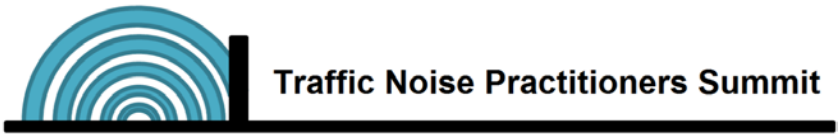
Traffic Noise Practitioners Summit White Paper and Noise Roadmap

February 22, 2016



Contents

Traffic Noise Practitioners Summit

Traffic Noise Practitioners Summit White Paper

Introduction

The Center for Environmental Excellence (CEE) convened a two-day practitioners' summit of state highway agency (SHA) noise program managers and Federal Highway Administration (FHWA) officials on October 21-22, 2015, at the Hotel Monaco in Baltimore, Maryland. The summit provided an opportunity to: discuss and share experiences about how noise is being studied and abated, identify issues that SHAs are experiencing, and recommend next steps for additional research and activities to assist the SHAs with these issues.

Many changes in the highway traffic noise field have occurred over the past several years and more are expected in the near future. The FHWA noise regulation in Title 23, Part 772, of the Code of Federal Regulations (23 CFR 772) was revised in 2010, its first major update in nearly 30 years. The updated regulation added new requirements and procedures that all SHAs had to incorporate into their noise policies by July 2011. SHAs have had four years of experience implementing the new regulation. Many lessons have been learned and a number of SHAs have undertaken - or plan to undertake - policy revisions. SHAs are also grappling with issues such as traffic and construction noise and vibration impacts on wildlife that are beyond the scope of 23 CFR 772. Also, FHWA supplements the noise regulation with its on-line Noise Policy Frequently Asked Questions (Noise Policy FAQs) as a way of supporting implementation. Finally, new resources and tools have been – or are being – researched and developed, such as the long-awaited new version of the FHWA Traffic Noise Model (TNM 3.0), which is nearing completion.

The CEE is managed by the American Association of State Highway and Transportation Officials (AASHTO) in cooperation with the FHWA. AASHTO contracted with Bowlby & Associates, Inc. to assist in developing the technical agenda and program, conducting the summit and reporting on it.

The summit provided a targeted, relevant program to help move the profession forward through future activities of the Center, the FHWA, individual SHAs, AASHTO's Standing Committee on the Environment (SCOE) and SCOE's Highway Traffic Noise Work Group. FHWA provided funding for the summit including

travel, eliminating an obstacle typically encountered in other forums such as meetings of the Transportation Research Board (TRB) ADC40 Transportation-Related Noise and Vibration Committee.

The last targeted gathering of SHA noise practitioners was in 2010 as part of the TRB ADC40 summer meeting in Denver Colorado.

The efforts on an appointed SHA Advisory Group (AG) were critical to the success of the summit. The AG defined the topics to be covered, considered key questions to be addressed, and identified possible program participants. AG members included:

- Noel Alcala, Ohio Department of Transportation (DOT)
- Mariano Berrios, Florida DOT
- Cora Helm, Montana DOT
- Carole Newvine, Oregon DOT
- Danielle Shellenberger, Pennsylvania DOT
- Greg Smith, North Carolina DOT

Mark Ferroni, FHWA, and Rob Effinger, AASHTO, also participated in the work of the AG. Bowlby & Associates' staff included Bill Bowlby, Darlene Reiter, Rennie Williamson and Lisa Rooks.

This white paper summarizes the summit and presents the "noise roadmap" based on the input from the summit participants. The noise roadmap lays out the key issues regarding highway traffic noise and potential opportunities to address these issues. It includes key takeaways from the meeting, technical assistance needs, research gaps, and recommendations for FHWA and AASHTO.

An associated webinar is being planned that will present the roadmap and provide an additional opportunity for discussion.

Summit Delegates and Program

Forty-one noise practitioners from 38 SHAs participated as "delegates" in the summit. A complete list of summit participants is provided in Appendix A. The full agenda is in Appendix B.

Over the two-day period, the summit consisted of the twelve topical sessions shown below and a session on shaping the Noise Roadmap:

1. 23 CFR 772: Type I Project Definitions
2. 23 CFR 772: Land Use Activity Categories and Evaluation Methodologies
3. 23 CFR 772: Noise Screening Procedures
4. 23 CFR 772: Cost Effectiveness Reasonableness Criteria
5. 23 CFR 772: Consideration of Viewpoints of Owners and Residents

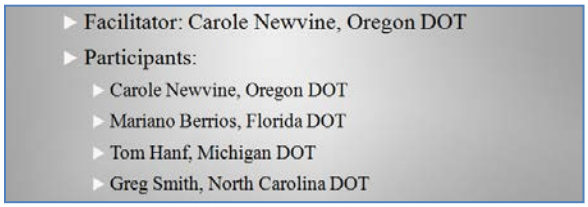
6. TNM 3.0 Status and Implementation Plans – FHWA Briefing and Q&A
7. Miscellaneous Traffic Noise Policy, Procedure and Program Topics – FHWA Briefing and Q&A
8. Traffic Noise Modeling: Best Practices for Modeling and Review of Models
9. Design-Build Projects
10. Construction Noise and Vibration and Pre-Construction Evaluation
11. Noise Barrier Materials, Design and Costs
12. Enhancing and Improving Technology Transfer, Training and Recruiting

In addition, a high-level demonstration of the standalone and MicroStation extension versions of FHWA TNM 3.0 was conducted as an optional session.

The topical sessions generally followed a similar format: one or more brief presentations by delegates to set the stage for discussion or to highlight accomplishments or activities that might be of interest to other delegates, followed by an open discussion facilitated by a delegate-moderator. To the extent possible, questions submitted in advance by the delegates were addressed.

Each session is summarized below. Copies of the presenters' PowerPoint slides are available as PDF files on the CEE web site at: http://environment.transportation.org/center/products_programs/conference/traffic_noise_practitioners_summit.aspx.

Type I Project Definitions

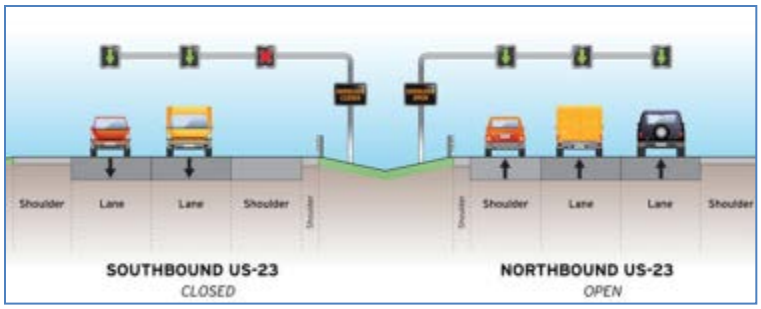


Type I projects are most commonly thought of as highways constructed on new location or highways having a through traffic lane added (including High-Occupancy Vehicle lanes, High-Occupancy Toll lanes, bus lanes or truck climbing lanes). The other Type I projects defined in 23 CFR 772 have led to questions on when and how they should be studied. These others include:

- Physical alteration of an existing highway where there is either:
  - Substantial Horizontal Alteration. A project that halves the distance between the traffic noise source and the closest receptor between the existing condition to the future build condition, or
  - Substantial Vertical Alteration. A project that removes shielding therefore exposing the line-of-sight between the receptor and the traffic noise source. This is done by either altering the vertical alignment of the highway or by altering the topography between the highway traffic noise source and the receptor
- Addition of an auxiliary lane, except for when the auxiliary lane is a turn lane
- Addition or relocation of interchange lanes or ramps added to a quadrant to complete an existing partial interchange
- Restriping existing pavement for the purpose of adding a through-traffic lane or an auxiliary lane
- Addition of a new or substantial alteration of a weigh station, rest stop, ride-share lot or toll plaza

As an example, Florida DOT has had issues applying the Type I definitions to auxiliary lanes and to work on interchange ramps. Florida has found FHWA's guidance difficult to apply and uncertain as an auxiliary lane length can vary depending on whom is defining it and what use is being considered. Auxiliary lanes could be acceleration and deceleration lanes, weaving and passing lanes, and truck climbing lanes. To assist Florida districts in identifying Type I projects, a "Type I Projects Matrix" (Matrix) was developed that expands upon and clarifies the CFR definitions for these two categories. The Florida Matrix provides the addition criteria to better identify what projects are considered Type I, including clarification of unique situations not clearly addressed in the rule or guidance.

As another example, Michigan DOT had issues applying Type I definitions on a 15-mile project corridor that included capital preventive maintenance (CPM) for the full corridor and 8.5 miles of managed use lanes. Communication with FHWA confirmed that the construction of the managed use lanes was a Type I project. Thus, as required in 23 CFR 772, the entire corridor was defined as a Type I project requiring a noise abatement analysis. MDOT, with FHWA Division Office approval, separated five miles off the CPM at a logical point, shortening the project corridor requiring the noise analysis to 10 miles including the managed use lanes. This issue of part of a project causing an entire project to be considered Type I was encountered by other SHAs as well.



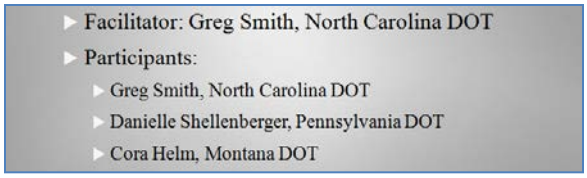
North Carolina DOT also had two projects with Type I definition issues. A road safety improvement project involving auxiliary lanes and a right turn lane was abandoned after the noise study showed that six noise barriers, while feasible, would be a prohibitive percentage of the total project cost. For the second, a 4,500-foot lane between two interchange ramps was proposed to provide for a safer weaving pattern. The status of the project as Type I was not clear, though, when they attempted to apply auxiliary lane language from 23 CFR 772, the FHWA Analysis & Abatement Guidance document and the on-line FAQ. This project is currently being reviewed by FHWA.

While one Noise Policy FAQ offers clarification that "… *an auxiliary lane should classify the project as Type I if the auxiliary lane is 2,500 feet or longer…",* there appears to be enough nuances and unique project variations regarding both auxiliary lanes and turn lanes that expanded or enhanced guidance is warranted. This could be done either with additional FAQs or expanded guidance, although use of the FAQs by FHWA is seen as a source of confusion when they do not align with other guidance or the noise regulation.

FHWA also considers projects that allow vehicles to use shoulders for through lanes during peak periods as Type I, but not incident management shoulder lanes.

With regards to the question of what constitutes a significant vertical change, some SHAs use a 5-ft change, while others consider the resulting change in line-of-sight. There are insufficient specifics regarding this in the FHWA FAQs or Guidance document; more clarification would be helpful.

Land Use Activity Categories and Evaluation Methodologies



A second major area of interest regarding 23 CFR 772 has to do with the noise receptors, in particular: (1) the Activity Categories in 23 CFR 772, the land uses within each category and the land uses not addressed, and (2) the evaluation methodologies for analyzing nonresidential land uses in terms of equivalent residential receptors.

Examples of questions regarding Activity Categories A through G in 23 CFR 772 included:

- Category A: Could this definition not include every cemetery, military park, and natural area?
- Category B: Should extended–stay hotels and motels be considered residences?
- Category C: Are active sports areas and playgrounds really noise-sensitive?
- Category D: Does a funeral home fall in to this category or Category C (place of worship/public meeting room) or E (office) or F (retail)?
- Category E: Is it really reasonable to treat hotels and motels the same as multi-family residences?
- Category F: No noise analysis is required for Category F land uses. Should they be given receptor numbers?
- Category G: Are TNM-generated noise contours sufficient to provide noise levels for local governments?

The recently updated Noise Policy FAQs do contain additional information on Category A land uses, including references to national cemeteries and public botanical gardens. The consensus at the summit, though, was that FHWA needs to move this FAQ material into more formal guidance. A Category A designation only gives a lower threshold for noise impact than other land uses; it does not change the feasibility and reasonableness criteria, which reintroduces the need to consider how the number and placement of receptors are determined. Wisconsin DOT had a project involving a national cemetery that was determined not to be Category A because the existing highway already went through the cemetery and the case for “extraordinary” serenity was not established.

Two related topics of interest are active versus passive use areas and what constitutes frequent human use. One example is cemeteries. Minnesota DOT has new guidance on cemeteries that focuses on placing receptors at formalized memorial gathering areas, not individual graves (available in the 2015 MnDOT Noise Policy, Appendix B, at: http://www.dot.state.mn.us/environment/noise/pdf/mndot-2015-noise-policy.pdf). Tennessee DOT has a qualitative definition for frequent human use that it applies to cemeteries, also not designating individual grave sites as noise-sensitive.

There are questions on the appropriate category for several other land uses. These include: cemeteries; prisons (and shorter-terms jails); "man camp" housing in North Dakota oil-boom towns (treated as Category E because of their expected shorter-term usage, despite being residential); extended stay hotels (a case for Category B?); funeral homes (office, commercial, or place of worship?); hospice care facilities (short-term care); nursing homes; assisted living facilities; and emergency entrances at hospitals. As an example, Illinois DOT would identify some of the above as "public or nonprofit institutional structures" and place them into Category C. Ultimately, the key is that an SHA should have a consistent interpretation and consistent analysis methodology that has been approved by FHWA.

Consideration of interior noise is of interest, including cases involving churches in Minnesota and Maryland and an office in Oklahoma. In the latter two states, indoor/outdoor measurements of existing noise reduction showed that there would be no future interior noise impacts when applied to future predicted exterior sound levels.

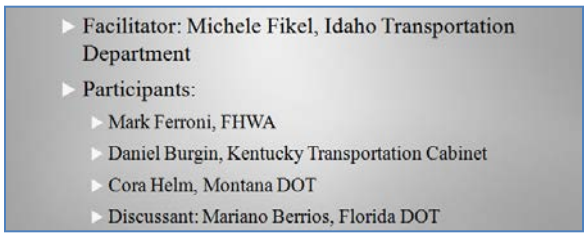
Regarding methodologies for determining equivalent residential receptors for non-residential land use, Pennsylvania DOT has a method developed as part of its noise policy revision in 2011. Initially, Pennsylvania used a grid method by placing a receptor every 130 feet. However, this method alone did not account for usage rates. The procedure was modified to incorporate the usage of a site. A value of person-hours per year was determined for an average residence. Then, a process was developed for determining usage hours for common grounds areas of apartments, such as a pool, and for other land uses, such as playgrounds and cemeteries. Dividing these hours by the average residential person-hours per year yields the number of equivalent residential receptors to assign to a land use. Pennsylvania's spreadsheets will be made available on-line for others to download and use. One of the key items for any usage-based method, including Pennsylvania's, is the gathering or developing of usage data, which usually requires use of "best professional judgment." Several delegates expressed concerns about obtaining future usage data for a usage-based method.

APPLICABLE CRITERIA ASOCIATED WITH ACTIVITY CATEGORY C		BASE	Category C Exterior Uses Represented by a Single Location on the Property
Exterior design year L_{eq} noise level equal to or exceeding 66dBA with the Build condition or design year exterior Build condition L_{eq} 10 dBA or greater than existing exterior L_{eq} noise level.		Single Family Residence	Playground
A	Average Event Attendance of Outside Use Area		
B	Average Time Used by Each Person Per Event (hours)		
C	Average Number of Events per Event Day		
D	Capacity of Site		
E	Average Use Factor		
G	Hours Available Per Day	15*	1
H	Persons Using Per Day	2.48*	150
I	Person-Hours Per Day	37.2*	150
J	Days Per Year Used	365*	300
K	Person-Hours Used Per Year = IxJ	13578*	45000
L	Equivalent Residential Units (ERU) = Row K Value divided by 13578	1	3

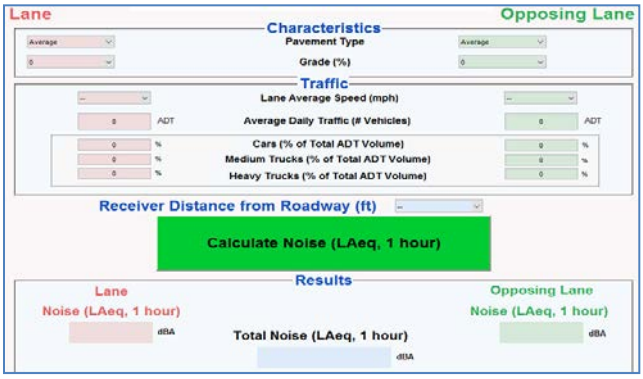
Montana DOT also has a procedure for determining non-residential benefited receptor equivalents. This procedure considers the average residential lot size adjacent to the project and the square footage of the non-residential activity, such as a trail running alongside the highway. The quotient of the land use's area divided by the average lot size yields an equivalent number of benefited receptors. Of particular interest is an adjustment if the land use is only used seasonally: the procedure applies a seasonal multiplier based on average hours of sunlight to scale down the benefited receptor equivalents.

Month	Average Hours Of Sunlight	Month	Average Hours of Sunlight
January	9.00	July	15.50
February	10.33	August	14.25
March	12.00	September	12.50
April	13.67	October	10.83
May	15.25	November	9.25
June	16.00	December	8.50

Noise Screening Procedures



There is a great deal of interest among practitioners in screening methods for noise analysis. The United States DOT Volpe Center's Acoustics Facility is finalizing a TNM v2.5 Low Traffic Volume Tool. This new tool will replace the old TNMLOOK tool, which was being used beyond its capabilities and subsequently disallowed for use in the 2010 revision to 23 CFR 772. The new computer-based tool has a simple interface to allow computation of the one-hour equivalent sound level for each direction of a two-lane road and the total level for both. The user enters traffic data (average daily traffic and percentage by vehicle type) and selects input values for pavement type, speed and distance to the roadway from pull-down pick lists. FHWA will issue caveats for its use - such as for a low volume road only (although what constitutes "low volume" is to be determined). Based on interest expressed at the summit, FHWA may consider having the tool modified for use for isolated receptors. In any case, analysts still must consider abatement for impacted isolated receptors, rather than dismissing the possibility.



The Kentucky Transportation Cabinet recently updated its Noise Analysis and Abatement Policy. Two of the goals of the changes were to reduce the amount of analysis that is required in cases of isolated

impacted receptors, and to utilize the research done for FHWA on analyzing policy criteria choices of other states on its Noise Abatement Feasibility and Reasonableness Analysis Tool (NAFRAT).[1] By changing the abatement feasibility criterion to a noise reduction of 5 dB or greater for at least three impacted receptors, the need to conduct a noise barrier analysis using TNM is eliminated for cases when there are only one or two impacted receptors.

Regarding the noise reduction design goal in the policy, Kentucky changed from requiring a reduction of 7 dB or greater for 40 percent or more of *all* benefited receptors (those receiving 5 dB or more reduction) to a reduction of 7 dB or greater for 50 percent or more of *front-row* benefited receptors. Changing to only front-row benefited receptors eliminated the sometimes counter-intuitive result of a reasonable barrier becoming unreasonable as its height is increased during design even though it benefits more receptors: the percentage of all benefits can decrease if the increase in the *total* number of benefited receptors (5 or more dB, and often located in the second or third row back from the road) is greater than the increase in the number of benefited receptors with a noise reduction of 7 dB or greater.

Montana DOT is an example of an SHA needing a screening procedure to reduce the need for travel to do noise measurements. With Montana being such a large and rural state, it costs a great deal in terms of time and money to travel across the state to do noise measurements for model validation when the likelihood of impacts is low and the likelihood of abatement, if there were to be impacts, is also low. Montana has a screening procedure based on simple TNM template runs, but the procedure does not eliminate the need for noise measurements.

There is interest in learning about other screening options; an example is a method used by the Idaho Transportation Department. There is also interest in what FHWA's definition of "low volume" will be. As an example, Kansas DOT has a value of 1,200 vehicles per day in its policy. As points of reference, for their purposes, the *Manual of Uniform Traffic Control Devices* defines "low volume" as 400 or fewer vehicles per day (http://mutcd.fhwa.dot.gov/pdfs/2009/part5.pdf) and AASHTO's *Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT ≤ 400), 1st Edition* uses 400 vehicles per day in its definition of "very low-volume" roads (https://bookstore.transportation.org/Item_details.aspx?id=157). While the TNM 3.0 Low Volume Tool could be used to rule out impacts, there is interest in having a way to rule out the need for abatement evaluation for isolated impacts. The new Kentucky feasibility criterion of a minimum of three impacted

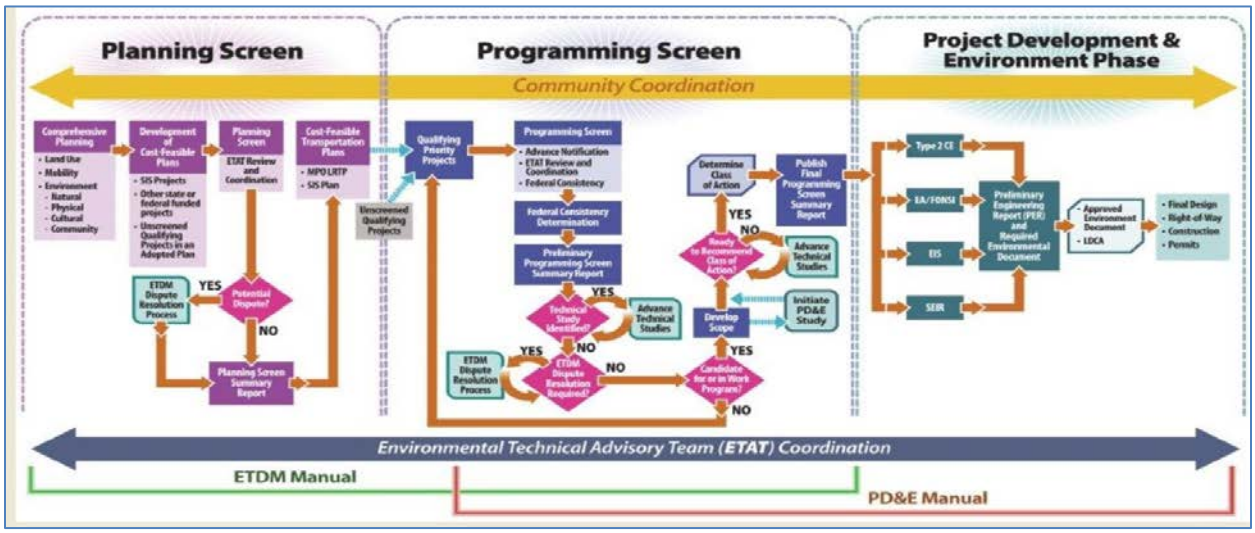
[1] NAFRAT is available on-line at:
http://www.fhwa.dot.gov/environment/noise/noise_barriers/acceptance_criteria/

receptors offers such an opportunity, although there have been examples where barriers were found to be feasible and reasonable for a single receptor (Georgia) and for two receptors (two cases in Nebraska).

The Nebraska Department of Roads avoids the concern over the likely inaccuracy of a simplified one-lane or two-lane roadway tool being used for other cross-sections by using TNM template runs with different number of lanes and multiple receivers spaced back from the highway.

Likewise, Tennessee DOT has developed a series of screening TNM runs for a variety of typical multi-lane cross-sections (e.g., four-lane curb-and-gutter, 4-lane divided, etc.) with a 64 dBA trigger warranting further analysis.

Florida DOT has comprehensive project screening procedures that are detailed in its Efficient Transportation Decision Making (ETDM) process manual (process summarized below). These procedures provide opportunities for introducing noise in the planning and programming process, such as a simple



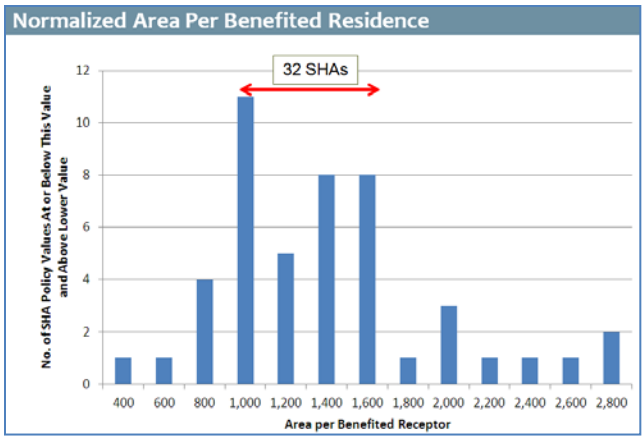
project review to make a preliminary assessment of noise abatement needs that would not involve noise modeling. Prior to starting the Project Development and Environmental Phase, Florida uses a Planning Screen process to develop cost-feasible transportation plans and then a Programming Screen process that results in a final programming screen summary report. Throughout the process, there is coordination within an Environmental Technical Advisory Team composed of state and federal environmental resource agencies.

Whatever analysis technique an agency uses, it is important to remember that impacts are still required to be determined and abatement feasibility and reasonableness must be addressed when impacts are identified. Also, as part of the required coordination with local officials, the need remains for the prediction of levels on undeveloped lands that not permitted for development.

Cost Effectiveness Reasonableness Criteria

- Facilitator: Jon Evans, New Hampshire DOT
- Participants:
  - Bill Bowlby, Bowlby & Associates, Inc. (FHWA research)
  - Jon Evans, New Hampshire DOT
  - Jim Ozment, Tennessee DOT
  - Jim Ponticello, Virginia DOT
  - Amber Phillips, Georgia DOT

Research conducted for FHWA on the feasibility and reasonableness criteria used by SHAs reveals a great deal of variability in the criteria in the SHA noise policies, which could lead to very different decisions on the same project.[2] As an example, the noise reduction design goal used by SHAs ranged from achieving at least 7 dB at one benefited receptor to achieving at least 10 dB at 80 percent of all first-row benefited receptors.



For the cost effectiveness criteria, the cost per benefited receptor ranged from $20,000 to $55,000, with barrier unit costs ranging from $18/square feet (sf) to $70/sf. To allow comparisons despite the wide range in costs and unit costs, the cost criteria were normalized to an equivalent barrier surface area per benefited receptor, a concept permitted by FHWA and used by six SHAs. The resulting range is from 250 sf/benefited receptor (for residential development that post-dates the SHA's noise policy change) to 2,750 sf/benefited receptor. Thirty-two of the SHAs' criteria fell in a range between 1,000 and 1,600 sf/benefited receptor. The full report is available on-line at: http://www.fhwa.dot.gov/environment/noise/noise_barriers/acceptance_criteria/analysis/

The New Hampshire DOT is in the process of finalizing a revision to its policy to add optional reasonableness criteria.

Properties permitted for development after DATE	Adjustment factor subtracted from base EC
1-25%	100 s.f.
26-50%	200 s.f.
51-75%	300 s.f.
76-100%	400 s.f.

In an effort to "combat increased noise sensitive development adjacent to state highways," New

[2] "23 CFR 772 Streamlining, Analysis, and Outreach Phase I, Task 3, Examination of Noise Abatement Feasibility and Reasonableness Factors Permitted under 23 CFR 772," performed by Bowlby & Associates with assistance from Environmental Acoustics and RSG, which was the lead firm on the Indefinite Delivery/Indefinite Quantity contract.

Hampshire plans to abandon its cost based effectiveness criteria in favor of the equivalent dimensionally based criteria of 1,500 sf which would then be used as the basis for determining effectiveness. The date of property development will then be used to lower the Base Effectiveness Criteria (BEC) of 1,500 sf based on the percentage of benefited residences that are permitted for development a year or more after the policy change. The presence of noise compatible planning by the local municipality will also add 200 sf to the BEC.

Tennessee DOT currently considers date of property development in its cost effectiveness evaluation criteria. Prior to 2005, Tennessee's policy allowed for giving "greater consideration" or "less consideration" to residential areas along proposed projects depending on the development date relative to the existing highway, without providing further guidance on those considerations. A 2005 policy change created an allowance system that considered several factors including development date, noise level and increase over existing level, which was contingent upon Tennessee's completion of a public outreach program. Tennessee switched from cost per benefited residence to an area per benefited residence when the policy was revised in 2011 and modified the allowances. Tennessee's approach gives land uses constructed before the road greater consideration while land uses constructed adjacent to an existing road receive less consideration. Also, using an area-based formula eliminates issues with estimating, updating, explaining and defending costs, although Tennessee has found it can sometimes be more difficult to explain this formula to the public.

Allowable Area per Benefited Residence =	
Base Allowance	_____ sf
+ Previous Type I Widening Allowance	_____ sf
+ Design Year Noise Levels Allowance	_____ sf
+ Noise Level Increase Allowance	_____ sf
+ Noise Compatible Planning Allowance	_____sf
Total	**_____ sf**

The use of the date of development – or any other factor – as an optional reasonableness factor is allowed by FHWA as long as the agency had an outreach program to public officials to educate them on the SHA's noise policy, as required in 23 CFR 772. The regulation also states that if an agency wants to use optional reasonableness factors, it must have at least two such optional factors in its policy.

Despite Tennessee's extensive public outreach program regarding the use of the development date in its decisions, local officials have not incorporated noise compatible planning practices in order to help avoid new residential development adjacent to existing Tennessee roads. While the state's disclosure form for the resale of existing homes does contain a "noise problem" question, no such disclosure is required for the sale of new homes.

As another example, Montana DOT had researched noise compatible planning and development and how the concept is perceived by local land use planners. Montana's attempts to implement such

planning with land use planners found little traction. Only one community, Kalispell, required developers to build barriers when needed.

Virginia DOT has a "Warranted, Feasible and Reasonable (WFR) Worksheet" that is completed for each noise impacted area warranting noise abatement consideration. The WFR worksheet becomes part of the permanent project file, documenting the rationale behind the abatement decision. Factors and criteria that are included are: community's development status relative to the project's date of public knowledge (the date of approval of the Categorical Exclusion, the Finding of No Significant Impact or the Record of Decision); the types of noise impacts; acoustical feasibility; engineering feasibility; cost-effectiveness; noise reduction design goal; and viewpoints of benefited receptors. The worksheet also documents the additional details of barrier length, height, height range, cost (unit and total) and type (reflective or absorptive).

	Reasonableness	
1	**Surface Area (Square foot)-Benefit Factors**	
a.	Surface Area (Total square foot) of the proposed noise barrier. (ft^2)	42,656 SF
b.	Impacted noise sensitive receptor(s) receiving 5 dB(A) IL or more.	11
c.	Non-impacted noise sensitive receptor(s) receiving 5 dB(A) IL or more.	50
d.	Total number of benefited receptors.	61
e.	Surface Area per benefited receptor unit. (ft^2/BR)	699 SF/BR
f.	Is (1e) less than or equal to the maximum square feet per benefited receptor (MaxSF/BR) value of 1600?	Yes
g.	Does the barrier provide an IL of at least 7 dB(A) for at least one impacted receptor in the design year?	Yes

Georgia DOT has made recent changes to its noise policy (effective January 2016) to provide clearer guidance on the criteria and lower the risk of differing interpretations. One change clarified the noise reduction design goal, emphasizing that "every attempt will be made to design a feasible and cost reasonable wall that reduces as many impacted receptors by 7 dB as possible." A second change provided more details regarding procedures and timing of updates, public outreach and construction activities on Design-Build projects prior to their being let for bid. Other Georgia policy changes included: increasing the barrier unit cost while not changing the cost per benefited receptor criterion, addressing residential building permits, and providing a standard approach for determining noise barrier treatments to provide consistency from project to project.

There are also difficulties in determining or estimating barrier costs, especially since these costs are often not consistently itemized in highway project bids. While Maryland has found some consistency in the barrier costs within its Type I and Type II projects, it still found a wide range in costs overall, often based on the size of the project, but also because true costs can be hidden in different parts of the bid. Several SHAs account for inflation in their barrier unit costs and policy costs: Georgia does so when it updates its policy; Minnesota has triennial updates; and Michigan and Iowa use the Consumer Price Index.

Consideration of Viewpoints of Owners and Residents

The research for FHWA on feasibility and reasonableness criteria referenced at the start of the previous section also examined the SHAs' implementation of viewpoints consideration requirement. As with the other feasibility and reasonableness criteria, there is a great deal of variability in how SHAs assess viewpoints, which could easily lead to different decisions on the same project - even with the same voting pattern. For example, 15 SHAs require 50 percent or a simple majority of the votes cast to be in favor of a noise barrier, while four require a 70 percent or greater positive vote. Several SHAs base the decision on a percentage of all possible votes, not on a percentage of the cast votes. However, based on court cases, FHWA will no longer allow SHAs to assume that a non-response is a "yes" or "no" vote.

There also is a wide range in which votes of property owners and renters are weighted, if at all. Seventeen SHAs give no guidance, simply stating that the viewpoints of the "property owners and residents" will be considered. Some SHAs give one vote to an owner-occupant and one vote each to a renter and a non-resident owner, while others give two votes to the owner-occupant. Voting by owners and tenants of multi-unit apartment complexes also varies in the weighting applied to the votes. Some SHAs give extra weighting for first-row benefited receptors, while others give extra weighting for impacted benefited receptors. After final approval of the work by FHWA, it is anticipated that the report and NAFRAT tool on the FHWA web site will be updated (see footnote 2 on page 11).

Voting in Favor of Barrier Based on % of Votes Received

Percentage of "Yes" Votes of Votes Received	Number of SHAs
50%	4
> 50%, 51%, 50%+1 vote	11
60%	1
67%	2
70%	1
75%	2
80% (of front row)	1

As one example, Wisconsin DOT focuses on voting in the context of its Noise Barrier Public Involvement Meeting (PIM) process. Wisconsin tries to hold a PIM no more than two years before the project will be let in order to gain a little more assurance that the people voting will be the people present when the barrier is built. Interestingly, the people owning and/or leasing residences across the road from the proposed noise barrier also get notified of the PIM. However, only the people determined to be benefited by the barrier get to vote. Owner-occupants get one vote and, for rental properties, the owner and the unit occupant each get one vote. A simple majority of the returned ballots decides the issue, with non-votes not being counted. If less than half of the eligible voters return a ballot, additional

outreach is conducted. Since Wisconsin began public voting instead of letting the local unit of government make the decision, only one barrier has been voted down. It should be noted, though, that when the local unit of government was the decision-maker, every barrier brought forward was accepted. Wisconsin also gathers comments on the color and texture of the barrier desired by the public, trying to accommodate the local unit of government on the texture on the highway side of the barrier and the benefited receptors on the texture on the residential side.

As a second example, in Oregon a noise abatement survey letter briefly explains the project and its noise impacts and provides a graphic or explanation of where the abatement will be located. The residents are then polled to see if they want abatement. If there is a response rate under 50 percent, the non-respondents are polled a second time. Even if less than a 50 percent response is obtained after the second polling, the majority of the returned votes determines the decision. Each property owner gets one vote and a renter of a single-family property also gets one vote. Beyond that, Oregon's approach to vote counting is unique. Benefited residents in multi-unit complexes (such as apartments) get one "yes" or "no" *collective* vote after those individual votes are tallied; the property owner of the multi-unit complex also gets one vote. For condominiums, where some units are owner-occupied and some are rented, owner-occupied units get unique votes, non-resident owners get one vote each and renters get one *collective* vote. For mobile home and trailer parks, each resident gets a unique vote and the property owner gets one vote.

North Carolina DOT has experienced controversy with the voting procedure in its policy. Its 2004 policy required that a simple majority of *all possible* votes had to be "yes" or else there would be no barrier. The 2011 policy reversed this approach so that a wall is reasonable unless a majority of *all possible* voting points are against the wall. Part of the reason for this change was that, often, only 10-20 percent of official ballots were returned, yet at public meetings there would be a clamor for abatement.

In the Charlotte area, many recently-proposed barriers passed in the voting process in part because of the low return rates. Design changes on one project necessitated a re-balloting, which was closely-scrutinized by the public because the walls would block the view of the downtown skyline both from the communities and the road. Many people, including those not receiving a ballot, did not want the walls and actively pursued their elimination. Considerable public outreach preceded the re-balloting. Vacant rental properties were not counted.[3] People who wanted the walls claimed these vacant properties

[3] North Carolina typically assumed that tax records going to the physical property meant the property was owner-occupied, and that records going elsewhere were rental properties.

could be occupied at any time. Ultimately, the proposed downtown walls were defeated in a very close and very contentious vote.

Because of the issues raised by the downtown Charlotte re-balloting, North Carolina was required to re-ballot an additional 1,500 owners and tenants along other projects in the Charlotte area. FHWA wanted the enhanced public outreach done for the downtown re-balloting to be duplicated in order to maintain consistency in the voting process. This second round of re-balloting did not change the previous outcome on any of the walls. North Carolina is now revisiting its current voting process.

Similarly, Michigan DOT usually gets a low percentage of returned votes. In response, Michigan successfully used a strategy that started with a kick-off meeting to introduce the public to the project and noise study and a second meeting to present the preliminary noise abatement analysis results. Based on positive public comments at the meeting and achieving the noise reduction and cost effectiveness goals, the barrier was identified as reasonable for the environmental review. The Statement of Likelihood in the noise technical report provided Michigan with flexibility to have the official vote of the benefited receptors after the approved environmental review. Then, at the Context Sensitive Design public meeting during final design, those visually affected by the barrier were allowed to vote on the barrier aesthetics in addition to the benefited receptors voting on the barrier itself. This activity was documented to provide a public involvement record in case of any inquiry or challenge.

In dealing with concerns over low response rates Illinois DOT found that its letter soliciting the votes of owners and residents was written at almost a "16th grade" readability level, which was cited as a possible cause of low response rates. A change was made to rewrite the letter at a 10th grade level to make it easier for all residents to understand.

Minnesota DOT went through a noise barrier audit conducted by the Minnesota Office of Legislative Audit. The audit recommendations and additional noise policy updates were addressed through a Noise Policy review process. The audit recommended an increase in the transparency of noise barrier policy decision making. This was accomplished by first having a Technical Advisory Committee and Policy Advisory Committee (PAC) review the existing policy. The eight voting PAC members – three State representatives, three State senators and two citizens – then voted on the 2015 Draft Noise Policy, which then went out for public comment. The finalized Draft 2015 Minnesota Noise Policy was then sent to the FHWA Division and headquarters' offices for review and determination of compliance with 23 CFR 772.

A second audit recommendation was a change in procedure for assessing public support for noise barriers on federal projects. The old policy was that greater than 50 percent of the *total possible* points (assigned based on status as property owner or renter) had to vote "no" on the barrier for it not to be constructed. The revised process requires a simple majority of the voting points *cast* to be either in favor of or in opposition to the barrier. Importantly, if less than 25 percent of all possible votes are cast after two solicitations of votes, the wall will not be constructed.

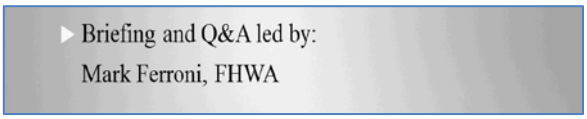
A third recommendation was to retain the doubling of the number of voting points for benefited receptors abutting the project and the giving of the most points to owner-residents, then non-resident owners, and then non-owner residents. Minnesota's cost effectiveness criterion of $43,500 per benefited receptor was retained. The updated process led to other policy and guidance changes regarding impacted trails, cemeteries, determining the worst noise hour, analyzing reflected noise, analyzing existing barriers and determining the physical limits of the noise analysis.

Some SHA noise practitioners also have concerns that 23 CFR 772 does not address the viewpoints of *non-benefited* first-row residents who will get a wall built in front of their houses but cannot vote on the barrier. Utah DOT and Washington State DOT are examples of SHAs that have wording in their policies about giving non-benefited receptors the ability to vote because of concerns over interference with their viewsheds.

The timing of the solicitation of viewpoints is also an issue, especially in regard to the Statement of Likelihood in the environmental document. Obtaining a positive vote for a barrier and then deciding to not build the barrier for nonacoustical feasibility reasons was seen as problematic. One suggestion is to wait as long as possible to vote, with an example of a project in Texas where a turnover of property owners after the vote resulted in a change in the desire of the affected community for the barrier.

Finally, there are concerns on how and whom to poll for unique land uses such as assisted living facilities, prisons and college dorms.

TNM 3.0 Status and Implementation Plans



The FHWA contractor for the FHWA TNM 3.0 program is nearing completion of its work on the MicroStation, AutoCAD and ArcGIS extensions for TNM input file creation. The Volpe Center has completed the Phase 1 validation of the stand-alone program against the original Phase 1 noise measurement data set used in the initial validation of TNM 1.0.

Eight SHAs (Georgia, Michigan, Minnesota, North Carolina, Ohio, Texas, Virginia and Washington State) began beta testing TNM 3.0 at the end of October with estimated completion time of 3 months.

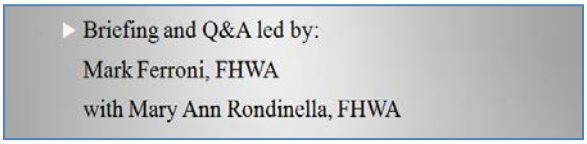
The Volpe Center will also be conducting a Phase 2 validation on TNM 3.0, comparing test results to multiple TNM 2.5 cases developed for FHWA in a "Consistency Test Suite." This Phase 2 testing is scheduled for completion in March 2016 but may go longer if test results indicate further work is necessary.

Any third party implementations of TNM 3.0 (such as within the SoundPlan or CadnaA environmental noise models) will need to pass the Consistency Test Suite requirements. Until that consistency is demonstrated, a third party implementation will not be allowed for use on Federal-aid projects.

There will be a phase-in period for TNM 3.0 after its initial release. The implementation will include several components. The FHWA contractor will provide technical information for promotional brochures. The contractor will also develop four webinars – one for the standalone version and one for each extension. These webinars will be 60 minutes long (30 minutes presentation and 30 minutes of Q & A), but no dates have been set yet.

Web-based workshops will also be developed – one as an overview, one on the interface and one on how to set up a project. The user's guide will also be built into the standalone version program; the extensions will have stand-alone documents. In-depth third-party training courses, such as are currently being taught for TNM 2.5, are expected to be offered.

Miscellaneous Traffic Noise Policy, Procedure and Program Topics



Several miscellaneous topics of interest were addressed in the summit. A takeaway from the summit was that while the SHA noise practitioners generally seemed to be aware of updates to FHWA's guidance document, they were not routinely aware of updates to the Noise Policy FAQs. Several updates to the Noise Policy FAQs (available at http://www.fhwa.dot.gov/environment/noise/regulations_and_guidance/faq_nois.cfm) include:

- Transit-only projects: Where the Federal Transit Administration (FTA) is the *lead agency* and *no* Federal-aid highway funds are being used, the FTA's *Transit Noise and Vibration Impact*

Assessment Guidance Manual procedures should be used to consider noise associated with the transit projects *and* any highway elements directly affected by the transit projects.

- Auxiliary lanes: The function of an auxiliary lane differs depending on the type of facility; an auxiliary lane should classify the project as Type I if the auxiliary lane is 2,500 feet or longer.
- Soliciting viewpoints of benefited receptors: SHAs should engage in robust and meaningful outreach in order to solicit the viewpoint of all benefited receptors and obtain enough responses on which to base their decision. A high-level decision was made that SHAs should consider *only* the votes that are submitted, and should *not* assume a non-response is a vote for or against the noise abatement.

Another important topic of recent interest involves environmental justice and Title VI (of the Civil Rights Act of 1964). In particular, the US Department of Housing and Urban Development (HUD) has challenged recent highway projects in Ohio and Texas on noise impacts and abatement decisions. The Ohio project included moving a ramp closer to a former HUD property that had been sold to the local housing authority. The Texas project involved an elevated approach to a bridge. These HUD challenges are a concern and potentially precedent-setting, especially since HUD wants its simplified assessment tool and its criteria applied, which are different from the FHWA methodology. Issues with HUD's positions, extending beyond noise, are a concern to FHWA and are also on AASHTOs' radar.

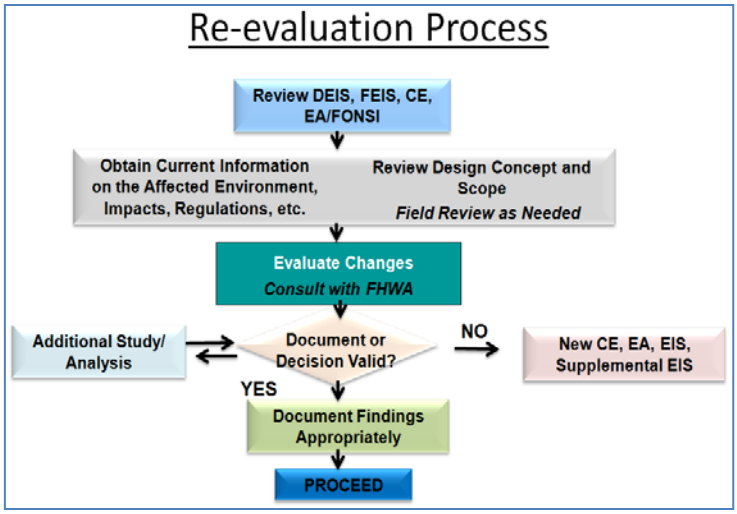
Third, the Noise Barrier Inventory data required to be submitted by the SHAs is currently being analyzed, with a desire to have the results available in early 2016. Changes are being recommended to improve the efficiency of the spreadsheets used to collect the data.

Fourth, FHWA continues to address the subject of quieter pavements. A 2013 Federal Register notice solicited SHA views on quieter pavements. One of the main over-arching responses was that while pavements need to be better accounted for within modeling predictions, there was no desire to have more policy or regulatory restrictions. At some point in the future, the Volpe Center will be updating the reference energy mean emission level database in TNM 3.0 for "average" pavement. A second over-arching response was not requiring a "quieter pavement" to be overlaid prematurely if its noise reduction effectiveness was lost (in essence, treating it as a Type I project). A 2005 FHWA memo on the subject of quieter pavements is in the process of being updated.

Fifth, any updates to a SHA's noise policies need to be reviewed by the FHWA's Division Office and FHWA Headquarters. SHAs must be mindful of making changes too often. In fact, SHAs may want to leave older versions of their policies on-line and reference the version used in an environmental document or noise report to help minimize confusion on the part of the public as to when policy changes were made and under which version the study was done.

Sixth, FHWA has guidance on new highway projects with existing noise barriers: http://www.fhwa.dot.gov/environment/noise/noise_barriers/abatement/existing.cfm. Items of particular interest include: details on the analysis process, what to do when the old barrier needs to be removed, and which costs to include in the reasonableness analysis.

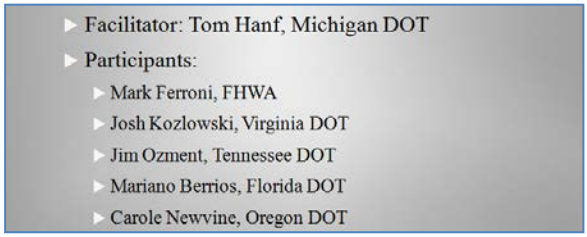
Finally, FHWA has guidance on re-evaluations located at: http://www.fhwa.dot.gov/environment/noise/regulations_and_guidance/frule772.cfm. Re-evaluations are described as the process by which highway agencies consult with FHWA to determine if NEPA documents and decisions remain valid as project development proceeds. Of particular concern is when a re-evaluation shows a barrier previously determined to be feasible and reasonable to no longer be so. Additional information on the subject, including a FHWA Resource Center two-part series on "FAQs about NEPA Re-evaluations," is available:



- https://www.fhwa.dot.gov/resourcecenter/teams/environment/vol5iss2.pdf
- https://www.fhwa.dot.gov/resourcecenter/teams/environment/vol5iss3.pdf

Traffic Noise Modeling: Best Practices for Modeling and Review of Models

SHA noise practitioners have identified a need for best practices not only for traffic noise modeling, but also for the review of modeling done by others, especially consultants. FHWA has research underway on best practices for modeling. The project has three components:



- TNM Object Input
- Noise Barrier Design Optimization
- TNM Quality Assurance (QA) Review

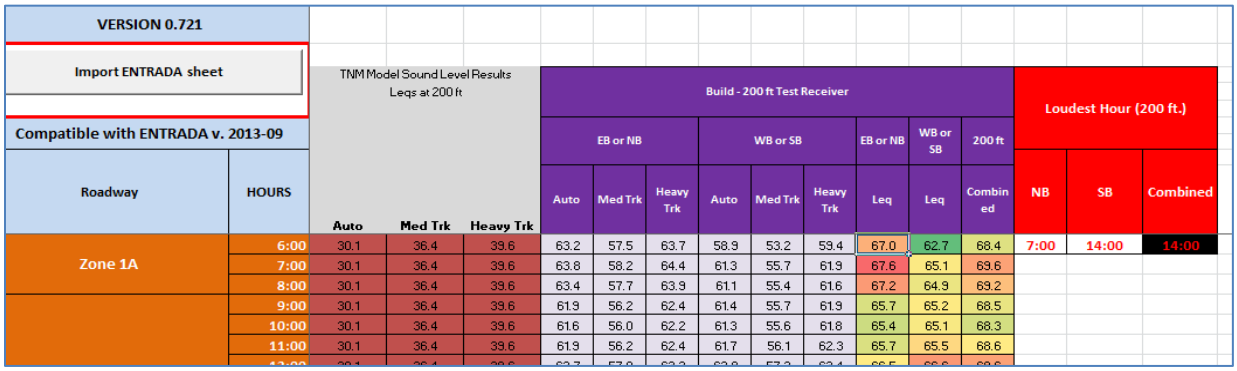
The TNM Object Input component addresses three topics:

- Sources of quality topographic and geospatial data

- Guidance for development of traffic data, including traffic distributions across lanes of a multiple-lane highway and selection of volumes and speeds based on level-of-service (LOS) or design hourly volumes (DHV)
- Recommendations for additional FHWA TNM output tables

Included in the research are questions posed to the SHAs by the researchers on each component and summaries of the responses.

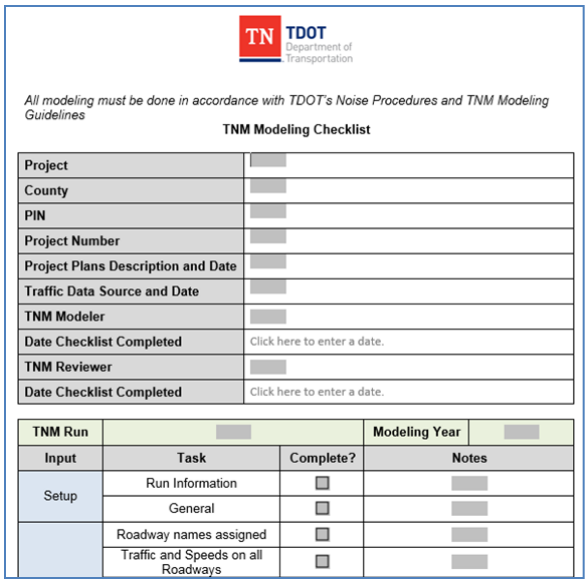
One example of a tool that assists in obtaining good modeling is Virginia DOT's ENTRADA traffic worksheet and its Worst Noise Hour (WNH) worksheet. ENTRADA provides project-level data on hourly



VERSION 0.721																
Import ENTRADA sheet		TNM Model Sound Level Results Leqs at 200 ft			Build - 200 ft Test Receiver									Loudest Hour (200 ft.)		
Compatible with ENTRADA v. 2013-09					EB or NB			WB or SB			EB or NB	WB or SB	200 ft			
Roadway	HOURS	Auto	Med Trk	Heavy Trk	Auto	Med Trk	Heavy Trk	Auto	Med Trk	Heavy Trk	Leq	Leq	Combined	NB	SB	Combined
Zone 1A	6:00	30.1	36.4	39.6	63.2	57.5	63.7	58.9	53.2	59.4	67.0	62.7	68.4	7:00	14:00	14:00
	7:00	30.1	36.4	39.6	63.8	58.2	64.4	61.3	55.7	61.9	67.6	65.1	69.6			
	8:00	30.1	36.4	39.6	63.4	57.7	63.9	61.1	55.4	61.6	67.2	64.9	69.2			
	9:00	30.1	36.4	39.6	61.9	56.2	62.4	61.4	55.7	61.9	65.7	65.2	68.5			
	10:00	30.1	36.4	39.6	61.6	56.0	62.2	61.3	55.6	61.8	65.4	65.1	68.3			
	11:00	30.1	36.4	39.6	61.9	56.2	62.4	61.7	56.1	62.3	65.7	65.5	68.6			

peak hour volumes (directional and two-way), medium and heavy truck percentages, posted and operational speeds, and capacity/LOS. The WNH worksheet, shown below, then extracts information from the ENTRADA sheet and performs worst noise hour screening.

As another example, Tennessee DOT provides modeling guidance to its consultants (who do all of the agency's noise studies) in two documents: a generalized modeling section in *Procedures for Highway Traffic Noise Abatement* and detailed guidance in Tennessee's *Guidelines for Noise Modeling Using FHWA's Traffic Noise Model (TNM)*. Tennessee's quality control process utilizes a comprehensive modeling checklist covering all TNM input objects that must be complete for TNM runs. The documents will be available on-line.



TN TDOT Department of Transportation

All modeling must be done in accordance with TDOT's Noise Procedures and TNM Modeling Guidelines

TNM Modeling Checklist

Project	
County	
PIN	
Project Number	
Project Plans Description and Date	
Traffic Data Source and Date	
TNM Modeler	
Date Checklist Completed	Click here to enter a date.
TNM Reviewer	
Date Checklist Completed	Click here to enter a date.

TNM Run			Modeling Year	
Input	Task	Complete?	Notes	
Setup	Run Information			
	General			
	Roadway names assigned			
	Traffic and Speeds on all Roadways			

Florida DOT also has a *Traffic Noise Modeling and Analysis Practitioners Handbook.* A key component of the handbook deals with traffic data, driven by

inconsistencies in past studies across the many Florida district offices and consultants. A standard traffic data form and standard scope language were developed. The handbook also provides model input guidance on the various TNM input objects, use of the state-plane coordinate system and barrier optimization and development of recommendations. The handbook also addresses public involvement and noise study documentation. Interestingly, the consultants who do most of the modeling for district offices also volunteer their time to serve on a task force for improved modeling on DOT projects.

Oregon DOT utilizes a "Noise Study QC and Report Review Checklist" that can be used by the noise analyst (typically a consultant) as well as the agency's reviewer. In addition to basic report items such the project description, land use, and methodology, the checklist also addresses:

- Existing Acoustic Environment, including noise measurements and model validation
- Traffic Noise Analysis, including predicted L_{eq}, analysis summary and noise level contours for undeveloped land
- Noise Abatement Measures, including a *Noise Evaluation and Recommendation* form for each noise abatement measure considered

Oregon DOT reports document why the project is Type I, give clear descriptions of how receptors are counted and assigned to receivers, and contain good graphics. Model validation is seen as an important way to confirm that the noise analyst understands the modeling process and is also being consistent in the modeling of the existing and future cases for a project.

Two other examples are:

- Maryland SHA wants a narrative or rationale on the process a consultant has followed during modeling and validation, especially if the model is not validating
- Oklahoma DOT has a scope of services for deliverables for its noise studies that clearly spell out the expectations, which includes PDFs of all TNM runs with the correct dates on which the runs were made

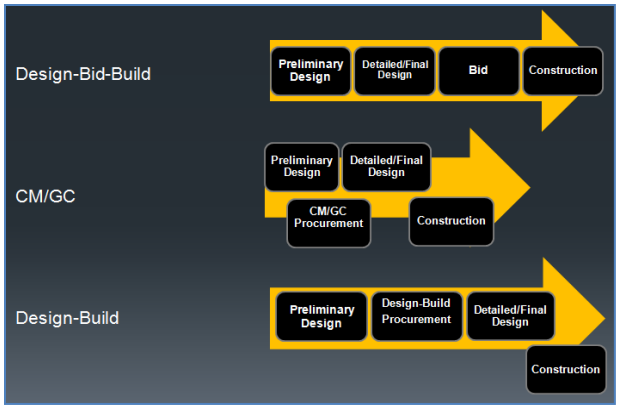
There are concerns about the need for better noise analyses on local programs projects. In Florida, the Local Agency Program office created its own manual that makes reference to the Florida *Project Development and Environment (PD&E) Manual*, which includes the state's noise policy. Florida DOT staff often spends a great deal of time working with local agency staff on noise studies.

Two other topics of interest are the sources and adequacy of traffic data and the need to perform model validation on all projects where validation is currently required.

Design-Build Projects

- Facilitator: Mariano Berrios, Florida DOT
- Participants:
  - Darren O'Neill, Delaware DOT
  - Amber Phillips, Georgia DOT
  - Mariano Berrios, Florida DOT
  - Noel Alcala, Ohio DOT
  - Discussant: Greg Smith, North Carolina DOT

There is a great deal of interest in alternatives to the traditional Design-Bid-Build approach, reflecting what was described as a resurgence in the "master builder" philosophy where the design team and the builder/contractor team work in unison for an owner. Delaware DOT makes extensive use of Design-Build (D-B) and also a newer project delivery method known as Construction Manager/General Contractor (CM/GC). A key difference in the two is that under D-B, design and construction activities are taken on by one entity, while with CM/GC, the owner coordinates and manages the entire project with both the design and construction entities working together early on. Under CM/GC, the owner engages a construction manager during the design process to provide input on, among other items, scheduling, pricing and phasing that helps the owner design a more constructible project. The owner and the construction manager then negotiate a price for the construction. If acceptable, a contract for construction services is executed and the construction manager becomes the general contractor; if not acceptable, the contract goes out for bid.



Among the challenges in D-B and CM/GC are the lack of standard competitive low bids, the possibly subjective nature of selection criteria, and public scrutiny of selected firms/teams. An issue regarding noise abatement is that D-B teams will try to "engineer out" feasible and reasonable noise barriers, saving substantial funds but challenging commitments to abutting communities. An important note is that if a project is high-risk with regards to noise (or other environmental areas), then D-B may not be the best project delivery option.

Georgia DOT has a great deal of experience with what was described as the "delicate balance" when dealing with noise abatement in the D-B process. Georgia is also using the Design-Build-Finance (Public Private Partnership) project delivery method, where a contract is let and awarded to a "developer/private concessionaire who designs, finances and constructs the project." Georgia is facing challenges such as dealing with differing interpretations of its Noise Policy and trying to fit D-B projects into the mold for traditional Design-Bid-Build projects. There is also a challenge in the public involvement process regarding the timing of the public outreach and the construction. Additionally, when future projects are being considered, there can be potential conflicts with wall placement and

abatement commitments. As noted earlier, Georgia updated its noise policy in part to close interpretation loopholes and assure that all policies, design and procedures do not conflict. Because more complex projects are moving to D-B in Georgia, there was a need for the noise policy to cover D-B rather than only covering Design-Bid-Build.

Florida DOT has also faced and addressed noise barrier design challenges with its D-B and Public-Private Partnership (PPP) projects. Among the noise abatement considerations for these types of projects are the following:

- The Request for Proposal (RFP) needs to accurately identify the noise barrier requirements.
- There is a tendency for D-B firms to evaluate designs that eliminate or modify recommended noise barriers to reduce their bids and increase profit.
- Florida is responsible for any additional noise barrier analysis required during the D-B Process.
- D-B teams cannot perform environmental re-evaluations.

For Florida, the biggest challenges have been with defining the noise requirements in the RFP and dealing with the "inevitable" design changes during D-B and PPP processes that require iterative noise analyses to result in an effective noise barrier design. A key recommendation was that the DOT's project noise analyst (typically a consultant) must be involved from the procurement phase through the design phase: during RFP development; during evaluation of "Alternative Technical Concepts" if changes to noise barriers are proposed; in the approval process for proposed deviations from the RFP; and in the reviews of roadway and structures plans.

Ohio DOT has also had a number of lessons learned regarding D-B projects involving noise barriers. For one, design changes cause delays and contracting issues and being on a fast-track schedule means reluctance to address minor comments. There is less flexibility and more reluctance to make changes. There is also less review time, meaning fewer issues get caught. Also, a DOT should implement a better system of checks and balances and should negotiate to retain the ability to make minor changes to project scope without incurring major additional costs or granting time extensions. Similar to Delaware DOT, Ohio will identify these items, look at the risk, and make a decision on whether D-B is appropriate.

Project-specific lessons for Ohio DOT have come from dealing with conflicts in the field with analysis results and D-B scope items. Examples include: bottom-of-wall elevations; wall square footage (above ground and buried); noise barrier design details; distance offsets of a wall from the edge of pavement;

and location of existing utilities. Another example was when a new noise wall was found to be needed, the added cost for it could not be added to the D-B project; it had to be a separate project.

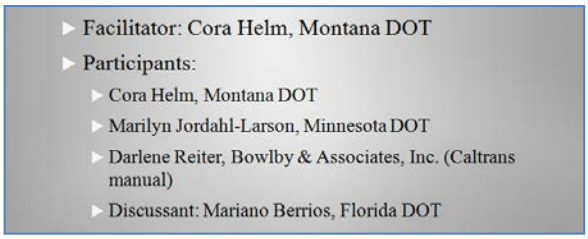
In North Carolina approximately 80 percent of the DOT's noise walls are being built on D-B projects. The agency began its first PPP project, which included 21 noise barriers, this past summer. North Carolina ballots the walls before the D-B RFP and incorporates the final design report and GIS elevations in the RFP. The D-B contract contains minimal noise criteria: the contractor uses the DOT's design and any change to the design must result in no net loss in noise reduction benefits. Design revisions can be frequent, especially for utilities and drainage. However, the DOT's 10-day review period for plan revisions is too short for major reevaluations of changes in noise barriers, especially with the goal of getting all noise barrier changes accomplished at the same time. North Carolina is resistant to having unit costs in D-B contracts, but can go back and ask contractors for line item costs. The accuracy of pricing information received from contractors makes it hard to provide data to management on abatement costs and unit costs. This matter currently is being reviewed, with a goal of finding a means of obtaining valid wall costs on D-B projects.

New Jersey DOT has a D-B checklist where any changes must be reviewed and approved, including by the environmental noise unit, before construction. Florida also uses a checklist for proposed changes.

AASTHO and FHWA could play more active roles in providing guidance in dealing with issues that often arise in balancing D-B contractor proposed cost-savings measures and ensuring proper noise abatement. It is important to note that FHWA's regulations prohibit the same contractor who did the NEPA work (including noise) from doing the D-B work, in order to "maintain the integrity" of the NEPA process. Also, D-B expertise is available to SHAs within the FHWA headquarters and resource centers.

Construction Noise and Vibration and Pre-Construction Evaluation

There are many challenges in the analysis, assessment, monitoring and mitigation of construction noise impacts on wildlife, especially threatened and endangered (T&E) species. The goals of the needed biological assessments for T&E species



are to avoid, minimize and mitigate. One issue is that operational and construction impacts on wildlife are not addressed in 23 CFR 772.

Montana, Idaho, Utah, and Alaska are examples of states facing these challenges, with Montana citing project examples related to all three of the above goals.

There was a call for better science on topics such as timing restrictions for more T&E species. The US Fish and Wildlife Service (USFWS) is requiring all states to utilize timing restrictions or mitigate for sound and vibration during construction and to monitor the hydroacoustical effectiveness of such mitigation. Some SHAs find the impact criteria and test procedures presented in current research literature to be impractical or inappropriate.

Florida DOT has had similar concerns dealing with USFWS, even though the habitats and species in Florida are much different than in the northwestern states. In addition to the wildlife issues, FDOT also deals with poorly written local noise ordinances. While local ordinances do not apply to projects on the state highway system by statute, the DOT tries to comply with local ordinances as much as possible and as long as it is practical. Poorly developed ordinances make this difficult though.

The Alaska Department of Transportation and Public Facilities has many construction projects in marine environments, such as bridges and ferry terminals. The National Marine Fisheries Service (NOAA Fisheries)[4] regulates underwater noise impacts on marine mammals and certain endangered species, such as humpback whales and stellar sea lions. Alaska has an ongoing FHWA-sponsored research project to monitor sound in different marine environments to improve the “best available science” for different marine environments, with results expected in 1-2 years. A programmatic agreement on underwater sound generated by pile driving in different marine environments may be needed.

Montana had been conducting internal research, hoping to get a mitigation method developed that would not require monitoring. However, this research was stopped when agency staff felt that the

[4] NOAA Fisheries, also known as the National Marine Fisheries Service, is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

USFWS would not change its requirements for timing restrictions and mitigation regardless of the research results.

FHWA's past dealings with NOAA Fisheries indicates that, even with good science, it was unlikely that bypassing monitoring and going straight to mitigation would be allowed. Further, AASHTO's interest in the summit was partly driven by SHA concerns over wildlife impacts coordination.

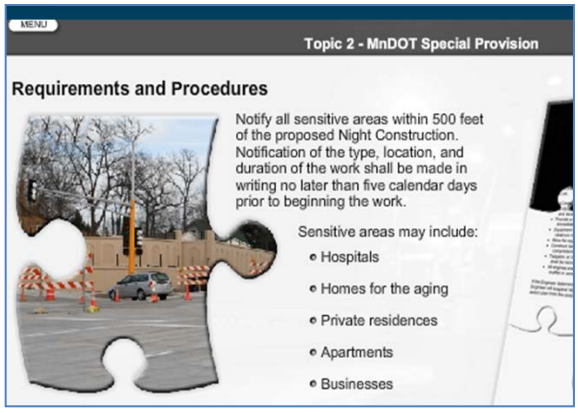
Several SHA representatives have started working on a National Cooperative Highway Research Program (NCHRP) problem statement on analyzing the effects of construction noise on wildlife. While initially planned for a November 2015 submittal, the current plan is to submit the problem statement during the 2016 cycle. Help from AASHTO, the TRB or upper management in the associated federal agencies may be needed to help advance assessment procedures.

Montana will be hosting the 2016 TRB ADC40 Committee summer meeting, with hopes of having a session on wildlife noise and vibration impacts.

While the California DOT was not represented at the summit, a brief presentation was made by the summit organizers on the recent update to California's *Transportation and Construction Vibration Guidance Manual,* an important resource to SHA noise practitioners. The manual covers: the basic physics of vibration; vibration sources, propagation and receivers; measurement, prediction and methods for reduction; general procedures for addressing vibration issues; and blasting. Other guidance documents on effects of noise on fish (hydroacoustic impacts of pile driving), birds (updated guidance) and bats (new guidance) were expected to be available in late 2015 at www.dot.ca.gov/hq/env/bio/avian_bioacoustics.htm.

Additionally, a NCHRP research project is underway to improve the current FHWA Roadway Construction Noise Model (RCNM). The new RCNM will use TNM 3.0 as a base.

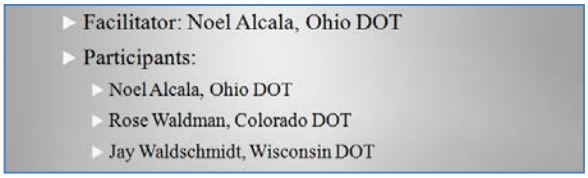
Also of interest, Minnesota DOT has a contract special provision for that addresses noise from night construction (SP S-52 1803). The provision requires a contractor's supervisor to take an online training package when planning to work at night. The training



covers the definition of night construction, night construction noise impacts, and the contents of the special provision, including typical prohibited activities, requirements and procedures and nighttime construction noise mitigation measures. The training is available at: http://www.dot.state.mn.us/onlinelearning/construction/noisemitigation/

Colorado DOT and the West Virginia Department of Highways had projects involving nighttime work and bridge demolition, respectively, in which advance notification and coordination with the public yielded positive experiences. In West Virginia, a community event was organized by the department for everyone to watch the bridge demolition.

Noise Barrier Materials, Design and Costs



A high priority subject apart from the noise regulation, policies and modeling is the more practical side of abatement – noise barrier materials, designs and costs. In particular, topics of interest included:

- Material selection, review and approval process
- Experiences with different materials and textures
- Design and construction costs
- Material innovations
- Qualified products evaluation and approval and contractor selection
- Construction inspection process
- Accounting for abatement costs when the level of design is very preliminary and the potential for hidden costs is great

Ohio DOT (ODOT) has experiences with many of these topics. The DOT surveys the public on materials and aesthetics for the residents' side of noise barriers and involves the local government for the highway side. Ohio has tried many different materials, having educated management their benefits by presentations by the DOT's noise specialist and system suppliers. All products associated with noise walls go through a review and approval process with the Offices of Environmental Services, Structures, and Material Management.

Barrier design costs have been about 7 to 10 percent of the construction cost. The estimated construction costs are $25/sf or $1.5 million/mile for ground-mounted noise barriers and $100/sf for structure-mounted barriers.

Finally, Ohio's noise barrier specification (NBS-1-09) contains acceptance requirements during the construction process, including a requirement for a fully erected control panel. A PowerPoint file of images of unacceptable newly constructed noise walls is also used.

Lessons learned on individual ODOT projects have included:

- There have been durability issues with some sound absorptive materials in harsh freeze/thaw areas in northeast Ohio.
- Posts and panels must be thoroughly and frequently inspected during construction.
- There have been issues with colored sealer adherence to concrete posts.
- Dark colors should be avoided.
- Designs should be kept simple – the fewer parts and pieces, the fewer issues.

Wisconsin DOT's *Noise Wall Pre Approval Requirements* is similar to that of Ohio's. Interested suppliers are required to submit certified independent third party test reports on flame spread index and smoke developed index, sound transmission loss, Noise Reduction Coefficient (NRC), salt scaling resistance, accelerated weathering, and corrosion resistance (salt fog exposure).

Wisconsin also requires independent third party certification of compliance for steel panels, aluminum panels, timber components, species of wood, preservative treatment, glue laminated timber, lumber, plywood, sealant/stain, hardware and fasteners and mineral fiber material. Structural and foundation designs are also required to be in compliance with Section 15 in AASHTO's *LRFD Bridge Design Specifications, 7th Edition, with 2015 and 2016 Interim Revisions* which include specifications for structural design of sound barriers.

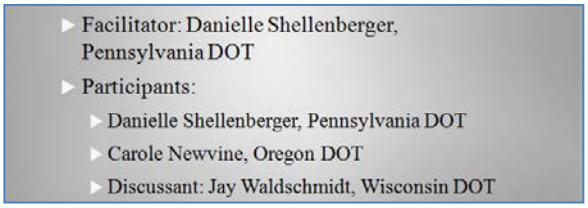
Colorado DOT is in the process of revising its noise wall material guidelines, which is used to determine if a material can be added to its approved products list. The original guidelines were relatively subjective and a revision is currently underway to add more objectivity. The revision team consists of specialists in noise, materials, and roadway design as well as a resident engineer and a staff bridge engineer. The team is assessing changes in the objective guidelines (such as NRC, sound transmission and freeze-thaw testing) and

the subjective guidelines (e.g., resistant to impact, graffiti, absorptive surface durability), as well as other requirements such as structural, durability, aesthetics, and whether to focus on panels or the entire wall system.

Several SHAs have raised issues on transparent walls, including uncertainty and variability of bid unit costs, design criteria, eligibility of impacted areas for use, crash-testing, maintenance, and durability. There are also other more general questions regarding recycled materials, toxicity of materials, dealing with snow, and identifying unique costs associated with certain projects or products.

Also of interest, New Mexico's FHWA Division Office has a policy on art (defined as involving a commissioned artist) and aesthetic treatments (i.e., texture, color and stamping). The need for such a policy was identified for transportation projects on tribal lands, but provides a framework for all transportation projects receiving art and/or aesthetic treatments.

Enhancing and Improving Technology Transfer, Training and Recruiting



The final focus of the summit was an open discussion on technology and knowledge transfer, training and recruiting. AASHTO has a Highway Traffic Noise Work Group chaired by Danielle Shellenberger of Pennsylvania DOT. The Work Group is under the AASHTO Standing Committee on the Environment (SCOE) and currently has 26 member states. Its purpose is to provide a forum to address noise issues and exchange information with member states. The Work Group's current activities include peer exchange, process improvements, research topics and regulation review. One desired outcome of the summit is to get more SHAs joining the Work Group and participating in its activities.

While the Work Group was originally set up with three regional chairs, a suggestion was made to add a fourth chair to align with AASHTO's geographic regions. A recommendation was also made to take advantage of this structure as a way of consolidating SHAs' problems, issues and needs, so that the chairs could efficiently and effectively present them as one voice to FHWA.

SHAs are interested in more AASHTO leadership as a clearinghouse and repository for available information, including the responses received when a member of the Work Group poses questions to the rest of the group. AASHTO also currently has a repository of legal cases that could be of value to the group. One idea was the creation of a committee within the Noise Work Group that would focus on how to handle technology transfer.

Of interest is readily available and up-to-date information on the various components of the SHA noise policies. There is no current on-line repository of all SHA noise policies, including at FHWA, because of the difficulty in keeping them updated. One possibility is that the FHWA noise web site could provide *links* to the SHA web sites to access the current policies. There would still be the need, however, to keep the links updated. An option is for AASHTO to provide a similar service. Members of the TRB ADC40 noise and vibration committee have also talked about its web site being a repository for information on topics of interest to the noise community.

Another avenue for technology transfer could be AASHTO's National Transportation Product Evaluation Program (NTPEP, pronounced "net pep"). NTPEP is looking to expand into additional material certifications, based on direction it receives from the states as to what types of products they want tested and certified. At this time, sound wall materials are not included but could be if there was enough demand and if the materials have common standards to be applied. Only those states that fund the program can use the NTPEP product data. The website is http://www.ntpep.org/Pages/default.aspx.

There was near-unanimous consensus at the summit for the holding of quarterly webinars on noise topics of interest. Such webinars could be conducted through AASHTO or possibly the National Highway Institute (NHI). NHI actually held its inaugural on-line Real Solutions Seminar Series on the subject of noise: *Solving Old Traffic Noise Ills - Tennessee DOT's Type II Noise Abatement Program*, available at: https://www.nhi.fhwa.dot.gov/downloads/other/real_solutions_presentations/real_solutions_presentation_2008_03.pdf.

Recruiting for air quality and noise analysis positions has been a challenge for SHAs. The difficulty arises, in part, when it is required that potential candidates have prior transportation air and noise experience, which means a relatively small pool of qualified individuals. It is also difficult to sell the idea of state employment to qualified consultants. A recent Oregon DOT advertisement for a Transportation Noise Specialist included minimum qualifications of education or experience in environmental science, civil engineering, surveying or transportation-related engineering. However, Oregon DOT requires its noise studies to be stamped by professional engineers, meaning that an in-house study noise study must be reviewed and stamped by an Oregon-licensed engineer. Interestingly, only a few of the SHAs represented at the summit require an engineering degree for their noise positions.

Problems recruiting qualified employees were also noted in Wisconsin and Florida. Retaining specialists is a challenge as after being trained and gaining experience they often move into the private sector for greater pay.

Overly restrictive requirements in job announcements can limit the pool of otherwise qualified applicants. One suggestion was to open the searches to include people with an atmospheric sciences background, which was done successfully in Kentucky. Opening searches to include Bachelor of Environmental Health degrees was also suggested because licensed environmental health practitioners have to demonstrate competencies in both air quality and noise. Targeted out reach for job candidates can be made through the National Environmental Health Association, which allows free posting of job announcements (http://www.neha.org/), and the Institute of Noise Control Engineering (http://www.inceusa.org/jobs).

One example of an opportunity for developing strong candidates is the Graduate Public Service Internship program at the University of Illinois at Springfield, which acts like a graduate assistantship assigned to a government agency, allowing the person to simultaneously begin a professional career while earning a master's degree. The Bachelor of Science in Acoustics program at Columbia College Chicago has also been a source of a number of new hires in the profession in recent years.

The Noise Roadmap

Introduction

This noise roadmap is a summary of the issues that were identified as well as how those issues might be addressed moving forward. The summit concluded with an open discussion aimed at identifying these issues. To further this roadmap, a post-summit on-line survey was developed. The goal of the survey was to more accurately gauge and understand the importance of the issues and potential remedies for the SHAs. For each of the summit sessions, several of the key discussion topics were identified. For each of these topics, the delegates were asked about the needs for:

- Technical assistance or guidance
- Research
- A change in the noise regulation

Delegates were then asked for any recommendations for FHWA or AASHTO with regards to these needs.

Responses were received from 27 delegates. It is not the intent to present the results of the survey in detail, but rather to use those results to shape the roadmap.

The survey also allowed for feedback on the summit itself. Based on the responses, the summit was very successful as a peer exchange. Nearly 80 percent of the delegates found the summit to have been extremely valuable. As one noted, “There really is no substitution for face-to-face peer exchange. Because noise is so different from other transportation disciplines, there really is no way to get the ‘training’ we need without this sort of gathering.”

Other feedback included:

- “As many of the states have few noise experts on staff…, it was extremely valuable to connect and discuss with other practitioners.”
- “The summit provided an excellent opportunity to talk with other DOTs. There were an excellent diversity in topics. The summit provoked discussion and deliberation.”
- “The state representatives were able to speak freely without concern for or being overshadowed by the consultant sector,” which was noted can happen at TRB noise committee meetings.
- “Great collaboration and networking. Very valuable to have FHWA and many state DOTs in the same conversation discussing noise policy and issues.”
- “Learning the issues that other states face and how they have dealt with those issues will be a benefit for the next time our state needs to revise its noise policy.”

Frequency of Future Summits

When asked how often a similar summit should be held, nearly 40 percent of the respondents said every year and nearly half said every two years. The sense was that the frequency might depend on how much has changed in terms of the regulation, policies and guidance and the state-of-the-art since the last one. Some said every year initially until, as one noted, "momentum" was established, and then moving to a longer interlude. Another delegate suggested an alternative approach: "Every 5 years is reasonable with intermittent work by groups on specific topics from which the outcomes can be reported to all states." Having outside funding seemed to be a necessity for many delegates to attend these meetings.

Recommendations for Future Summits

Delegates were asked about recommended changes for a future summit. The consensus was that while the duration, content and format were good for this first summit, less emphasis should be on presentations with more time on roundtable discussions. As one delegate noted, "It seemed that the purpose and result of this summit was more to bring up issues that need to be addressed than to actually solve issues." Another suggested, "I would like to see a common hot button issue completely resolved in a working group environment." Some ideas along that line were:

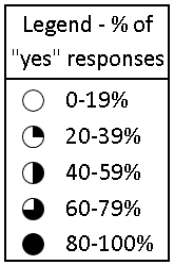
- Divide into groups with an FHWA liaison in each to work through an entire noise policy, modeling, or construction issue from start to resolution.
- Set aside some time to discuss specific examples of projects and issues that states have run into and how they dealt with them. If the issues are unresolved, this would allow other states to provide suggestions and - if it is an issue in multiple states - perhaps even provide an opportunity to collaborate on a solution.
- Structure the meeting as multiple breakout sessions where each SHA can participate in two preferred topics of interest. Each session would have a moderator to keep the discussion going.
- Have smaller work groups to address possible solutions between future summit dates.
- Have small groups work before the summit to present alternative solutions that can be presented by these groups at the Summit.
- Have a list of policy issues or policy implementation specifics where each SHA identifies its approach so that there is data on how others are handling situations.

Top Noise Needs

The next sections of this roadmap present the key subjects and issues from each session and the needs and recommendations moving forward. First, this section presents the primary needs in each of the three action areas – technical assistance or guidance, research, and regulation change – are presented.

In these matrices, the first column gives the session numbers and session topic names. The session numbers match what are in the summit agenda in Appendix B. The second column shows the subject item numbers and the subjects. The item numbers are keyed to the items in the roadmap figures for each individual topic in the sections that follow this section.

The percentages in the matrices represent the "yes" responses (as opposed to "no" or "no opinion") and the corresponding circles represent the percentage ranges shown to the right. The responses from the survey are then summarized by a matrix for each session, along with discussions of comments received in the last session of the summit and in the survey.



Technical Assistance or Guidance

The chart on the next page shows all of the subjects across the twelve sessions with a 60 percent or greater "yes" response for more technical assistance or guidance, sorted by percentage in the third column. This action area showed many more subjects with higher percentages of "yes" votes than the research and regulation change areas.

Screening Methods and Technology Transfer (including training and recruiting) accounted for six of the top seven needs. In fact, six of the nine technology transfer subjects had a 60 percent or greater "yes" vote. All of the other sessions with the exception of Land Use Activity Categories, Cost Effectiveness Reasonableness Criteria and Noise Barrier Materials, Design and Costs had at least one subject represented on this list.

More details are provided in the individual session sections after the listing of the top needs for research and regulation change. The full matrix of results for needs for technical assistance or guidance for all of the subjects is in Appendix C.

Session	Subject	Technical Assistance/ Guidance	Research	Regulation Change
3-Screening	1. Acceptable methods for screening for impacts on traffic noise studies, including isolated receptors and unlimited access roads	88%	42%	28%
3-Screening	2. Methods to minimize abatement evaluation (barrier analysis) for isolated impacted receptors	81%	40%	28%
12-Tech transfer	4. Holding periodic webinars on noise topics of interest	81%	0%	0%
12-Tech transfer	1. Making practitioners aware of new/revised FAQs and other guidance	76%	17%	0%
12-Tech transfer	2. Central library/repository for questions and answers that have been posed to the AASHTO Noise Work Group and for noise literature, research reports, etc.	76%	4%	4%
1-Type I	1. Auxiliary lanes (please note FHWA FAQ C.2)	74%	22%	22%
3-Screening	3. Active versus passive use areas and frequent human use (e.g., trails, cemeteries)	73%	32%	21%
10-Construction	1. Coordination with sister federal agencies regarding wildlife (e.g., F&WS) during project development	72%	42%	15%
6-TNM 3	1. Self-taught training modules	69%	16%	0%
7-Misc. FHWA	4. Rumble strips (stripes)	69%	58%	12%
8-Modeling	1. Best practices for TNM modeling and/or reviewing TNM modeling	69%	15%	0%
12-Tech transfer	5. Using regional subgroups within AASHTO's Noise Work Group for identifying issues and bringing them to FHWA	69%	8%	0%
12-Tech transfer	7. Training on how to review noise studies done by others (e.g., for SHA staff)	69%	12%	4%
12-Tech transfer	8. Training for FHWA Division Office staff on noise policy issues	69%	8%	4%
8-Modeling	4. FHWA screening tools – validation against TNM, accuracy, application guidance, including low-volume roads	68%	29%	8%
6-TNM 3	4. Expected duration of phase-in before required use; is there a phase-in plan?	68%	19%	4%
5-Viewpoints	2. Amount of required effort to get responses	65%	12%	12%
5-Viewpoints	3. Weighting of owner and tenant votes, including single family residences, condos, apartments, and mobile homes	65%	8%	19%
10-Construction	2. Assessment procedures for aquatic and terrestrial wildlife	65%	58%	20%
8-Modeling	4. Determination of worst noise hour traffic volumes	62%	31%	8%
8-Modeling	5. Addressing planned future projects within the project limits of a current noise study	62%	23%	4%
10-Construction	3. (human-related) Construction noise criteria, analysis methods, and mitigation techniques	62%	36%	8%
12-Tech transfer	6. Training and qualifications of those who do noise studies (e.g., consultants)	62%	15%	8%
9-Design/build	2. Noise analysis process during re-evaluations for D-B projects	60%	8%	8%

Research

The results were much different for research needs. The chart shows only those subjects in all twelve sessions that had a 40 percent or greater "yes" response, sorted by percentage in the fourth column. Only seven are listed, with two each from the Screening Methods, Miscellaneous FHWA Topics, and Construction Noise and Vibration sessions.

More details are provided in the individual session sections after the listing of the top needs for a regulation change below. The full matrix of results for research needs for all of the subjects is in Appendix C, with 30 of the 57 topics getting 19 percent or less "yes" votes.

Session	Subject	Technical Assistance/ Guidance	Research	Regulation Change
7-Misc. FHWA	4. Rumble strips (stripes)	69%	58%	12%
10-Construction	2. Assessment procedures for aquatic and terrestrial wildlife	65%	58%	20%
7-Misc. FHWA	3. Quieter pavements (research; new REMELs; as abatement measures; for impact avoidance, etc.)	46%	50%	12%
11-Barriers	3. Cost variations by type of material	42%	48%	0%
3-Screening	1. Acceptable methods for screening for impacts on traffic noise studies, including isolated receptors and unlimited	88%	42%	28%
10-Construction	1. Coordination with sister federal agencies regarding wildlife (e.g., F&WS) during project development	72%	42%	15%
3-Screening	2. Methods to minimize abatement evaluation (barrier analysis) for isolated impacted receptors	81%	40%	28%

Regulation Change

The results regarding a need for a noise regulation change are shown in the chart below for all of the subjects with a 20 percent or greater "yes" response, sorted by percentage in the last column. Only nine subjects are listed, with two each from the Screening session and the Miscellaneous FHWA Topics session. None received greater than a 40 percent "yes" vote.

More details are provided in the individual session sections that follow below. The full matrix of results for this action area for all of the subjects is in Appendix C, with 39 of the 57 topics getting 19 percent or less "yes" votes.

Session	Subject	Technical Assistance/ Guidance	Research	Regulation Change
2-Land use	1. Reclassification/Reconsideration of land uses listed in Table 1 in 23 CFR 772	42%	21%	36%
1-Type I	3. Park-and-Ride lots & rest areas	46%	4%	31%
7-Misc. FHWA	2. HUD's push to have HUD-financed properties bought out if impacted by proposed Type I project	58%	35%	31%
3-Screening	1. Acceptable methods for screening for impacts on traffic noise studies, including isolated receptors and unlimited access roads	88%	42%	28%
3-Screening	2. Methods to minimize abatement evaluation (barrier analysis) for isolated impacted receptors	81%	40%	28%
5-Viewpoints	5. Considering viewpoints or votes of non-impacted and/or non-benefitted first-row residents	50%	12%	27%
1-Type I	1. Auxiliary lanes (please note FHWA FAQ C.2)	74%	22%	22%
2-Land use	3. Active versus passive use areas and frequent human use (e.g., trails, cemeteries)	73%	32%	21%
10-Construction	2. Assessment procedures for aquatic and terrestrial wildlife	65%	58%	20%

Roadmap for Type I Project Definitions in 23 CFR 772

23 CFR 772: Type I Project Definitions	Technical Assistance /Guidance	Research	Regulation Change
1. Auxiliary lanes (please note FHWA FAQ C.2)	74%	22%	22%
2. Shoulder use and managed-use lanes	58%	27%	8%
3. Park-and-Ride lots & rest areas	46%	4%	31%
4. Substantial vertical alteration	54%	35%	4%
5. Transit-only or multimodal projects (FTA, FRA)	58%	15%	8%

The above matrix shows the five Type I Project Definition subjects that emerged from the summit. Potential research, technical assistance and guidance and potential regulatory changes associated with these issues include:

Research

- Substantial vertical alteration, shoulders and managed use lanes and auxiliary lanes: Soft research (e.g. a TRB synthesis project) would be useful on SHA studies of when and how these types of projects are implemented. Hard research could be done on a methodology or screening criterion for determining when a vertical alteration or the addition of a managed or auxiliary lane causes a quantifiable change in the noise environment.
- A synthesis-type study of how SHAs address these five Type I issues would help provide consistent interpretation and application of the regulations.

Technical Assistance and Guidance

- Auxiliary Lanes – SHAs have encountered interpretation issues with 23 CFR 722 that are not adequately addressed in the Noise Policy FAQs leading to inconsistent and conflicting determinations of project type. There is some sentiment that guidance is needed addressing the purpose of an auxiliary lane or its potential impacts, not just its length. However, a counter-argument could be made that trying to pre-judge impact as a means of making a Type I decision is too fraught with difficulties, whereas a clearer definition, via regulatory change, could trigger the need to study, with the results of the study then determining the outcome. There needs to be consistency in the regulation and the FHWA guidance document to include the 2,500-ft length criterion that appears in the Noise Policy FAQs.
- A listing of all types of auxiliary lane determinations that were or were not approved by the FHWA allowing a state to check and see if a similar situation had been encountered and how it was resolved. Such a listing could also result in more consistency in interpretation across the

country. Issues with a listing include who would maintain the listing, what format would it be in, and how would determinations be identified and entered into the listing.

- Shoulders as travel lanes and managed-use lanes are relatively new topics for some SHAs and the need was identified for more guidance on how and when to handle them.
- Transit-only and multimodal projects involving FTA or Federal Railroad Administration (FRA) require more guidance, including how to integrate the regulatory aspects of the various modes and how to model such projects. The guidance provided at the summit was helpful. Compilation of case studies would also be helpful.

For the topic of "Type I definitions" as well as the other 23 CFR 772 topics, two more general needs were identified:

- Consolidate FHWA and other guidance, which is currently spread over several resources, into a single document and made consistent.
- Develop better mechanisms to notify SHAs of new policy interpretations, guidance and FAQs.

Regulatory Change

- The definition of auxiliary lanes could be enhanced to include the 2,500-ft length used to justify a Type I classification, as described in the Noise Policy FAQ. This action may be more appropriately addressed through guidance (as described above) as that retains additional flexibility.
- There is some sentiment that park-and-Ride (P&R) lots and rest areas should be removed as Type I projects from 23 CFR 722. Alternatively, 23 CFR 772 could be clarified as to which types of P&R facilities have the potential to cause impact given the likely dominance of noise from adjacent noise generators.

Roadmap for Land Use Activity Categories and Evaluation Methodologies

23 CFR 772: Land Use Activity Categories and Evaluation Methodologies	Technical Assistance /Guidance	Research	Regulation Change
1. Reclassification/Reconsideration of land uses listed Table 1 in 23 CFR 772.	42%	21%	36%
2. Identification and classification of land uses not listed in 23 CFR 772.	46%	12%	19%
3. Active versus passive use areas and frequent human use (e.g., trails, cemeteries)	73%	32%	21%
4. Category A definition (please note FAQ D.2)	35%	8%	8%
5. Determining equivalent receptors for non-residential land uses (Including obtaining usage data)	46%	31%	12%

The above matrix shows the five land use activity categories and evaluation methodology issues that emerged from the summit. Potential research, technical assistance and guidance and potential regulatory changes associated with these issues include:

Research

- A synthesis of how states are calculating equivalent use, including resources for usage data.

Technical Assistance and Guidance

- More guidance is sought on determining equivalent receptors for nonresidential land uses without affecting the current flexibility afforded to those SHAs with procedures satisfactory to them. Guidance would include the implications of each method, including if there are inappropriate ways of calculating equivalent receptors.
- Active versus passive use areas and frequent human use: Clarification may be needed on the differentiation between active and passive areas. One suggestion was to define "active" and "passive" in 23 CFR 772, a hard approach, versus the flexibility provided by guidance or a FAQ. In reality, the only use of the word "active" in 23 CFR 772, FHWA policy guidance document, and the Noise Policy FAQs, is in the definition of Activity Category C land uses, which includes "*active* sports areas." Perhaps the concern over this subject is whether an activity that generates a great deal of its own noise (e.g., racetracks and football stadiums) should be in a different category than other activities that do not generate much of their own noise (such as a campground or cemetery). Clarification may also be needed that the term "frequent human use" really refers to a *location* on a property for analysis, not a determination of how often that location is actually used; guidance on both defining the location and assessing how often that location is used could be helpful.
- Regarding the Category A definition, the FHWA FAQ D.2 provides helpful information, as does the FHWA guidance document but greater clarification between Category A and certain Category C land uses would be helpful.

Regulatory Change

- There is a need to reclassify or reconsider certain land uses listed in 23 CFR 772 Table 1 and to add certain uses. Suggested examples include:
    - Adding funeral homes, possibly as Activity Category C (place of worship), E (office) or F (retail).
    - Classifying as Category A certain religious facilities of "special" significance such as Latter Day Saints temples.
    - Adding to Category E non-permanent transient work housing (e.g. oil drilling field "man camps").

- Removing from Category C trails, sports areas and possibly other land uses that are not practicable for noise analysis; identifying golf courses in the same way.
- Change the emergency area for hospitals without other outdoor uses to Category F because that category includes "emergency services."
- Removal of radio studios and recording studios from Category C, as the activity is not occurring outside.
- Clarification of designated land uses (such as National Monuments, State Parks, etc.) as either special places or as the same as any other similar land use.

Roadmap for Noise Screening Procedures

23 CFR 772: Noise Screening Procedures	Technical Assistance /Guidance	Research	Regulation Change
1. Acceptable methods for screening for impacts on traffic noise studies, including isolated receptors and unlimited access roads	88%	42%	28%
2. Methods to minimize abatement evaluation (barrier analysis) for isolated impacted receptors	81%	40%	28%
3. Consistency in screening applicability and methodologies	54%	23%	8%
4. FHWA screening tools – validation against TNM, accuracy, application guidance, including low-volume roads	68%	29%	8%

The above matrix shows the four noise screening procedure subjects that emerged from the summit. Potential research, technical assistance and guidance and potential regulatory changes associated with these issues include:

Research

- Development of typical scenarios that demonstrate why and under what conditions abatement would not be feasible or reasonable, which would assist in developing acceptable methods for impact screening for isolated receptors and unlimited access roads.
- Analysis and evaluation of methods to minimize abatement assessment (e.g. barrier analysis) for isolated impacted receptors.
- It would also be useful to have independent testing of the upcoming FHWA Low Traffic Volume Tool against TNM 2.5 and TNM 3.0 to identify its accuracy for a variety of situations. In fact, requiring testing of any screening method should be considered as a means of establishing credibility of these methods. Selective cases in the FHWA TNM 3.0 Consistency Test Suite could be used for this purpose. FHWA should consider creating other similar tools.

Technical Assistance and Guidance

- With screening not being mentioned in 23 CFR 772, there is a strong need for guidance on when and how to screen for low volume roads and isolated receptors, both for impact determination and abatement evaluation. While consistency in the details of different screening methodologies is not critical, clarification is needed on when and under what circumstances a screening or a streamlined analysis approach would be acceptable. This need is considered a priority as some SHAs believe that they are being required to do unneeded work at additional expense.
- Similar to the impact screening above, guidance is currently required on the methods to minimize abatement evaluations for isolated impacted receptors
- The upcoming FHWA Low Traffic Volume Tool requires guidance on when it can be used, but its use should not be required at the exclusion of other approved methods.
- The perception of inconsistencies between FHWA Division Offices on screening methods and requirements need to be addressed. These inconsistencies could be a result of differences in the various SHA noise policies, or to FHWA environmental specialists having multiple responsibilities with varying levels of comfort on the subject of noise, or to various other reasons. Appropriate guidance to Division Offices should make the process more consistent and efficient. Additionally, such guidance could help improve consultants' understanding of their clients' noise policies, resulting in better and more efficient project noise analyses.

Regulatory Change

- Allowance of screening might require a regulatory change even though screening is not mentioned in 23 CFR 772. However, any existing, approved screening methods should not be superseded by new requirements.

Roadmap for Cost Effectiveness Reasonableness Criteria

23 CFR 772: Cost Effectiveness Reasonableness Criteria	Technical Assistance /Guidance	Research	Regulation Change
1. Costs to include/not include in the barrier unit cost for cost-reasonableness	58%	35%	8%
2. Obtaining and analyzing total barrier cost and unit cost data	38%	31%	4%
3. Accounting for cost changes due to inflation or other market factors	31%	27%	8%
4. Misinterpretation of "noise reduction design goal" as a design goal rather than a minimum threshold for reasonableness	19%	0%	15%
5. Application of noise reduction design goal to impacted receptors instead of benefited receptors	38%	15%	19%
6. Benefits/disbenefits of using area per benefited receptor vs. cost per benefited receptor	42%	31%	4%

The above matrix shows the six key subjects on cost effectiveness criteria arising from the summit. There were no real needs expressed for regulatory change. Potential research and technical assistance and guidance needs associated with these issues include:

Research

- There is a need for synthesis-type research or a survey of SHA cost effectiveness practices, experiences, policies, and results, as evidenced by the examples of various interpretations of cost effectiveness criteria demonstrated during the summit.
- There is an identified interest in understanding the approaches used by other SHAs in obtaining and analyzing total barrier cost data and unit cost data. This interest includes Design-Build projects where costs are hard to determine and obtain.

Technical Assistance and Guidance

- The greatest need for technical assistance and guidance in this area is in deciding which costs to include or exclude in the development of barrier unit cost, given the amount of variation in the costs that are included by different SHAs. More uniformity could be achieved by emphasizing that the barrier unit cost is for calculating cost reasonableness and is therefore only a "planning cost for benefited receptors," not typically accounting for special construction conditions.
- There is interest in more information on the use of barrier surface area per benefited receptor instead of cost per benefited receptor, but very little interest in a regulation change because SHAs that are satisfied with the criteria that they have developed should not be required to change them.
- Guidance is sought in accounting for cost changes due to inflation or other market factors. Since 23 CFR 772 does require SHAs to review their cost reasonableness criteria periodically, information

on how other SHAs account for inflation could be helpful. Use of a barrier surface area per benefited receptor method avoids this issue.

- While the "noise reduction design goal" criterion is properly understood by noise practitioners as a minimum threshold for reasonableness, the use of the phrase "design goal" has been a source of confusion for others, such as management, consultants, design-build contractors and the public. More emphasis should be given to the true goal of mitigating all impacts.
- There is a need to have the noise reduction design goal applied to *impacted* receptors instead of *benefited* receptors, which would require a regulatory change even though summit delegates did not express the need in that way. Changing to impacted receptors would help avoid the "moving target" problem that occurs when applying the goal to all benefited receptors. A shift to a focus on only *first-row* benefits would also help to avoid this problem and would only require an SHA policy change, not a change to 23 CFR 772.
- FHWA collects noise barrier inventory data from the SHAs, including cost information. More standardization of the cost reporting would make the information more usable and useful to others trying to understand and analyze that data.

Roadmap for Consideration of Viewpoints of Owners and Residents

23 CFR 772: Consideration of Viewpoints of Owners and Residents	Technical Assistance /Guidance	Research	Regulation Change
1. Required or desired minimum response rates for reasonableness	58%	8%	12%
2. Amount of required effort to get responses	65%	12%	12%
3. Weighting of owner and tenant votes, including single family residences, condos, apartments, and mobile homes	65%	8%	19%
4. Voting procedures for special-use residential facilities (e.g., assisted living, prisons, dorms)	58%	12%	4%
5. Considering viewpoints or votes of non-impacted and/or non-benefitted first-row residents	50%	12%	27%

The above matrix shows the five high-interest summit subjects on considerations of viewpoints of owners and residents. Potential research, technical assistance and guidance and potential regulatory changes associated with these issues include:

Research

- While no specific research needs were identified, some research may be needed to support the guidance needs identified below.

Technical Assistance and Guidance

- SHAs often get low response rates to noise abatement measure voting solicitations, with the even lower response rates for tenants compared with the property owners. Some SHAs struggle with methods of obtaining sufficient input from those affected. Others struggle with the extent of efforts to reach out to tenants given the often transitory nature of tenants. Due to turn-over, the tenants who voted are often gone by the time the abatement measure is constructed. Some SHAs are looking for clarification on the needed outreach efforts to obtain consistent and effective communication and provide defensible results without expending inordinate resources in the process.
- Guidance is sought by some SHAs on how much weight to give to the viewpoints (votes) of owner-occupants, off-site property owners and tenants without being unfair or discriminatory. Methods developed by some SHAs have been challenged, requiring some adjustment. Being more definitive in terms of how weighting is assigned from a regulatory perspective could ease the burden on states to defend the weighting in the face of concerns over equality and equal protection.
- Guidance is also needed as to special-use residential locations such as assisted living and rehabilitation facilities, military barracks, dormitories, prisons and jails. A survey of how SHAs handle these types of sites could provide useful information to other SHAs.
- More guidance on considering the viewpoints of first-row residents who are not impacted and/or benefited may be needed. A case can be made that any first-row receptor with a barrier in front of it is visually impacted by the barrier and should have a say in its installation, especially if the resident is impacted by the noise but not benefiting from the barrier.

Regulatory Change

- Little need for a regulation change was identified although an exception might be to allow non-impacted/non-benefited first-row receptors to vote.
- There is a strong desire among many SHAs to maintain the flexibility given to them as they developed their noise policies, so regulatory changes are considered a low priority in this (and other) subject areas.

Roadmap for TNM 3.0 Status and Implementation Plans

TNM 3.0 Status and Implementation Plans – FHWA Briefing and Q&A	Technical Assistance /Guidance	Research	Regulation Change
1. Self-taught training modules	69%	16%	0%
2. Training in use of 3rd party versions of TNM 3.0	54%	8%	4%
3. Improvements over TNM 2.5; unchanged features; features no longer included	50%	12%	0%
4. Expected duration of phase-in before required use; is there a phase-in plan?	68%	19%	4%

The above matrix shows the four TNM 3.0 implementation plan subjects that emerged from the summit. As this is an implementation plan, research and regulatory change do not apply, but guidance includes:

Technical Assistance and Guidance

- Guidance is needed on the phase-in plans for TNM 3.0. SHAs need to know how the results of the SHA beta-testing may affect the timeline for program release and phase-in. Once TNM 3.0 released, time will be needed for SHAs and their consultants to become familiar and comfortable with the program.
- Guidance will also be needed on how to handle NEPA re-evaluations when the original studies were done using TNM 2.5.
- Guidance on the differences between TNM 3.0 and TNM 2.5 would be helpful, especially in terms of changes, new features, and excluded features.
- Self-training modules can be very useful for those analysts with prior experience with TNM 2.5. However, self-training modules may not be sufficient in meeting SHAs' noise study prequalification requirements. Training alone does not qualify a person to be able to conduct a good noise study. Rather, experience developed over time through mentoring is essential, not only in modeling but in understanding noise principles and an SHA's noise policy.
- There is some interest is training on the use of the expected third-party commercial versions of TNM 3.0.

Regulatory Change

- There may be a need to change 23 CFR 772 to require the use of TNM 3.0 instead of TNM 2.5 on Federal-aid highway projects, unless an interpretation is made that TNM 3.0 is "consistent with the methodology" of FHWA TNM 2.5, as referenced in the regulation.

Roadmap for Miscellaneous Traffic Noise Policy, Procedure and Program Topics

Miscellaneous Traffic Noise Policy, Procedure and Program Topics – FHWA Briefing and Q&A	Technical Assistance /Guidance	Research	Regulation Change
1. Existing barriers on new Type I projects (e.g., analysis, funding) (please note current FHWA guidance)	42%	4%	12%
2. How to consider HUD-financed properties that are impacted by a proposed Type I project	58%	35%	31%
3. Quieter pavements (research; new REMELs; as abatement measures; for impact avoidance, etc.)	46%	50%	12%
4. Rumble strips (stripes)	69%	58%	12%

The above matrix shows the four high-interest subjects from the miscellaneous topics that emerged from the summit. Potential research, technical assistance and guidance and potential regulatory changes associated with these issues include:

Research

- Rumble strips (across lanes) and stripes (along the shoulder or centerline) are important safety measures and their use should not be limited by noise concerns. However, there is a need for a better understanding of the noise impacts that rumble strips and stripes cause and how to address those impacts, especially since these features are not mentioned in 23 CFR 772 and their installation is not a Type I project. While research in this area currently exists, some of it is lacking by only addressing A-weighted 1-hr equivalent sound levels instead of 1/3 octave bands or maximum levels. A synthesis of best practices, with any existing acoustical test results, identifying or highlighting lower-noise designs would be a good starting point. A research study to field test different rumble strip designs would be helpful, especially if it identified alternative rumble strip designs that would reduce noise emissions while still meeting the intended safety improvements. A current NCHRP research proposal on this topic was mentioned at the summit.
- SHAs expressed some need for more research into the long-term effects of quieter pavements. Some interest was also expressed for updating the reference energy mean emission levels (REMELs) in TNM and improving TNM's ability to study different pavements' noise levels,

Technical Assistance and Guidance

- As noted in the research area, rumble strips and stripes are not described in the regulation or Noise Policy FAQs. Given the current extensive implementation of these features, some

guidance or an FAQ would be helpful to SHAs in working with designers and planners on the use of these safety measures and in addressing noise complaints.

- Guidance is needed on the recent interactions that HUD has had on Federal-aid highway projects, in particular in Texas and Ohio, both of which have possible cost and other implications to all SHAs. There is a need to keep SHA noise professionals and decision-makers informed on these cases and any further discussions between FHWA and HUD. There could be a higher-level role for AASHTO – beyond simply providing guidance – when two Federal agencies are at odds. There is also concern over the inadequacy and out-of-date nature of the HUD noise prediction methodology, both in terms of impact identification (because of its use of 1970s' vehicle noise emission levels) and abatement evaluation and design (being very simplified). There is a need for HUD to accept the use of TNM on HUD studies and on SHA analyses that involve properties covered by HUD's noise regulation.
- SHAs requested more information beyond current FHWA guidance on handling existing noise barriers on new Type I projects. Areas to expand upon include:
    - How to address replacement, reconstruction and rehabilitation.
    - Clarification on the allowable time within which an existing barrier must be replaced (how long the benefited residents should be inconvenienced without the barrier).
    - Funding for maintenance of existing barriers.
    - Actions necessary when an existing barrier does not provide the noise reduction that the TNM predicts during a new project's model validation process.

Regulatory Change

- None identified.

Roadmap for Best Practices for Traffic Noise Modeling and Review of Models

Traffic Noise Modeling: Best Practices for Modeling and Modeling Input and Review of Models	Technical Assistance /Guidance	Research	Regulation Change
1. Best practices for TNM modeling and/or reviewing TNM modeling	69%	15%	0%
2. Model validation requirement, including when a screening procedure identifies a potential impact	58%	23%	12%
3. Noise study process for Local Programs Projects (adequacy of studies, qualifications of those doing/reviewing studies)	46%	12%	4%
4. Determination of worst noise hour traffic volumes	62%	31%	8%
5. Addressing planned future projects within the project limits of a current noise study	62%	23%	4%

The above matrix shows the five subjects under best practices that emerged from the summit. Potential technical assistance and guidance needs associated with these issues include:

Research

- Some need was expressed for research on determining the worst noise hour traffic volumes.

Technical Assistance and Guidance

- As presented in the summit, some SHAs have good modeling procedures and guidance, much of which is documented, that could be shared with other states. A peer exchange, community of practice, practitioner's handbook, or other means to communicate these would be helpful. Those SHAs with good procedures and guidance do not want new practices impose upon them.
- Development of training or a procedure guide on reviewing a noise study would be beneficial to some SHAs. A focus on key factors to address when a quick turn-around is required for a review should be included.
- Guidance on the circumstances under which a SHA might forego model validation or judge it to be optional is needed. SHAs want flexibility to determine when field validation of the model is needed. To support the effort, a synthesis of best practices utilized for achieving validations goals may be necessary.
- Additional guidance on worst noise hour determinations is desired. Tools like Virginia DOT's worst noise hour screening tool could be of value to others and could be worth referencing on the FHWA noise web site along with other worst-hour traffic tools.
- Additional guidance on how to address planned projects already within the project limits of a current noise study is needed. One concern deals with interim projects, that is, short-term fixes before a larger project addresses the ultimate transportation need: should abatement be considered on the interim projects? There is also a need to address when interim abatement measures might have to be moved for a future project. A third concern has to do with abatement reasonableness decisions for lands that had been allowed to develop after locals were notified through a past project that noise impacts would occur on those then-undeveloped lands.
- Other assistance areas (examples of which were presented at the summit) include:
    - Noise report templates or outlines.
    - Checklists for TNM models or noise study reports.
    - Quality Assurance and Quality Control procedures for TNMs.

Regulatory Change

- If FHWA were to change its position on when model validation was needed, a change might be required in 23 CFR 772.

Roadmap for Design-Build Projects

Design/Build Projects	Technical Assistance /Guidance	Research	Regulation Change
1. Meeting/changing D/B project noise abatement commitments per 23 CFR 772.13(i)	58%	15%	12%
2. Noise analysis process during re-evaluations for D/B projects	60%	8%	8%
3. Cost-sharing mechanisms for noise barriers removed during the D/B process	42%	15%	4%

The above matrix shows the three subjects related to Design-Build projects that emerged from the summit. Potential needs associated with these issues include:

Research

- None identified.

Technical Assistance and Guidance

- Design-Build is an area where many SHAs could benefit from learning more about what other SHAs are doing. Mechanisms for information sharing could include workshops, webinars, future summit meetings, a synthesis of best practices, and an information clearinghouse on the CEE web site. Topics of interest include:
    - Creating RFP language that address and avoids potential conflicts
    - Developing guidance on noise-related performance specifications
    - Developing a timeline on when milestones such as public involvement should occur in the D-B process
    - Ensuring that contractors follow up on mitigation commitments
    - Closing loopholes in SHA noise policies
- Guidance from FHWA on when it is too late to require a re-evaluation, such as when a D-B project is in the construction phase, is sought.

Regulatory Change

- None were identified, although cautions were given at the summit that loosely written noise policies, especially with regard to abatement feasibility and reasonableness, could be subject to misinterpretation or manipulation. An example is where a noise reduction design goal of “7 dB

at one benefited receptor" is interpreted as meaning that achieving 7 dB at one receptor is sufficient, instead of trying to mitigate impacts at all impacted receptors.

Roadmap for Construction Noise and Vibration and Pre-Construction Evaluation

Construction Noise and Vibration and Pre-Construction Evaluation	Technical Assistance /Guidance	Research	Regulation Change
1. Coordination with sister federal agencies regarding wildlife (e.g., F&WS) during project development	72%	42%	15%
2. Assessment procedures for aquatic and terrestrial wildlife	65%	58%	20%
3. (human-related) Construction noise criteria, analysis methods, and mitigation techniques	62%	36%	8%
4. (human-related) Construction vibration criteria, analysis methods, and mitigation techniques	50%	31%	8%

The above matrix shows the four construction noise and vibration subjects that emerged from the summit. Potential technical assistance and guidance needs associated with these issues include:

Research

- Development of noise and vibration impact and mitigation assessment procedures for threatened and endangered species affected by transportation construction and operation.
- Synthesis of SHA and other research on construction noise and vibration effects on wildlife and the mitigation of those effects
- Synthesis of successful communication and coordination efforts between SHAs and federal resource agencies for addressing wildlife noise and vibration impact assessment and mitigation.
- An examination of the need by SHAs for more research on construction noise and vibration criteria, analysis methods and mitigation, including an assessment of the current use and sufficiency of the FHWA *Construction Noise Handbook* (the need expressed for more research at the summit could represent a general unawareness of the FHWA handbook).

Technical Assistance and Guidance

- Regarding wildlife, SHAs need assistance during project development in the coordination process with federal resource agencies, in particular the U.S. Fish and Wildlife Service (USFWS). Part of the coordination issue may be unawareness by SHA noise practitioners of the ongoing headquarters-level interactions between FHWA and USFWS. There is concern, rightly or not, that USFWS does not bring expertise in acoustics to the table. An example was cited of USFWS supporting use of A-weighted sound levels when addressing impacts in Northern Long Eared

Bats, where the frequency range for hearing is much different from humans (*Northern Long Eared Bat Interim Conference and Planning Guidance*, USFWS Regions 2, 3, 4, 5, & 6, January 6, 2014).

- Also regarding wildlife, SHAs need assistance and guidance with assessment procedures. There is concern about the USFWS accepting that research done by a SHA actually adds to the best available science. One idea is a meeting of the federal agencies and concerned SHAs to determine how best to analyze noise and vibration impacts in various habitats for various species. Meetings could also address when mitigation will be required, what that mitigation will be, how it will be installed, and how much it will cost.
- Regarding impacts on humans, updated guidance is needed on construction noise criteria, analysis methods and mitigation techniques, including when to consider noise monitoring or conducting a quantitative analysis using a tool like the FHWA R*oadway Construction Noise Model*. Also, guidance on construction vibration criteria, analysis methods and mitigation techniques would help. The recently updated Caltrans *Transportation and Construction Vibration Guidance Manual* is an important resource to other SHAs and could be referenced on the FHWA and CEE web sites.

Regulatory Change

- No changes to 23 CFR 772 have been identified. Further, any regulatory changes regarding wildlife needs should be done outside of 23 CFR 772, which should retain its focus as being solely on impacts on humans.

Roadmap for Noise Barrier Materials, Design and Costs

Noise Barrier Materials, Design and Costs	Technical Assistance /Guidance	Research	Regulation Change
1. Maintenance or replacement of existing noise barriers due to age or damage	54%	38%	12%
2. Material costs vs. bid/installed costs	31%	31%	0%
3. Cost variations by type of material	42%	48%	0%
4. Barrier design and testing specifications, including sound-absorbing barriers	46%	31%	4%

The above matrix shows the four subjects pertaining to noise barrier materials, design, and cost. Potential research and technical assistance and guidance needs associated with these issues include:

Research

- Analysis of noise barrier material costs and bid and installed costs would help the SHAs develop better barrier unit costs and more effective and cost efficient abatement measures.

- Periodic updates on the costs of various barrier materials throughout the country and how material costs compare, both initially and over the life cycle of the barriers would benefit the SHAs.

Technical Assistance and Guidance

- Guidance is sought in several areas regarding maintenance or replacement of existing noise barriers due to age or damage, including:
    - At what point do deteriorating walls require replacement, in terms of reduced acoustical effectiveness, structural integrity and/or appearance?
    - Does a barrier that requires substantial maintenance have to be replaced if the land use has changed, especially where there are no longer impacts or doing so would no longer be feasible or reasonable?
    - What is the cost of maintaining noise barrier structures, broken down by wall material?
    - Can there be a funding mechanism for maintaining noise barriers?
- Guidance on barrier design and testing specifications is needed by some SHAs, while others, like Wisconsin and Ohio, have done a great deal of work on this subject that has benefited and could continue to benefit others.
- With regards to specifications for sound-absorbing materials, there has been strong disagreement between manufacturers of different products on the proper testing methods, which has led to some confusion or uncertainty among SHA noise practitioners and barrier designers. AASHTO's Structures, Materials and Noise work groups could take the lead in synthesizing current SHA noise barrier design and testing specifications and develop a guide specification that goes beyond its current guide specifications and also includes sound-absorbing materials.

Regulatory Change

- None identified.

Roadmap for Enhancing and Improving Technology Transfer, Training and Recruiting

Enhancing and Improving Technology Transfer, including Training and Recruiting Needs	Technical Assistance /Guidance	Research	Regulation Change
1. Making practitioners aware of new/revised FAQs and other guidance.	76%	17%	0%
2. Central library/repository for questions and answers that have been posed to the AASHTO Noise Work Group and for noise literature, research reports, etc.	76%	4%	4%
3. SHA noise policy links on CEE and/or FHWA website	58%	4%	0%
4. Holding periodic webinars on noise topics of interest	81%	0%	0%
5. Using regional subgroups within AASHTO's Noise Work Group for identifying issues and bringing them to FHWA	69%	8%	0%
6. Training and qualifications of those who do noise studies (e.g., consultants)	62%	15%	8%
7. Training on how to review noise studies done by others (e.g., for SHA staff)	69%	12%	4%
8. Training for FHWA Division Office staff on noise policy issues	69%	8%	4%
9. Recruitment ideas, including desired/required education and background	54%	15%	4%

The above matrix shows the nine technology transfer, training and recruiting subjects that emerged from the summit. Potential technical assistance and guidance needs associated with these issues include:

Research

- None identified.

Technical Assistance and Guidance

- *Communication*. A strong desire exists to enable noise practitioners to share knowledge. Suggested were periodic webinars on noise topics of interest every 3, 6 and 12 months were suggested or on an as-needed basis.
- *Communication*. There is a strong need for a consistent method of making practitioners aware of new and revised FAQs and other guidance. Ideas proposed include: emails from FHWA to SHA noise practitioners; use of an email list share similar to the AASHTO Noise Work Group's system; and announcements via the CEE, AASHTO, or FHWA website when changes are posted online. A link on the FHWA noise web site to the CEE noise web page would be helpful.
- *Noise Policy FAQs*. One suggestion for making the FAQs more effective and accessible is to move away from an entirely separate FAQ section on the FHWA web site and integrate the FAQs into the topical structure of the web site. Each topic would then contain sub-items on regulatory material, then guidance, and then the FAQs or additional information and explanation.

- *Communication*. A central library or repository for questions and answers that have been posed to the AASHTO Noise Work Group and for noise literature, research reports, and etc. would provide important knowledge to noise practitioners. A working group of FHWA, AASHTO, and a few SHAs could be assembled to determine the best location for this information.
- *Communication on policies.* As it can be a challenge to navigate through individual SHA websites, SHA practitioners would like to have web links to all SHA noise policies (or possibly noise web sites) on either the CEE or FHWA web sites. A breakdown of the SHA policies by topic into a spreadsheet would be a very helpful tool, although it was recognized that keeping even just a central repository of the individual policies up to date would be very difficult.
- *Noise Work Group*. Members of the AASHTO Transportation Noise Work Group consider the group very beneficial and want to recruit more SHA members and meet more regularly. Representation is from only half of the SHAs at this time. The group currently has regional chairpersons representing three of the four AASHTO regions, and there is a need to appoint a fourth regional chair. Use of the regional subgroups could be an effective way of identifying issues and bringing them to the attention of FHWA. SHA noise practitioners recognize that they must continue to play leading roles in the national transportation noise program. The work group would be a primary way of maintaining the momentum created by the summit and can become an important mechanism for technology transfer and moving the profession forward.
- *Noise practitioner standards.* There is a need to survey the noise study prequalification requirements of SHAs and provide guidance on prequalifications. Most traffic noise studies are conducted by consultants. Many SHAs have expressed concern over the quality of some of the studies done for them. There is a strong need for these consultants to have proper training and experience. Some SHAs require in their noise policies that consultants complete the 3-day, live-instruction NHI Highway Traffic Noise course. Some further require training in traffic noise modeling, available through a third party. Yet, training alone is not sufficient. As a result, some SHAs also require that proficiency be demonstrated by passing a test or by showing a minimum number of years of noise study experience.
- *Training*. In addition to its 3-day Highway Traffic Noise course, NHI offers a half-day on-line traffic noise fundamentals course, based on a component of the 3-day course. A need has been identified for additional on-line training courses tailored to generalists, NEPA specialists and noise modelers.
- *Training*. Training on how to *review* noise studies would be helpful. While the current NHI Highway Traffic Noise course should be a prerequisite for new SHA noise practitioners who will be reviewing consultants' studies, the course does not have a component on how to review a noise study.
- *Training*. Training for FHWA division office staff on noise policy issues is seen as an important need. Some concerns expressed at the summit include:

  - Some division office staff lean on the SHAs for expertise.
  - Some division office staff do not have the needed background, training, knowledge or experience to help clarify and resolve issues.
  - Some division office staff seem reluctant to request input from FHWA's subject matter experts.

  Training for division staff would be most beneficial if the FHWA and SHA were both involved, perhaps in a discussion format including FHWA headquarters staff. Alternatively, a work group or peer group where FHWA division office and SHA noise staff for a particular state or group of states would get together to talk about major issues, perhaps on a yearly basis.
- *Staff recruitment.* There is a need to promote the concept that a traffic noise specialist is an interesting, rewarding and desirable career opportunity. Within some agencies, there is also an internal need to market the noise professional to other parts of the agency as an important and essential member of the project development team.
- *Staff position requirements.* Some SHAs require noise studies to be conducted or directed by a licensed professional engineer which can severely limit the pool of applicants to noise practitioner positions. Such a requirement rules out entire categories of professionals who, by education or experience, might be better qualified to conduct a noise study than a traditionally educated civil engineer. Position requirements should be kept broad to encourage those with bachelor degrees in natural or physical sciences, environmental science and environmental health to apply. A "best practices" page for recruiting on the FHWA website might be of help to SHAs.

Regulatory Change

- None identified.

Appendix A - Traffic Noise Practitioner Summit Participants

Delegate	*Agency*
Taylor Horne	Alaska Department of Transportation and Public Facilities Statewide Environmental Program Manager
Dolha Kayisavera, P.E	Alabama Department of Transportation Environmental Technical Section
Linda DeMasi, MSCED, GISP	Arkansas State Highway and Transportation Department Environmental Division
Rose Waldman	Colorado Department of Transportation Air Quality and Noise Specialist
Christine A. Tedford Caroline Kieltyka	Connecticut Department of Transportation Office of Environmental Planning
Austina Casey	District Department of Transportation Project Development and Environment Division
Darren O'Neill, P.E.	Delaware Department of Transportation Regional Group Engineer
Mariano Berrios	Florida Department of Transportation Environmental Management Office
Amber L. Phillips	Georgia Department of Transportation Office of Environmental Services
Charles J. Bernhard	Iowa Department of Transportation Office of Location and Environment
Michele A. Fikel	Idaho Transportation Department Environmental Section
Dr. Ken Runkle, LEHP, REHS	Illinois Department of Transportation Bureau of Design & Environment
Joan Myer	Kansas Department of Transportation Environmental Services Section
Daniel Burgin	Kentucky Transportation Cabinet Division of Environmental Analysis
Robert Lott	Louisiana Department of Transportation & Development Environmental Section
Ken Polcak	Maryland State Highway Administration Noise Abatement Design & Analysis Team
Tom Hanf	Michigan Department of Transportation Environmental Services Section
Marilyn Jordahl Larson, P.E.	Minnesota Department of Transportation Environmental Modeling & Testing Unit

Delegate	*Agency*
Matt Burcham	Missouri Dept. of Transportation Senior Environmental Specialist
Cora G. Helm, P.G.	Montana Department of Transportation Environmental Services
Gregory A. Smith, P.E.	North Carolina Department of Transportation Human Environment Unit
Paul J. Moch	North Dakota Department of Transportation Environmental & Transportation Services
Will Packard	Nebraska Department of Roads Project Development Division
Jon Evans	New Hampshire Department of Transportation Bureau of Environment
Marie C. Limage	New Jersey Department of Transportation Division of Environmental Resources
Gwyneth Duncan	New Mexico Department of Transportation Environmental Section
Daniel L. Harms, CEM	Nevada Department of Transportation Environmental Services Division
Noel Alcala, P.E.	Ohio Department of Transportation Office of Environmental Services
Kevin Larios, P.E.	Oklahoma Department of Transportation Environmental Programs Division
Carole Newvine	Oregon Department of Transportation Environmental Services
Danielle Shellenberger	Pennsylvania Department of Transportation Bureau of Design
Chad Long	South Carolina Department of Transportation Environmental Management Office
Jim Ozment	Tennessee Department of Transportation Environmental Division
Ray Umscheid George Reeves	Texas Dept. of Transportation, Environmental Affairs Division *and* Dallas District Advance Project Development
Naomi Kisen	Utah Department of Transportation Environmental Division
Jim Ponticello Josh Kozlowski	Virginia Department of Transportation Environmental Division, Noise Abatement Section
Jay Waldschmidt	Wisconsin Department of Transportation Bureau of Technical Services
Martin E. Dougherty, P.E.	West Virginia Dept. of Transportation/Dept. of Highways Environmental Engineering Unit

Participant	*Organization*
Mark Ferroni	Federal Highway Administration
Mike Roberts	Federal Highway Administration
Mary Ann Rondinella	Federal Highway Administration
Rob Effinger, P.E.	American Association of State Highway and Transportation Officials
Bill Bowlby, Ph.D., P.E.	Bowlby & Associates, Inc.
Darlene Reiter, Ph.D., P.E.	Bowlby & Associates, Inc.
Rennie Williamson	Bowlby & Associates, Inc.

Appendix B - Traffic Noise Practitioner Summit Agenda

DAY 1

Introduction to Summit: Objectives, Format and Logistics

- Rob Effinger, AASHTO
- Mark Ferroni, FHWA
- Bill Bowlby, Bowlby & Associates, Inc.

Delegates' 2-minute introductions

Session 1 – 23 CFR 772: Type I Project Definitions
Facilitator: Carole Newvine, Oregon DOT, Noise Specialist
Participants:

- Carole Newvine, Oregon DOT, Noise Specialist
- Mariano Berrios, Florida DOT, Environmental Programs Coordinator
- Tom Hanf, Michigan DOT, Highway Noise and Project Level Air Quality Specialist
- Greg Smith, North Carolina DOT, Traffic Noise & Air Quality Supervisor, Human Environment Section

Session 2 – 23 CFR 772: Land Use Activity Categories and Evaluation Methodologies
Facilitator: Greg Smith, North Carolina DOT, Traffic Noise & Air Quality Supervisor, Human Environment Section
Participants:

- Greg Smith, North Carolina DOT, Traffic Noise & Air Quality Supervisor, Human Environment Section
- Danielle Shellenberger, Pennsylvania DOT, Environmental Planner
- Cora Helm, Montana DOT, Environmental Services

Session 3 – 23 CFR 772: Noise Screening Procedures
Facilitator: Michele Fikel, Idaho Transportation Department, Sr. Environmental Planner
Participants:

- Mark Ferroni, FHWA, FHWA Noise Program Manager
- Daniel Burgin, Kentucky Transportation Cabinet, Air Quality and Noise Specialist and Environmental Project Manger
- Cora Helm, Montana DOT, Environmental Services
- Discussant: Mariano Berrios, Florida DOT, Environmental Programs Coordinator

Session 4 – 23 CFR 772: Cost Effectiveness Reasonableness Criteria
Facilitator: Jon Evans, New Hampshire DOT, Air & Noise Program Manager
Participants:

- Bill Bowlby, Bowlby & Associates, Inc., President (FHWA research results)
- Jon Evans, New Hampshire DOT, Air & Noise Program Manager
- Jim Ozment, Tennessee DOT, Director TDOT Environmental Division
- Jim Ponticello, Virginia DOT, Air Quality & Noise Program Manager
- Amber Phillips, Georgia DOT, Office of Environmental Services

Session 5 – 23 CFR 772: Consideration of Viewpoints of Owners and Residents
Facilitator: Jay Waldschmidt, Wisconsin DOT, Noise and Air Quality Engineer
Participants:

- Bill Bowlby, Bowlby & Associates, Inc. (FHWA research results)
- Jay Waldschmidt, Wisconsin DOT, Noise and Air Quality Engineer
- Marilyn Jordahl-Larson, Minnesota DOT, Chief, Environmental Modeling and Testing Unit
- Carole Newvine, Oregon DOT, Noise Specialist
- Discussants: Greg Smith, North Carolina DOT, and Tom Hanf, Michigan DOT

Session 6 – TNM 3.0 Status and Implementation Plan. Briefing and Q&A led by Mark Ferroni, FHWA, FHWA Noise Program Manager

Optional TNM 3.0 Demonstration

DAY 2

Session 7 – Miscellaneous Traffic Noise Policy, Procedure and Program Topics. Briefing and Q&A led by Mark Ferroni, FHWA Noise Program Manager with Mary Ann Rondinella, FHWA Resource Center

Session 8 – Traffic Noise Modeling: Best Practices for Modeling and Review of Models
Facilitator: Tom Hanf, Michigan DOT, Highway Noise and Project Level Air Quality Specialist
Participants:

- Mark Ferroni, FHWA Noise Program Manage
- Josh Kozlowski, Virginia DOT
- Jim Ozment, Tennessee DOT, Director TDOT Environmental Division
- Mariano Berrios, Florida DOT, Environmental Programs Coordinator
- Carole Newvine, Oregon DOT, Noise Specialist

Session 9 – Design-Build Projects
Facilitator: Mariano Berrios, Florida DOT, Environmental Programs Coordinator
Participants:

- Darren O'Neill, Delaware DOT, Group Engineer
- Amber Phillips, Georgia DOT, Office of Environmental Services
- Mariano Berrios, Florida DOT, Environmental Programs Coordinator
- Noel Alcala, Ohio DOT, Noise and Air Quality Coordinator
- Discussant: Greg Smith, North Carolina DOT, Traffic Noise & Air Quality Supervisor, Human Environment Section

Session 10 – Construction Noise and Vibration and Pre-Construction Evaluation
Facilitator: Cora Helm, Montana DOT, Environmental Services
Participants:

- Cora Helm, Montana DOT, Environmental Services
- Marilyn Jordahl-Larson, Minnesota DOT, Chief, Environmental Modeling and Testing Unit
- Darlene Reiter, Bowlby & Associates, Inc. Vice President of Engineering (re: Caltrans vibration manual)
- Discussant: Mariano Berrios, Florida DOT, Environmental Programs Coordinator

Session 11 – Noise Barrier Materials, Design and Costs
Facilitator: Noel Alcala, Ohio DOT, Noise and Air Quality Coordinator
Participants:

- Noel Alcala, Ohio DOT, Noise and Air Quality Coordinator
- Rose Waldman, Colorado DOT, Air Quality and Noise Specialist
- Jay Waldschmidt, Wisconsin DOT, Noise and Air Quality Engineer

Session 12 – Enhancing and Improving Technology Transfer, Training and Recruiting
Facilitator: Danielle Shellenberger, Pennsylvania DOT, Environmental Planner
Roundtable discussion including:

- Danielle Shellenberger, Pennsylvania DOT, Environmental Planner
- Carole Newvine, Oregon DOT, Noise Specialist
- Discussant: Jay Waldschmidt, Wisconsin DOT, Noise and Air Quality Engineer

Shaping the Noise Roadmap – Discussion led by Bill Bowlby with all participants: *Mapping out the issues surrounding highway traffic noise as well as potential opportunities to address these issues*

- What are the key takeaways from the summit?
- What are the technical assistance needs and research gaps?
- What are your recommendations for FHWA and AASHTO for additional research and activities to assist the states with their issues?

Summit Closing - Including planned follow-up survey and deliverables

Appendix C – Full Matrices of Results of the Post-Summit Survey on Needs for: (1) Technical Assistance/Guidance, (2) Research; and (3) Regulation Change

(Percentages are "Yes" responses based on 27 returned surveys)

Session	Subject	Technical Assistance/ Guidance	Research	Regulation Change
3-Screening	1. Acceptable methods for screening for impacts on traffic noise studies, including isolated receptors and unlimited access roads	88%	42%	28%
3-Screening	2. Methods to minimize abatement evaluation (barrier analysis) for isolated impacted receptors	81%	40%	28%
12-Tech transfer	4. Holding periodic webinars on noise topics of interest	81%	0%	0%
12-Tech transfer	1. Making practitioners aware of new/revised FAQs and other guidance	76%	17%	0%
12-Tech transfer	2. Central library/repository for questions and answers that have been posed to the AASHTO Noise Work Group and for noise literature, research reports, etc.	76%	4%	4%
1-Type I	1. Auxiliary lanes (please note FHWA FAQ C.2)	74%	22%	22%
3-Screening	3. Active versus passive use areas and frequent human use (e.g., trails, cemeteries)	73%	32%	21%
10-Construction	1. Coordination with sister federal agencies regarding wildlife (e.g., F&WS) during project development	72%	42%	15%
6-TNM 3	1. Self-taught training modules	69%	16%	0%
7-Misc. FHWA	4. Rumble strips (stripes)	69%	58%	12%
8-Modeling	1. Best practices for TNM modeling and/or reviewing TNM modeling	69%	15%	0%
12-Tech transfer	5. Using regional subgroups within AASHTO's Noise Work Group for identifying issues and bringing them to FHWA	69%	8%	0%
12-Tech transfer	7. Training on how to review noise studies done by others (e.g., for SHA staff)	69%	12%	4%
12-Tech transfer	8. Training for FHWA Division Office staff on noise policy issues	69%	8%	4%
8-Modeling	4. FHWA screening tools – validation against TNM, accuracy, application guidance, including low-volume roads	68%	29%	8%
6-TNM 3	4. Expected duration of phase-in before required use; is there a phase-in plan?	68%	19%	4%
5-Viewpoints	2. Amount of required effort to get responses	65%	12%	12%
5-Viewpoints	3. Weighting of owner and tenant votes, including single family residences, condos, apartments, and mobile homes	65%	8%	19%
10-Construction	2. Assessment procedures for aquatic and terrestrial wildlife	65%	58%	20%
8-Modeling	4. Determination of worst noise hour traffic volumes	62%	31%	8%
8-Modeling	5. Addressing planned future projects within the project limits of a current noise study	62%	23%	4%
10-Construction	3. (human-related) Construction noise criteria, analysis methods, and mitigation techniques	62%	36%	8%
12-Tech transfer	6. Training and qualifications of those who do noise studies (e.g., consultants)	62%	15%	8%
9-Design/build	2. Noise analysis process during re-evaluations for D-B projects	60%	8%	8%
1-Type I	2. Shoulder use and managed-use lanes	58%	27%	8%
1-Type I	5. Transit-only or multimodal projects (FTA, FRA)	58%	15%	8%
4-Cost Criteria	1. Costs to include/not include in the barrier unit cost for cost-reasonableness	58%	35%	8%
5-Viewpoints	1. Required or desired minimum response rates for reasonableness	58%	8%	12%

Session	Subject	Technical Assistance/ Guidance	Research	Regulation Change
6-TNM 3	4. Voting procedures for special-use residential facilities (e.g., assisted living, prisons, dorms)	58%	12%	4%
7-Misc. FHWA	2. How to consider HUD-financed properties that are impacted by a proposed Type I project	58%	35%	31%
6-TNM 3	2. Model validation requirement, including when a screening procedure identifies a potential impact	58%	23%	12%
9-Design/build	1. Meeting/changing D-B project noise abatement commitments per 23 CFR 772...13(i)	58%	15%	12%
12-Tech transfer	3. SHA noise policy links on CEE and/or FHWA website	58%	4%	0%
3-Screening	3. Consistency in screening applicability and methodologies	54%	23%	8%
6-TNM 3	2. Training in use of 3rd party versions of TNM 3.0	54%	8%	4%
11-Barriers	1. Maintenance or replacement of existing noise barriers due to age or damage	54%	38%	12%
12-Tech transfer	9. Recruitment ideas, including desired/required education and background	54%	15%	4%
1-Type I	4. Substantial vertical alteration	54%	35%	4%
5-Viewpoints	5. Considering viewpoints or votes of non-impacted and/or non-benefitted first-row residents	50%	12%	27%
6-TNM 3	3. Improvements over TNM 2.5; unchanged features; features no longer included	50%	12%	0%
10-Construction	4. (human-related) Construction vibration criteria, analysis methods, and mitigation techniques	50%	31%	8%
1-Type I	3. Park-and-Ride lots & rest areas	46%	4%	31%
2-Land uses	2. Identification and classification of land uses not listed in	46%	12%	19%
6-TNM 3	5. Determining equivalent receptors for non-residential land uses (Including obtaining usage data)	46%	31%	12%
7-Misc. FHWA	3. Quieter pavements (research; new REMELs; as abatement measures; for impact avoidance, etc.)	46%	50%	12%
8-Modeling	3. Noise study process for Local Programs Projects (adequacy of studies, qualifications of those doing/reviewing studies)	46%	12%	4%
11-Barriers	4. Barrier design and testing specifications, including sound-absorbing barriers	46%	31%	4%
2-Land uses	1. Reclassification/Reconsideration of land uses listed Table 1 in 23 CFR 772	42%	21%	36%
4-Cost Criteria	6. Benefits/disbenefits of using area per benefited receptor vs. cost per benefited receptor	42%	31%	4%
7-Misc. FHWA	1. Existing barriers on new Type I projects (e.g., analysis, funding) (please note current FHWA guidance)	42%	4%	12%
9-Design/build	3. Cost-sharing mechanisms for noise barriers removed during the D/B process	42%	15%	4%
6-TNM	3. Cost variations by type of material	42%	48%	0%
4-Cost Criteria	2. Obtaining and analyzing total barrier cost and unit cost	38%	31%	4%
4-Cost Criteria	5. Application of noise reduction design goal to impacted receptors instead of benefited receptors	38%	15%	19%
2-Land uses	4. Category A definition (please note FAQ D.2)	35%	8%	8%
4-Cost Criteria	3. Accounting for cost changes due to inflation or other market factors	31%	27%	8%
11-Barriers	2. Material costs vs. bid/installed costs	31%	31%	0%
4-Cost Criteria	4. Misinterpretation of "noise reduction design goal" as a design goal rather than a minimum threshold for reasonableness	19%	0%	15%

Session	Subject	Technical Assistance/ Guidance	Research	Regulation Change
7-Misc. FHWA	4. Rumble strips (stripes)	69%	58%	12%
10-Construction	2. Assessment procedures for aquatic and terrestrial	65%	58%	20%
7-Misc. FHWA	3. Quieter pavements (research; new REMELs; as abatement measures; for impact avoidance, etc.)	46%	50%	12%
11-Barriers	3. Cost variations by type of material	42%	48%	0%
3-Screening	1. Acceptable methods for screening for impacts on traffic noise studies, including isolated receptors and unlimited access roads	88%	42%	28%
10-Construction	1. Coordination with sister federal agencies regarding wildlife (e.g., F&WS) during project development	72%	42%	15%
3-Screening	2. Methods to minimize abatement evaluation (barrier analysis) for isolated impacted receptors	81%	40%	28%
11-Barriers	1. Maintenance or replacement of existing noise barriers due to age or damage	54%	38%	12%
10-Construction	3. (human-related) Construction noise criteria, analysis methods, and mitigation techniques	62%	36%	8%
4-Cost Criteria	1. Costs to include/not include in the barrier unit cost for cost-reasonableness	58%	35%	8%
7-Misc. FHWA	2. How to consider HUD-financed properties that are impacted by a proposed Type I project	58%	35%	31%
1-Type I	4. Substantial vertical alteration	54%	35%	4%
2-Land use	3. Active versus passive use areas and frequent human use (e.g., trails, cemeteries)	73%	32%	21%
8-Modeling	4. Determination of worst noise hour traffic volumes	62%	31%	8%
7-Misc. FHWA	4. (human-related) Construction vibration criteria, analysis methods, and mitigation techniques	50%	31%	8%
2-Land use	5. Determining equivalent receptors for non-residential land uses (Including obtaining usage data)	46%	31%	12%
11-Barriers	4. Barrier design and testing specifications, including sound	46%	31%	4%
4-Cost Criteria	6. Benefits/disbenefits of using area per benefited receptor vs. cost per benefited receptor	42%	31%	4%
4-Cost Criteria	2. Obtaining and analyzing total barrier cost and unit cost data	38%	31%	4%
11-Barriers	2. Material costs vs. bid/installed costs	31%	31%	0%
3-Screening	4. FHWA screening tools –validation against TNM, accuracy, application guidance, including low-volume roads	68%	29%	8%
4-Cost Criteria	3. Accounting for cost changes due to inflation or other market factors	31%	27%	8%
1-Type I	2. Shoulder use and managed-use lanes	58%	27%	8%
8-Modeling	5. Addressing planned future projects within the project limits of a current noise study	62%	23%	4%
8-Modeling	2. Model validation requirement, including when a screening procedure identifies a potential impact	58%	23%	12%
3-Screening	3. Consistency in screening applicability and	54%	23%	8%
1-Type I	1. Auxiliary lanes (please note FHWA FAQ C.2)	74%	22%	22%
2-Land use	1. Reclassification/Reconsideration of land uses listed Table 1 in 23 CFR 772	42%	21%	36%
6-TNM 3	4. Expected duration of phase-in before required use; is there a phase-in plan?	68%	19%	4%

Session	Subject	Technical Assistance/ Guidance	Research	Regulation Change
12-Tech transfer	1. Making practitioners aware of new/revised FAQs and other guidance	76%	17%	0%
6-TNM 3	1. Self-taught training modules	69%	16%	0%
1-Type I	5. Transit-only or multimodal projects (FTA, FRA)	58%	15%	8%
8-Modeling	1. Best practices for TNM modeling and/or reviewing TNM modeling	69%	15%	0%
12-Tech transfer	6. Training and qualifications of those who do noise studies (e.g., consultants)	62%	15%	8%
6-TNM 3	1. Meeting/changing D-B project noise abatement commitments per 23 CFR 772...13(i)	58%	15%	12%
12-Tech transfer	9. Recruitment ideas, including desired/required	54%	15%	4%
9-Design/build	3. Cost-sharing mechanisms for noise barriers removed during the D-B process	42%	15%	4%
4-Cost Criteria	5. Application of noise reduction design goal to impacted receptors instead of benefited receptors	38%	15%	19%
5-Viewpoints	5. Considering viewpoints or votes of non-impacted and/or non-benefitted first-row residents	50%	12%	27%
2-Land use	2. Identification and classification of land uses not listed in 23 CFR 772	46%	12%	19%
12-Tech transfer	7. Training on how to review noise studies done by others (e.g., for SHA staff)	69%	12%	4%
5-Viewpoints	2. Amount of required effort to get responses	65%	12%	12%
5-Viewpoints	4. Voting procedures for special-use residential facilities (e.g., assisted living, prisons, dorms)	58%	12%	4%
6-TNM 3	3. Improvements over TNM 2.5; unchanged features; features no longer included	50%	12%	0%
8-Modeling	3. Noise study process for Local Programs Projects (adequacy of studies, qualifications of those doing/reviewing studies)	46%	12%	4%
12-Tech transfer	5. Using regional subgroups within AASHTO's Noise Work Group for identifying issues and bringing them to FHWA	69%	8%	0%
9-Design/build	2. Noise analysis process during re-evaluations for D-B projects	60%	8%	8%
2-Land use	4. Category A definition (please note FAQ D.2)	35%	8%	8%
12-Tech transfer	8. Training for FHWA Division Office staff on noise policy issues	69%	8%	4%
5-Viewpoints	3. Weighting of owner and tenant votes, including single family residences, condos, apartments, and mobile homes	65%	8%	19%
5-Viewpoints	1. Required or desired minimum response rates for reasonableness	58%	8%	12%
6-TNM	2. Training in use of 3rd party versions of TNM 3.0	54%	8%	4%
12-Tech transfer	2. Central library/repository for questions and answers that have been posed to the AASHTO Noise Work Group and for noise literature, research reports, etc.	76%	4%	4%
12-Tech transfer	3. SHA noise policy links on CEE and/or FHWA website	58%	4%	0%
7-Misc. FHWA	1. Existing barriers on new Type I projects (e.g., analysis, funding) (please note current FHWA guidance)	42%	4%	12%
1-Type I	3. Park-and-Ride lots & rest areas	46%	4%	31%
12-Tech transfer	4. Holding periodic webinars on noise topics of interest	81%	0%	0%
4-Cost Criteria	4. Misinterpretation of "noise reduction design goal" as a design goal rather than a minimum threshold for reasonableness	19%	0%	15%

Session	Subject	Technical Assistance/ Guidance	Research	Regulation Change
2-Land use	1. Reclassification/Reconsideration of land uses listed Table 1 in 23 CFR 772	42%	21%	36%
1-Type I	3. Park-and-Ride lots & rest areas	46%	4%	31%
7-Misc. FHWA	2. How to consider HUD-financed properties that are impacted by a proposed Type I project	58%	35%	31%
3-Screening	1. Acceptable methods for screening for impacts on traffic noise studies, including isolated receptors and unlimited access roads	88%	42%	28%
3-Screening	2. Methods to minimize abatement evaluation (barrier analysis) for isolated impacted receptors	81%	40%	28%
5-Viewpoints	5. Considering viewpoints or votes of non-impacted and/or non-benefitted first-row residents	50%	12%	27%
1-Type I	1. Auxiliary lanes (please note FHWA FAQ C.2)	74%	22%	22%
2-Land use	3. Active versus passive use areas and frequent human use (e.g., trails, cemeteries)	73%	32%	21%
10-Construction	2. Assessment procedures for aquatic and terrestrial wildlife	65%	58%	20%
4-Cost Criteria	5. Application of noise reduction design goal to impacted receptors instead of benefited receptors	38%	15%	19%
2-Land use	2. Identification and classification of land uses not listed in 23 CFR 772	46%	12%	19%
5-Viewpoints	3. Weighting of owner and tenant votes, including single family residences, condos, apartments, and mobile homes	65%	8%	19%
10-Construction	1. Coordination with sister federal agencies regarding wildlife (e.g., F&WS) during project development	72%	42%	15%
4-Cost Criteria	4. Misinterpretation of "noise reduction design goal" as a design goal rather than a minimum threshold for reasonableness	19%	0%	15%
2-Land use	5. Determining equivalent receptors for non-residential land uses (Including obtaining usage data)	46%	31%	12%
7-Misc. FHWA	4. Rumble strips (stripes)	69%	58%	12%
7-Misc. FHWA	3. Quieter pavements (research; new REMELs; as abatement measures; for impact avoidance, etc.)	46%	50%	12%
11-Barriers	1. Maintenance or replacement of existing noise barriers due to age or damage	54%	38%	12%
8-Modeling	2. Model validation requirement, including when a screening procedure identifies a potential impact	58%	23%	12%
9-Design/build	1. Meeting/changing D-B project noise abatement commitments per 23 CFR 772...13(i)	58%	15%	12%
5-Viewpoints	2. Amount of required effort to get responses	65%	12%	12%
5-Viewpoints	1. Required or desired minimum response rates for reasonableness	58%	8%	12%
7-Misc. FHWA	1. Existing barriers on new Type I projects (e.g., analysis, funding) (please note current FHWA guidance)	42%	4%	12%
8-Modeling	4. Determination of worst noise hour traffic volumes	62%	31%	8%
2-Land use	4. Category A definition (please note FAQ D.2)	35%	8%	8%
3-Screening	4. FHWA screening tools – validation against TNM, accuracy, application guidance, including low-volume roads	68%	29%	8%
1-Type I	5. Transit-only or multimodal projects (FTA, FRA)	58%	15%	8%
12-Tech transfer	6. Training and qualifications of those who do noise studies (e.g., consultants)	62%	15%	8%
6-TNM 3	2. Noise analysis process during re-evaluations for D-B projects	60%	8%	8%

Session	Subject	Technical Assistance/ Guidance	Research	Regulation Change
1-Type I	2. Shoulder use and managed-use lanes	58%	27%	8%
6-TNM 3	3. (human-related) Construction noise criteria, analysis methods, and mitigation techniques	62%	36%	8%
4-Cost Criteria	1. Costs to include/not include in the barrier unit cost for cost-reasonableness	58%	35%	8%
10-Construction	4. (human-related) Construction vibration criteria, analysis methods, and mitigation techniques	50%	31%	8%
4-Cost Criteria	3. Accounting for cost changes due to inflation or other market factors	31%	27%	8%
6-TNM 3	3. Consistency in screening applicability and methodologies	54%	23%	8%
12-Tech transfer	2. Central library/repository for questions and answers that have been posed to the AASHTO Noise Work Group and for noise literature, research reports, etc.	76%	4%	4%
11-Barriers	4. Barrier design and testing specifications, including sound-absorbing barriers	46%	31%	4%
4-Cost Criteria	6. Benefits/disbenefits of using area per benefited receptor vs. cost per benefited receptor	42%	31%	4%
4-Cost Criteria	2. Obtaining and analyzing total barrier cost and unit cost data	38%	31%	4%
8-Modeling	5. Addressing planned future projects within the project limits of a current noise study	62%	23%	4%
6-TNM 3	4. Expected duration of phase-in before required use; is there a phase-in plan?	68%	19%	4%
12-Tech transfer	9. Recruitment ideas, including desired/required education and background	54%	15%	4%
9-Design/build	3. Cost-sharing mechanisms for noise barriers removed during the D/B process	42%	15%	4%
6-TNM 3	7. Training on how to review noise studies done by others (e.g., for SHA staff)	69%	12%	4%
5-Viewpoints	4. Voting procedures for special-use residential facilities (e.g., assisted living, prisons, dorms)	58%	12%	4%
8-Modeling	3. Noise study process for Local Programs Projects (adequacy of studies, qualifications of those doing/reviewing studies)	46%	12%	4%
12-Tech transfer	8. Training for FHWA Division Office staff on noise policy issues	69%	8%	4%
6-TNM 3	2. Training in use of 3rd party versions of TNM 3.0	54%	8%	4%
1-Type I	4. Substantial vertical alteration	54%	35%	4%
11-Barriers	3. Cost variations by type of material	42%	48%	0%
11-Barriers	2. Material costs vs. bid/installed costs	31%	31%	0%
6-TNM	1. Making practitioners aware of new/revised FAQs and other guidance.	76%	17%	0%
6-TNM 3	1. Self-taught training modules	69%	16%	0%
8-Modeling	1. Best practices for TNM modeling and/or reviewing TNM modeling	69%	15%	0%
6-TNM 3	3. Improvements over TNM 2.5; unchanged features; features no longer included	50%	12%	0%
12-Tech transfer	5. Using regional subgroups within AASHTO's Noise Work Group for identifying issues and bringing them to FHWA	69%	8%	0%
12-Tech transfer	3. SHA noise policy links on CEE and/or FHWA website	58%	4%	0%
12-Tech transfer	4. Holding periodic webinars on noise topics of interest	81%	0%	0%