintenance issues will become increasingly difficult to ignore.

MnDOT maintenance administrators told us that their first priority is to address maintenance needs that directly affect public safety. We do not disagree with this approach. Further, assessing how MnDOT should prioritize its many maintenance needs—and whether it should shift money away from other needs to address noise wall deterioration—is beyond the scope of this evaluation. However, in our 2008 *State Highways and Bridges* evaluation, we expressed concern that MnDOT had continued to fund new construction projects while allowing needed preservation work to fall behind.⁶ As we suggested in that evaluation, it is important to balance new construction with ongoing maintenance. If MnDOT cannot fund noise barrier maintenance, then it should reexamine its funding commitments to new barrier construction.

The 2012 study suggested that Minnesota's older noise walls are generally in good condition. Therefore, MnDOT has time to develop a maintenance schedule and identify funding sources with confidence that no crisis is looming. However, this lack of urgency should not result in a lack of action. MnDOT Metro District should take steps to address noise wall maintenance issues on a regular basis. MnDOT officials told us that the department is currently developing a noise barrier maintenance protocol based on the 2012 study, but they did not explain

⁵ *Metro Area Noise Wall Assessment Report*, 4-5.

⁶ Office of the Legislative Auditor, *State Highways and Bridges* (St. Paul, 2008).

how work identified by the protocol would be funded. One approach might be to repeat the funding mechanism used in fiscal year 2013, and occasionally (perhaps once every five or seven years) devote some or all of Metro District's stand-alone noise barrier budget to needed maintenance tasks.

Decision Making

In previous chapters of this report, we discussed decisions made by the Minnesota Department of Transportation (MnDOT) and the consequences of those decisions. In this chapter, we address the decision-making process itself.

TRANSPARENCY

As outlined in earlier chapters, MnDOT builds noise barriers on federal projects only if certain criteria are met, and it builds state-funded stand-alone noise barriers only if a location rises to the top of Metro District's priority list. These criteria are outlined in MnDOT's noise policy. Among other things, the policy is intended to limit ambiguity and increase consistency in how MnDOT responds to noise complaints and noise barrier requests.

MnDOT has spent years discussing and explaining its noise barrier policies with concerned residents, neighborhood groups, community organizations, and legislators. Despite the clear public interest in noise abatement, we found that:

- **MnDOT's noise barrier policies have been decided with local government involvement, but with little public notice or input.**

When MnDOT instituted a major revision of its noise policy in 2010-2011 in response to changes in federal regulations, it made no attempt to solicit public or legislative involvement. MnDOT's efforts to seek external review focused on other constituencies within MnDOT, local government engineers, and the Minnesota Pollution Control Agency (MPCA). While preparing its 2011 noise policy changes, MnDOT convened a Noise Policy Review Committee made up of 22 people—15 of whom were MnDOT staff or consultants hired by MnDOT, and 19 of whom were licensed engineers or individuals with engineering training. (The three nonengineers were the MnDOT Ombudsman, a MnDOT lawyer, and a representative from MPCA.)

This insular process meant that many issues important to engineers were raised, but some issues that may be of significant interest to local residents were ignored. For example, there was no discussion of whether MnDOT had chosen an appropriate maximum cost threshold of \$43,500 per residence, a key criterion that will determine whether or not local communities receive barriers for years to come. Discussion of the voting process used on federal projects was limited and focused mostly around which properties would be eligible to participate. Although engineers from several local governments were involved, the minutes and associated documentation suggest that they were most concerned with which locally led projects would require noise barriers and how to apportion costs. After the review committee had met twice, the final noise policy draft was completed by MnDOT staff and MnDOT-hired consultants, distributed to committee members for final comments, and then submitted to FHWA.

MnDOT has sought little public input when making noise barrier policies.

However, unlike other states, MnDOT has invited policy suggestions from cities and counties.

The time available to the department to complete its new noise policy was extremely short—FHWA required states to submit draft noise policies within six months of the publication of its final rule. Thus, inserting a formal public comment period into the available time would have been difficult, and MnDOT did not do so. MnDOT did not make any other efforts to invite participation by citizens or legislators in the development of its policy. However, MnDOT's inclusion of local government engineers was a noteworthy step toward more participatory decision-making. Federal officials told us that as far as they were aware, Minnesota was the only state to involve local government representatives in its noise policy revision process after the 2010 changes to federal regulations.

DOCUMENTATION

Our evaluation of MnDOT's noise policies and procedures was complicated by the fact that:

- **MnDOT often does not document its rationale for key noise policy decisions.**

In the course of our work, we repeatedly asked why MnDOT had chosen to do things one way rather than another. Frequently, we found that these answers lay within the institutional memories of long-term department staff. Some older decisions still in effect cannot be explained by MnDOT because no explanation was written down and no current staff were there when decisions were made.

Noise Policy

A recent example of lack of documentation is MnDOT's 2011 noise policy. The main documentation of the department's decision-making process consists of the minutes of the Noise Policy Review Committee and written responses to questions from local government engineers and FHWA. However, these documents do not mention several key elements of the noise policy. For example, there is no written documentation of why MnDOT chose to set its new maximum cost threshold at \$43,500 per residence. MnDOT staff told us that the level was set so that it would be very similar to the previous \$3,250 cost-per-decibel-reduction-per-residence level for a wall that provided a 10-decibel reduction for affected residences.¹ However, MnDOT staff could not explain why the \$3,250 level was originally decided upon. Similarly, we found no written documentation of why the voting process on federal projects is tilted in favor of constructing noise barriers.

Such a lack of documentation is not a major concern at the moment. The MnDOT staff who made these decisions are still in their positions and can answer questions about why choices were made and how different circumstances might cause them to reconsider their decisions. However, we describe below two other decision-making areas where the original reasons for some decisions are lost because they were not documented.

Many MnDOT noise barrier decisions have been insufficiently documented.

¹ More specifically, it would be a 10-decibel reduction for residences projected to experience noise levels exceeding state standards or projected to experience a substantial increase in noise.

MnDOT has built noise walls predominantly out of wood since the 1970s.

Priority List

Although MnDOT Metro District has been making funding decisions based on its priority list for more than a decade, there is no written explanation for why the list is ordered as it is. Many other possible orderings exist—for example, Metro District could build noise barriers in areas with the loudest noise first or areas with the most people first. In our view, using cost-effectiveness as the most important criterion is a plausible ranking method, but some documentation should exist describing what alternatives were considered and why cost-effectiveness was chosen. In addition, until we asked for one, there was no written explanation of the complex mathematical formulas used to order projects on the priority list.

Similarly, the decision to rank priority list locations using category groupings was apparently the preference of a MnDOT administrator who worked on noise issues in the 1990s, and MnDOT has simply carried that method forward. No documentation was created at the time explaining why this approach was taken.

Building Materials

Since it began building noise barriers in the 1970s, MnDOT has built noise walls predominantly out of wood. Minnesota’s preference for wood is unusual, as is shown in Exhibit 5.1. Only two other states in the country (New Hampshire and Connecticut) build walls primarily out of wood.

Inquiries we made with other state transportation departments suggested that other states have a variety of reasons for using alternatives to wood. Some states have had poor experiences with wood walls in the past; others said that alternative materials are more readily available. Wisconsin, the nearest state that frequently builds noise barriers, builds all of its walls using an absorptive composite material that reduces overall noise levels.

Exhibit 5.1: Noise Barriers Built Using Wood Materials, 1981-2010

Years	Minnesota	All Other States
1981-1985	100%	15%
1986-1990	72	20
1991-1995	100	8
1996-2000	100	1
2001-2005	83	6
2006-2010	100	1

NOTE: Percentages are calculated using total square footage. Composite materials that may contain wood are not included.

SOURCE: Office of the Legislative Auditor, analysis of Federal Highway Administration data.

MnDOT has never formally evaluated the long-term costs of wood compared with other noise barrier materials.

MnDOT's reliance on wood appears to be based mostly on anecdotal evidence, and we had difficulty verifying department claims. For example, we were told that graffiti is easier to clean off of wood walls than concrete walls. However, noise quality staff in some other states and a MnDOT Metro District maintenance administrator disagreed that graffiti is easier to clean off of wood walls. We found that:

- **MnDOT has not fully investigated the costs and benefits of different noise wall materials.**

According to department staff, MnDOT initially chose to build noise walls predominantly out of wood due to cost, but there is no documentation of how this assessment was made. As far as current MnDOT staff are aware, the department has never formally evaluated the costs of alternative materials. In nearly all instances, MnDOT specifies to bidders that noise walls must be made of wood. Therefore, it does not receive bids to build walls out of other materials and cannot compare those bids against the bids for wood walls. Even were it to collect such bids, it is unclear how MnDOT would assess the long-term costs of alternative materials when comparing bids. MnDOT staff acknowledged that concrete walls would likely last longer, but MnDOT has never assessed whether such long-term savings might offset higher short-term construction costs.

MnDOT will build walls out of materials other than wood if local governments agree beforehand to pay the difference in cost. To estimate that difference, MnDOT has generally assumed that costs for alternative materials will be similar to the average nationwide cost as reported by states to FHWA. However, the FHWA data show that states have paid a wide variety of prices. Reported costs for concrete walls ranged from \$10 per square foot in Idaho to \$101 per square foot in Alaska. It is unclear whether the average of these varying prices would be an accurate estimate for the cost of concrete walls in Minnesota. One Minnesota concrete contractor with whom we spoke expressed considerable skepticism of the price MnDOT had estimated for concrete walls for a recent project.

While we did not find much evidence supporting MnDOT's use of wood for noise walls, we also did not find evidence strongly suggesting that other materials are superior to wood. Metropolitan-area county engineers who had an opinion generally supported the construction of wood walls. The 2012 study of older noise walls we described in Chapter 4 found that many of Minnesota's older wood walls are holding up well. Other states have various reasons for using other materials, not all of which may apply in Minnesota. Lastly, although maintenance costs for concrete walls may be lower, it is less expensive to demolish and replace old wood walls than it is to demolish old concrete walls. Therefore, we make no recommendation that MnDOT change its practices.

According to department staff, MnDOT has recently reconsidered its reliance on wood for building noise walls. As an experiment, MnDOT plans to accept bids for both wood and concrete walls for a state-funded noise wall project scheduled for 2015 or 2016. We endorse such experimentation.

RECOMMENDATION

MnDOT should increase transparency in its noise barrier policy decision making.

Greater transparency and clearer documentation would better serve the public.

Concerns about noise barriers are an ongoing issue for MnDOT. Although assessing noise levels and designing mitigation measures make up a small part of the department's mission, its work in this area is frequently a source of tension between neighborhoods and the department. When questions are raised about whether noise barriers will be built in particular locations, MnDOT's general response is to fall back on its noise policy—if a barrier meets the noise policy criteria, it will be built. This answer makes it seem as if its decisions are made on an evidentiary, objective basis.

However, we were unable to find documentation describing how some of these criteria were arrived at or what alternatives were considered and rejected. Further, the criteria were not created through a public process. Earlier decisions made in this manner have lasted for decades without any written explanation of why they were made—as was the case with MnDOT's preference for wood walls, its use of categories within the priority-list ranking formula, and the maximum cost level used to determine whether a barrier is too expensive to build.

MnDOT should recognize that noise abatement is routinely a matter of public interest and provide greater transparency and clearer documentation of its policy-making activities. Doing so would not only better serve the public, it would also limit the extent to which the department is dependent on the institutional memory of a handful of key staff.

List of Recommendations

- Minnesota Department of Transportation (MnDOT) should change its procedure for assessing public support for noise barriers on federal projects.([p. 22](#))
- MnDOT should create a pathway for communities outside of the metropolitan area to become eligible for state-funded noise barrier projects. ([p. 28](#))
- MnDOT should revise its priority list ranking formula for state-funded noise barriers and re-rank locations on the list. ([p. 33](#))
- MnDOT should develop long-term schedules and funding plans for routine noise barrier maintenance. ([p. 38](#))
- MnDOT should increase transparency in its noise barrier policy decision making. ([p. 45](#))



Minnesota Department of Transportation

395 John Ireland Boulevard

Saint Paul, MN 55155

October 11, 2013

Mr. Jim Nobles, Legislative Auditor
State of Minnesota
Office of the Legislative Auditor
658 Cedar Street, Room 140
St. Paul, MN 55155

Dear Mr. Nobles:

The Minnesota Department of Transportation (MnDOT) has reviewed the evaluation report entitled "MnDOT Noise Barriers". Generally, MnDOT believes the report is accurate and agrees with its findings. We commit to the following actions to address the report recommendations:

- MnDOT understands the concerns that have been expressed by the public and in this audit. We will convene a review team, which will include state-wide representation from local jurisdictions, as well as from MPCA, FHWA and MnDOT. The team will include technical experts as well as advisory committee members to consider citizen concerns. MnDOT is starting the process for the technical portion of the Noise Policy review. We expect to convene the Noise Policy Review Committee by the end of this calendar year.
- The great majority of noise issues in Minnesota are in the Twin Cities Metropolitan area due to the density of homes, proximity to the roadway and high vehicle and heavy truck volumes. MnDOT will consider the audit's recommendation to expand the current Metro District Highway Noise Abatement Program discretionary funding to a state-wide level, recognizing that funding to this area may result in a decrease in funding to another area of need.
- MnDOT's practice is to update Metro District's priority listing for state-funded noise barrier projects every five years. These updates include seasonal field monitoring, analyzing and ranking of noise levels at hundreds of locations and re-prioritizing the list. MnDOT will be reviewing the mathematical distributions and methodology as recommended in this audit.

MnDOT fully appreciates and agrees with the need to maintain and preserve the State's more than \$10 billion worth of assets (which includes noise walls). Unfortunately, current funding levels do not allow us to maintain all these assets to the levels recommended by engineering standards. We therefore have to prioritize maintenance by its direct effect on public safety. MnDOT has conducted a study to inventory and evaluate our existing noise barriers and are currently developing a noise barrier maintenance protocol based on the study findings and funding availability. Federal rule 23 CFR 772 states that, if all other criteria are met, the project proposer must "solicit the opinion of the benefited receptors". The rule does not use the words "public support", it uses "benefited receptor". We believe that these words have different meanings. A "benefited receptor" is defined as the receptor of an abatement measure that receives a noise reduction at or above the minimum threshold of 5 dBA. Therefore, although MnDOT always considers the concerns and needs of all our constituents, the Federal rule requires that only those who actually "benefit", determine if a proposed noise abatement measure is built.

Minnesota is more likely to build noise barriers because the State of Minnesota has its own State Noise Standards (MN Rule 7030.0040) that are more stringent than the federal noise abatement criteria. Historically a majority of property owners and residents have supported the installation of noise barriers, therefore, MnDOT chose to set the threshold criteria in our 2011 Noise Policy to reflect the majority of our constituents' opinions; that is, to favor providing noise mitigation. MnDOT will remain committed to providing noise mitigation for our constituents through a fair and uniformly applied Noise Policy while fulfilling the requirements of the federal rule and guidance.

Please accept my thanks for clarifying issues that will support MnDOT's efforts to review and refine the 2011 Noise Policy.

Sincerely,

Charles A. Zelle, Commissioner
Minnesota Department of Transportation
395 John Ireland Blvd.
St. Paul, MN 55155

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